DISSERTATION

A Study of Limited Resources and Security Adaptation in Wireless Sensor Network

Graduate school of
Natural Science & Technology
Kanazawa University

Division of
Electrical Engineering and Computer Science

Student ID: 1524042009
Name: Jumadi Mabe Parenreng

Chief Advisor: Prof. Akio Kitagawa
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Abstract

View of WSN devices is small, but have exceptional functionality and widely implemented technology for early warning detection systems. Each node of a WSN must have the ability to compute, to transmit and to receive data. However, WSN nodes have limited resources in terms of battery capacity, CPU, memory, bandwidth, and data security. Memory limitations mean that WSN devices cannot store a lot of information, while CPU limitations make them operate slowly and limited battery capacity makes them operate for shorter periods of time.

The main advantage of WSNs is their ability to be deployed in areas that are difficult to access by humans. In such areas, regular maintenance may be impossible; therefore, WSN devices must utilize their limited resources to operate for as long as possible, but longer operations require maintenance.

Moreover, the data gathered and processed by the network face real security threats. The availability of resources and data security on WSN devices is an absolute requirement, but resource capacity is very limited. The limitation of resources force the devices to use the resources as efficiently as possible. Security is the largest resource used when the highest security is required for the output security data. Resource-adaptation and security-adaptation solutions on sensors nodes are extremely important, particularly if they are used to monitor extreme areas where maintenance, such as replacing batteries or just checking the proper position of the device, is very difficult. One method of maintenance is to apply a resource adaptation policy when a system reaches a critical threshold.

This study presents an Adaptable Resource and Security Framework (ARSy Framework) that is able to adapt to the workload, security requirements, and available resources in a wireless sensor network. The workload adaptation is intended to preserve the resource availability of the WSN, while the security adaptation balances the level of security with the resource utilization.

Sending all collected data to the server is not a solution, so filtering data collected by a sensor is done through data mining. The data-mining is done on-board, each datum is collected by the sensor directly, and selection is done with the data-mining algorithm at the board node. The final result is then sent to the data server. For security, data in this research is collected by estimating security-level based on average resources availability in sensor node. The more average resource availability, the higher the security level that will be implemented in the output data. This solution makes resources available on the basis of the workload of the system and adjusts the level of security for resource savings and makes the WSN devices work more efficiently.

For testing this model, using a single node comprising a Raspberry Pi 3 Model B and a DS18B20 temperature sensor were tested in a laboratory under normal and stressful conditions. The result shows that under normal conditions, the system operates approximately three times longer than under stressful conditions. Maintaining the stability of the resources also enables the security level of a network's data output to stay at a high or medium level.

Keywords: Wireless Sensor Network; Sensor Node, Resource-Aware; Security-Aware; Security Levels; Limited Resources; Adaptable System; ARSy Framework; Mining Data.

Table of Contents

List of Figures

List of Table

Chapter 1. Introductions

Evolution Technology occur so rapidly entering all fields and strive to maximize all possible potentials to be managed, not only on human resources but also in natural resources. To be able to maximize the utilization of existing potentials, then used wireless sensor network technology (WSN) that is able to explore cheaper, faster, precise and continuously, so that every change is recorded in the form of data and allows for analysis at certain times.

Wireless sensor network technology (WSNs) is known as low-cost, small, applicable, very powerful and useful technology for a wide range of applications, enabling to monitor and control the physical environment from remote locations with high accuracy, can be applied to various domains such us monitoring environment and agriculture, healthcare, public safety and military system, Industry, and transportation system (Rault, Bouabdallah, & Challal, 2014), The biggest achievement of researchers in this field is design system that can combine not only in scientific community but also to the industry so that they can synergize together.

The use of WSN is not only for regular area monitoring, but it is much more advanced and developed to monitor the more difficult and even extreme areas to reach by humans. For extreme areas usually use a new smart sensor that allows for areas such as underground, underwater and space (Habib F. Rashvand., 2017). For implementation in areas that are difficult to reach usually this sensor network system without regular maintenance. So that required mechanism to maximize lifetime system. Lifetime sensor nodes rely heavily on the success of system design whose determinant factors are based on several parts, such as fault tolerant, scalability, production cost, hardware constraints, network topology sensors, environment, transmission media and power consumption (Ian F. Akyildiz, Su, Sankarasubramaniam, & Cayirci, 2002).

Nodes are usually widely distributed in certain environments for controlling, interconnecting and communicating, processing data when needed, sending and receiving data, from and to the sensing node, connected to the sync node in a centralized network between one node and the node other. These nodes are dispersed in large amounts of density in the target area of monitoring and sensing for a long time, with data transmitted so that the node is able to provide much more detailed information about the physical environments in the area it is monitoring (Archana, Bharathidasan., Vijay, Anand, Sai, 2003).

To more effectively communicate and coordinate between nodes, network systems typically use network topologies such as mesh, star or other options, allowing faster coordination of the node to sink sensor, and then to the server as the information center. In general, such as computer networks, there are three challenges when designing a network node system and is very influential on the efficiency of network systems, the first is a type of network protocol that can minimize control data and packets to be sent, the second is the selection of the best network topology and position the node where the most appropriate, and the third is the application of a routing algorithm that is able to work effectively pass data on the network from the original node to the destination node (Pour, 2016).

In the implementation of each sensor node only allows to perform limited data processing based on the availability of resources attached to it. The most difficult challenge so far is how to maximize the utilization of WSN resources in the form of battery, CPU, memory and radio communications, because this is the main part that supports wireless sensor network to be able to work with long time (Karl, Holger., Andreas, 2005), (Phung, Gaber, & Roehm, 2007), (I.F. Akyildiz, Su, Sankarasubramaniam, & Cayirci, 2002).

1.1. Background Overview

Generally the sensor node is small, cheap, and lightweight and the function is extraordinary. There are many variations of sensors commonly used for WSN such as acoustic, seismic, image, heat, direction, smoke, temperature and other sensors. Implementation is also diverse, for example, used for traffic congestion information, forex movements, public transportation arrival schedules, even used to monitor unaffordable environmental conditions, such as detection of earthquake triggers in the depths of the ocean, radiation levels of chemicals in certain areas, monitoring volcanic conditions and many other functions. WSN has the ability to receive data, process data and transmit the results. To perform monitoring, tracking and controlling continuously for 24 hours full on large area. For the implementation of WSN network is not stand alone, but is supported with network systems and supporting devices are scattered (I.F. Akyildiz et al., 2002). Figure 1.1 and figure 1.2 shows WSNs implementation for forest fires detection.

Figure 1.1. Early Detecting forest fires using Wireless Sensor Networks

Figure 1.2. Forest fires (Javier Solobera, 2010)

The main components of the node sensor consist of a sensing unit usually composed of sub-unit sensors and analog to digital converters (ADCs), processing units for processing data, managing the procedures that make the sensor nodes collaborate to another node for completing a particular spell, a transceiver unit for connection node to a wider network, the power unit becomes a very important part of a sensor node because the lifetime depends on the availability of the battery resource (I.F. Akyildiz et al., 2002). For more details, see Figure 2.3.

To maximize the lifetime sensor node, the success depends on the system design, based on (Ian F. Akyildiz et al., 2002):

- Fault tolerant; this is related to the failure that may be caused by one of the node sensor in the network for example due to the failure of source power that impact on the system as a whole.
- Scalability; this concept is related to the range of the system, because the use of device node sensor is usually in large quantities with the implementation covering a large area.
- Production cost; sensor nodes with large numbers, small and lightweight, then the cost per item should be as cheap as possible. For cost production embedded WSN devices that are integrated with flash storage, analog-to-digital converter and digital I / O per item price between $ 1- $ 5 (Jason Lester Hill, 2003).
- Hardware constraints; basically subunits on each sensor node i.e. sensing unit, processing unit, transceiver unit, power unit and storage unit. All of these subunits may need to fit in a matchbox-sized module (C. Intanagonwiwat, R. Govindan, 2000), with size stringent constraints will affect the existing resource constraints on the sensor node (Kahn, Fellow, & Pister, 1999).
- Sensor network topology; this becomes a very important part because the sensor nodes are not stand alone but work in parallel and dispersed with high density.

- Environment; the placement environment becomes a challenge for node sensor equipment because it could be placed in an area that is not reachable by humans.
- Transmission media; choice of communication media between node to node, node to sink and node to main server can be done with some variant such as using radio communications, infrared or optic media.
- Power consumption; this part is a big challenge as it impacts the lifetime. System requirements require the sensor nodes to operate for as long as possible. Operationally supported by battery equipped with a limited power source (<0.5 Ah, 1.2 V) and should be capable of supporting the work of sensing, communication and data processing.

With a small average node sensor size, the embedded resource also adjusts, for example wireless integrated network sensor (WINS). WINS nodes get a power supply from a lithium battery (Li) coin cells with a diameter of 2.5 cm and 1 cm in thickness. The total average system supply currents must be less than 30 microampere to support longer operation time. Another alternative power unit using Energy scavenging (Cymbet Corporation, 2011) allows extend lifetime sensor network, which means doing extract energy from the surrounding environment.

With limited resources, unreachable placement, and without alternative energy scavenging, then the choice is only by using a power battery. In this condition, the energy saving mechanism is required from all operational aspects of the sensor node.

The latest trend in the wireless network scope is online data stream where data processing is done on a wireless sensor network scope that rely on high speed data input stream, then at the same time sending data update with energy available (Phung, Gaber, & Röhm, 2007). Therefore energy efficiency and resource management are a very important part for data processing techniques in this network model. The cost efficiency of mining data stream of this model, which is to distribute data at high speed based on existing events and mining in data stream is the processing of data online and real time from certain desired data pattern (J. M. Parenreng & Kitagawa, 2018). Another method is by applying data mining mechanisms on-board process (Tanner, Alshayeb, & Criswell, 2002), each data captured by the sensor is directly processed on-board then the end result is sent to the server (Gaber & Yu, 2006). The on-board process of space astronomy is one example of its application because these onboard sensor devices generate large amounts of data captured streaming and with high data rates. This on-board process brings a tremendous impact because of its ability to minimize resource sensor utilization, especially energy saving on the side of communication media.

Other policies applied for energy saving, one of which is by applying dynamic power management (DMP) policy (Amit, Sinha., Anantha, 2001), the principle of this policy sets the node sensor mode from active to sleep or idle status. With this status change the value of energy consumption varies and much more saves the sensor node resource. Table 1.1. Shows the Mote IV Telos data sheet showing the different energy consumption in each operating status.

Table 1.1. Power consume Telos Mote-iv (Moteiv-Corporation, 2004)

Operation status	**Min**	**Norm**	**Max**	**Units**
Supply voltage	2.1		3.6	V
Supply voltage during flash memory programming	2.7		3.6	V
Operating free air temperature	-40		85	°C
Current Consumption: MCU on, Radio on		20.2	23	mA
Current Consumption: MCU on, Radio off		420	1400	µA
Current Consumption: MCU asleep		2.4	6	µA

Another interesting issue is network security and data on sensor nodes. Traditionally security offers a model of system protection as strong as possible, but most data protection levels are always higher than the potential threats required. When security policies are implemented very strongly, it will affect the overall performance of the system, excessive protection will reduce reliability and availability and will affect global security(Pour, 2016). Appropriate level of security can be estimated in terms of providing protection model with different security quality (Ksiezopolski, Szalachowski, & Kotulski, 2010).

Another threat when the system implements a very strong security policy, it can be a threat of device performance that has limited resources and will be a way for new threats such as exhaustion of resources, whose impact will reduce system efficiency, availability and introduce redundancy. Another effect of excessive estimation on security will increase the complexity of the system, which then affects implementation, but enforcing restrictions will reduce its function. As a solution by predicting the appropriate level of security on each output data (Ksiezopolski & Kotulski, 2007), (J. M. Parenreng & Kitagawa, 2017), (J. M. Parenreng & Kitagawa, 2018).

Other study (Chui Sian Ong, 2003) discusses the quality of protection (QoP) that defines the security level based on security parameters. The parameters are like; a key length, the length and contents of an encrypted block of data. Other study (Schwan, 1997) proposed a protocol adaptation whose concentration on authorization, capable of changing the version of authorization protocol and finally able to make changes to symmetric parameters and asymmetric cipher.

1.2. Research Objectives

This study attempts to maximize the sensor node function, by capturing data, processing data with available resource capabilities, and sending it to the server with data security based on existing resources on the sensor node. The ultimate goal is expected to increase the efficiency of resource use and lifetime system.

The availability of resource and data security on WSN devices is an absolute requirement, but the node sensor resource capacity is very limited. Limitations of Battery, CPU and Memory resources on WSN make it operate by utilizing resources as efficiently as possible. Security includes the largest use of resources when output security data is desired with the highest security. Therefore, the resource and security adaptation of the device node sensor becomes very important.

In this topic proposes a model of security and resource adaptation in wireless sensor network (ARSy Framework). Adaptation of resources to maintain the availability of limited resources is always in a stable condition. Battery power will regularly decrease over time node operation, CPU busy will affect to the memory and this activity will spend battery power faster than normal conditions, so that the sensor activity will affect the lifetime sensor node. Basically the availability of resources on the sensor node can be maintained by setting the input data mechanism through time capture. So that the CPU and Memory activities able to operate normally and the battery resource will not decrease significantly. Security Adaptation is intended for data security, which does not require that node sensors encrypt with the highest security. The security adaptation to the sensor node resource is to encrypt data based on existing resources, so the most appropriate security level prediction mechanism for available resources on the sensor node is required.

Figure 1.3 below shows the relationship between Resource Aware and Security Aware. One side of the sensor node resource must be maintained from time to time, while the security uses the resource to encrypt the data, if it is driven with a strong security quality then the limited sensor node resources will quickly run out, so the mechanism of security quality adjustment based on available resources.

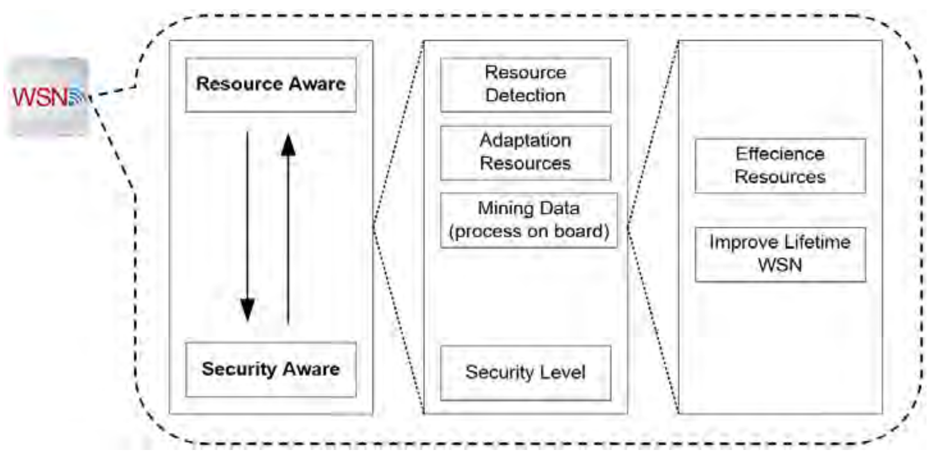


Figure 1.3. Relationship Resource-Aware and Security-Aware

This study implements a proposed adaptation model, is expected to be a solution to the problem of limited resources and security on wireless sensor network. Here are some of the purposes of this research:

- We want to operational sensor node adaptable to resource condition; this system is designed to find out the latest update of any resource at any time in order to adapt to the available resource conditions.
- How to efficiency resource usage of WSN; is intended to maximize the utilization of the limited resources available for data processing.
- How to improve the lifetime device WSN and operate under low resource; expected with the efficiency of resources, the lifetime sensor node can be

increased, and able to operate under low resources because the adaptation applied.

- How to workload adapt, when the system in heavy workload or light workload; this is intended to be an indicator if the resource is in critical condition which means heavy workload and not critical which means operate with normal workload.
- How to create a security system that can adapt to the conditions of limited resources; by default security must be strong, but in fact, in the case of WSN this condition is different, so the security design in this case is expected to adapt to existing resource conditions. Adaptation model through security level, each level based on resource conditions that change from time to time.

1.3. Contributions

Combining the issue of security adaptation and resource efficiency in this research is a challenge, because researchers in the field of security assume that with any conditions on security must be strong. But in fact, this is a different case, and specifically designed for implementation in areas that are not possible to reach even for routine maintenance such as replacing the battery. Claim contributions of researchers in this study are:

- A Framework of Security Adaptation for Limited Resources in Wireless Sensor Network.
- I think this is the first model adaptation that combining adaptable resources using mining data and adaptable security using security level, both of process are done on-board in sensor node.

1.4. Dissertation Organization

Generally speaking the discussion on this dissertation there are two main parts, the first is the deception of resource and security adaptation model ARSy Framework. The second is the discussion on the implementation of the proposed adaptation model. More detailed discussion of this my dissertation is organized as follow:

- Chapter 2; this section contains a review of previous research, which discusses the basic concepts of resources on sensor nodes, data streams, data mining, resource-aware, security-aware, and implementation of sensors for environmental extreme areas.
- Chapter 3; this section discusses the complete block diagram, basic logic and pseudocode for ARSy Framework.
- Chapter 4; this section discusses the requirements hardware system, hardware hookup, testing mechanisms, schemes and test scenarios, results and results analysis for ARSy Framework
- Chapter 5; is the final section, which contains conclusions and future work. After this section contains some document attachments which are an important part of this research.

Chapter 2. Fundamental Literature Review

Hardware and software technology for WSN is growing rapidly, making it possible to process and distribute large amounts of data. For research related to environmental monitoring it will be associated with the capture and processing of large amounts of data streams, and this is a challenge for monitoring. Sensor nodes have limited memory, computational capabilities and battery energy (C. Aggarwal, 2006). For solutions, it is desirable to minimize memory utilization, processing and data communications on the nodes. This problem is very interesting, because in reality there are millions of sensor nodes that are used to provide information globally for analysis.

Generally a wireless node is a device that operates using a battery, so it has limited energy capacity, although in its implementation some devices allow for charging, battery replacement or allowing to implement energy harvesting in the location of placement. But the fact is, there is a sensor node device that placement in a very extreme area so it is impossible to reach and not possible to perform routine maintenance even to replace the battery. This is the reason for saving power consumption on WSN, and become the biggest challenge researchers today.

If you want to look more deeply from some of the main components of WSN, then the most consume energy is the processor and media communication, this is because the processor works simultaneously by checking the radio communications and encoding and decoding every data packet that arrives through communication media and this requires higher communication rate and required faster computation (Jason Lester Hill, 2003). The more busy the CPU, the greater the energy consumption (Potlapally, Ravi, Raghunathan, & Jha, 2006).

The 2020 prediction that half of the internet-connection sensors and devices will be run using the battery as an energy source, this being the main focus because battery replacement will cost a lot, while configuring it in sleep mode will make the device work with low performance (Pretz, 2017). The largest energy consumption in the node sensor is one of them on the radio communication side. In this case, one of the solutions to preserve available power is Wi-Fi radio setting in sleep mode, this power-saving setting is IEEE Wake-Up Radio will activate radio every few milliseconds to get the data signal. 100 milliWatt Wi-Fi radio can consume 3 volts and 130 milliaAmpere hour battery for operational about 4 hours. Most smart devices connect to IoT through three radio communication modes: short-range using Bluetooth, medium-range via WLAN or Wi-Fi, and longer-range via cellular radio.

Sensors are classified into two broad categories, namely passive and Active sensors; passive sensor is divided into two, the first Passive, the sensor is the type of Omni directional, for example, PIR sensor (passive infrared receive), this type of sensor is also widely applied to robots, such as line detection. This type of sensor performs data capture but does not manipulate data. The existing energy is only used to amplify analog signals, required for capture data transfer. The second is Passive, Narrow-beam sensor, an example of this type is the camera. The system performs sensing only in certain directions. The latter is an Active sensor, this type of sensor commonly used for habitat or environmental monitoring and is usually applied for early warning detection in disaster-affected environments.

In node sensors, the processing unit is generally 8-16 bits, 1-24MHz microcontroller with memory capacity of 1KB-4MB onboard memory, this resource capacity varies due to the microcontroller family and the vendors that produce it. For power units, usually consisting of one or more batteries, capable of supplying 3V-4.5V, which is generally the capacity between 1700mAh-2700mAh (Dinesh, Kumar, 2013).

The choice between lifetime or security on WSN becomes an interesting topic, this is because it needs to balance between resource availability and output security level predictions, and will sacrifice one of them. If the desired data with high security then sacrificing the efficiency of limited resources, the impact will reduce the lifetime device. But if the efficiency of the resource, then the security data output will be sacrificed, because each data output is based on the prediction of the most appropriate data security level based on the availability of WSN resources (J. M. Parenreng & Kitagawa, 2018).

2.1. Basic of Resources in WSN

Although it seems small WSN successfully combine component sensing, computation and communication into a single tiny device. With the appropriate network topology it is possible to perform sensing in areas that are difficult to reach such as deep sea exploitation, highest mountains, magma detection, and even out of space. This concept is like in Figure 2.1 which is a collaboration between research, development and implementation that utilizes wireless sensor system device for Space, underwater, underground and industry (Habib F. Rashvand., 2017).

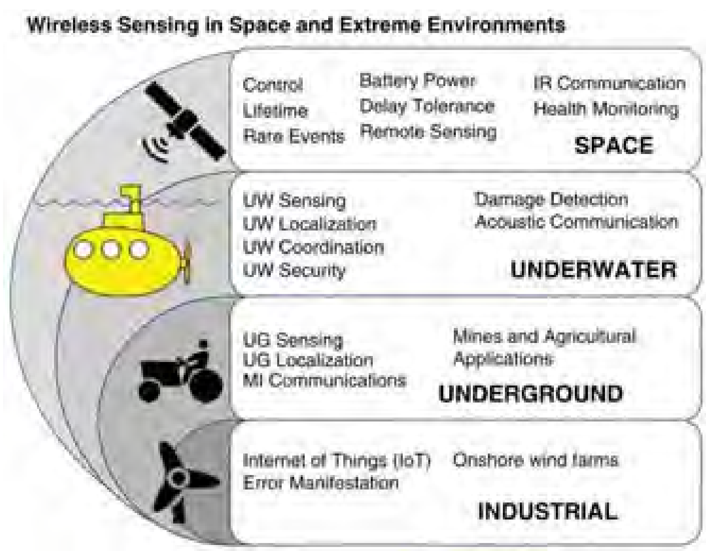


Figure 2.1 Illustration of WSN usage and implementation

When a single node sensor, its ability is very limited, but if combined with thousands and even millions of pieces of WSN, then this technology offers radical new technological possibilities (Jason Lester Hill, 2003). With a large number and appropriate placement then node sensor technology is able to exploit each side and provide information with more complete data, fast and accurate. More details about sensor nodes that have the ability to do tracking in real-time, monitoring environmental conditions, agriculture, Healthcare, public safety and military system, Industry, transportation system and others. In addition, the system can be accessed remotely via wireless interconnection network with range of distances up to thousands of kilometers. Figure 2.2 below is WSN Node Mika Z whose system is already integrated with sensing system.

Figure 2.2. WSN Node Mica Z (Luca Mottola., 2007)

In general, each node sensor has five main components namely, sensing device, processor, memory, power supply, and transceiver (Archana, Bharathidasan., Vijay, Anand, Sai, 2003). The system units are depicted as shown in Figure 2.3.

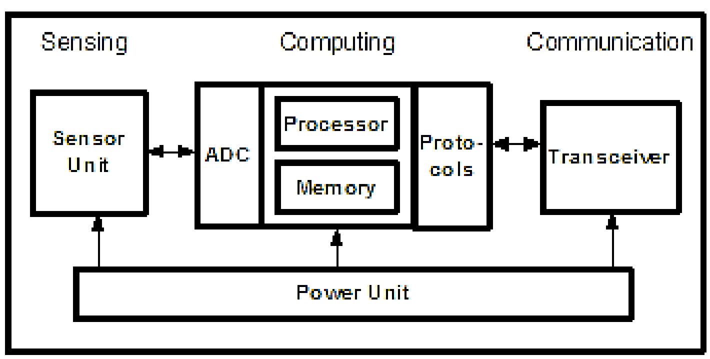


Figure 2.3. The Components of a Sensor Node (Sahitya, 2016)

Each unit has unique characteristics and interconnected with the board system, more detailed function is described as follows:

- Sensing Units; usually composed of two subunits: sensors and analog-to-digital Converters (ADCs). The analog signals are produced by the ADC, and fed into the processing unit.
- Processing Unit; Associates with a small storage unit (tens of kilobytes order) and manages the procedures to collaborate with other nodes to carry out the assigned sensing task.

- Memory unit; modern flash-based microcontrollers, comprising between 1 to 128 KB of on-chip memory storage program, it is sufficient to use as a memory program and as a temporary data storage. In addition memory still has 128 and 32KB of RAM data that can be used for program execution, or storage with a much larger capacity(Jason Lester Hill, 2003).
- Power Units; Supplies power to the system by small size batteries which makes the energy a scarce resource.
- Transceiver Unit; Connects the node to the network via various possible transmission media such as infra, light, radio and so on.

2.1.1. Sensors

Sensors are devices for sensing physical systems or an environment. Generally, it produces an electrical or optical signal output as a measure of a certain quantity change. Some types of sensors based on electrical or electronic applications are classified as: chemical, pressure, temperature, humidity, position, thermal, optical, sound, speed, magnetic, heat sensors and many other types. As seen in table 2.1 below is a variant of the sensor that is applied to smart home, government offices or industry and many options available in the market (Jason Lester Hill, 2003).

Table 2.1. Variant and characteristic sensor

Sensor Varian	**Current**	**Discrete Sample Time**	**Voltage Requirement**	**Manufacture**
Photo	1.9 mA	330 µS	2.7-5.5V	Taos
Temperature	1 mA	400 mS	2.5-5.5V	Dallas Semiconductor
Humidity	550 µA	300 mS	2.4-5.5V	Sensirion
Pressure	1 mA	35 mS	2.2V-3.6V	Intersema
Magnetic Fields	4 mA	30 µS	Any	Honeywell
Acceleration	2 mA	10 mS	2.5-3.3V	Analog Devices
Acoustic	.5 mA	1 mS	2-10 V	Panasonic
Smoke	5 µA	--	6-12 V	Motorola
Passive IR (Motion)	0 mA	1 mS	Any	Melixis
Photosynthetic Light	0 mA	1 mS	Any	Li-Cor
Soil Moisture	2 mA	10 mS	2-5 V	Ech2o

In general, the sensor is divided into two types of interfaces that can be used on sensor networks, namely analog and digital. Analog Sensors generally produce continuous output signals and are associated with physical phenomena such as; accelerometers, pressure sensors, light sensors, sound sensors, temperature sensors, and so on (Tarun, 2018). Digital Sensors are usually electronic sensor or electrochemical sensor, this sensor performs data conversion and digital data transmission. This digital sensor replaces the analog sensor because it can overcome the existing deficiencies in analog sensors. Generally digital sensors consist of three main components: sensors, cables, and transmitters. In digital sensors, the measured signal is directly converted to a digital-value measure within the digital sensor itself and then displayed in the form of easy-to-read digit values. The most common analog and digital value readings are analog clocks and digital clocks, analog measuring instruments and digital measuring instruments and joysticks, as shown in Figure 2.4.

Figure 2.4. Analog to Digital value (Jimbo, 2018)

Generally in the market, analog sensor prices are slightly more expensive than digital sensors, so the selection and use of each type of sensor will be adjusted to the object to be detected, and input signal required. Analog quantities can't be processed directly by programmed system controls such as PCs, Microcontrollers or PLCs because devices that have CPUs are only capable to processing digital data. Therefore, the use of analog sensors always coincides with the converter from analog to digital or ADC (Analog to Digital Converter)

2.1.2. CPU

The latest microcontroller is designed with integrated flash memory, RAM, ADC converter and I / O integrated in a module that costs between 1 $ to 5 $ (Jason Lester Hill, 2003). This integration is ideal for embedded systems such as WSN. Implementation of node sensors is usually in a certain area with a large number of nodes, so some key requirements to consider when going to choose a microcontroller such as; energy consumption, voltage requirement, cost per unit, support peripherals and external components requirements required.

Processing unit on sensor node, generally 8-16 bit, 1-24MHz microcontroller with memory capacity 1KB-4MB onboard memory, this resource capacity varies because family microcontroller and vendor that produce it (Dinesh, Kumar, 2013). For power consumption on microcontroller is also different, generation microcontroller with standard 8 bit or 16 bit power consumption between 0.250 mA to 2.5 mA per MHz. While operational node sensors are generally powered by a power unit that usually consists of one or more batteries, capable of supplying 3V-4.5V, which is generally the capacity between 1700mAh-2700mAh.

For implementations in areas requiring high-efficiency power consumption, some mode options such as sleep or idle are used. Extremely low power consumption on microcontroller during idle mode. At idle condition microcontroller will be in sleep mode so that CPU stop executing. Sleep mode consumes currents between 1µA and 50µA across the controller families (Instruments, 2018).

Table 2.2 below describes some MCU platform variants and memory capacity commonly used for WSN nodes(Rodrigues, Montez, Budke, Vasques, & Portugal, 2017).

Table 2.2. MCU specifications

MCU	Platform	Clock (MHz)	Wait State	FPU	Flash (KB)	SRAM (KB)	EEPROM (KB)	Typical Current (mA)
ATmega328P	8-bit AVR	16	0	No	32	2	1	0.2
ATmega128RFA1	8-bit AVR	16	0	No	128	16	4	4.1
ATxmega256A3U	8/16-bit AVR	32	0	No	256	16	4	9.5
SAMR21G18A	32-bit ARM Cortex-M0+	48	1	No	256	32	0	6.7
SAMG55	32-bit ARM Cortex-M4	120	5	Yes	512	160	0	24.2
SAMV71Q21	32-bit ARM Cortex-M7	300	6	Yes	2048	384	0	83.0

2.1.3. Memory

The initial design of the memory system on network sensor operations such as TinyOS is not designed to have memory management (Farooq & Kunz, 2011). The assumption is that WSN device is only used to execute single application on sensor node so that it does not need memory. But over time, as required by WSN systems and applications that are used to support multiple thread execution operations, the memory management system becomes a very important issue for OS on WSN.

Generally sensor nodes require only a small amount of storage and program memory because the stored data is temporary on the sensor node. Modern flash-based microcontroller consists of 1 to 128 KB of on-chip memory storage program, It is enough used for memory program and as temporary data storage. In addition memory still has 128 and 32KB of RAM data that can be used for program execution, or additional storage for storage media with a much larger capacity. As seen in table 2.2 above about some variants of MCU and memory capacity available.

Usually the memory on the sensor node already include on flash memory and RAM. Flash memory is used to store downloaded application code and RAM is used to store application programs, data sensors and intermediate results of computations. Table 2.3 shows some variants of OS WSN with available memory capacity (Lajara, Pelegrí-Sebastiá, & Perez Solano, 2010).

Table 2.3 Operating System for WSN

OS	Model	ROM Memory	RAM Memory	Type of Processes
TinyOS v1	Events	3.4 kbytes	336 Bytes	Tasks, commands and event handlers
TinyOS v2	Events	3.4 kbytes	336 Bytes	Tasks, commands and event handlers
Contiki	Events	3.8 kbytes	230 Bytes	Protothreads
MantisOS	Multithreading	14 kbytes	500 Bytes	Threads
Nano-RK	Multithreading	10 kbytes	2,000 Bytes	Tasks with priority
t-kernel	Multithreading	28.2 kbytes	2,000 Bytes	Threads
Bertha	Mobile agents	10 kbytes	1,500 Bytes	Process fragments
CORMO	Events	5.5 kbytes	130 Bytes	Tasks and event handlers
SOS	Events	20 kbytes	1,163 Bytes	Tasks defined as modules
SenOS	State Machines	Not specified	Not specified	Processes

2.1.4. Radio Communication

Radio communication is a very important resource on WSN, and includes the components that consume the greatest energy. The higher the activity of radio communications the greater the energy consumption. For the transmission and reception of short-range data packets energy consumption between 15 to 300 milliwatt and this energy consumption occurs when the radio is active (Jason Lester Hill, 2003). In radio communications, increased bit rate will have an impact on the decrease of transmission time. Unlike with high performance data networks, WSN does not require high bit rate. With a large bandwidth network 10-100 Kbps is enough to run many applications.

Table 2.4. Sleep status for sensor node (Amit, Sinha., Anantha, 2001)

Sleep state	StrongARM	Memory	Sensor, analog-digital converter	Radio
S_0	Active	Active	On	Tx, Rx
S_1	Idle	Sleep	On	Rx
S_2	Sleep	Sleep	On	Rx
S_3	Sleep	Sleep	On	Off
S_4	Sleep	Sleep	Off	Off
Tx=transmit, Rx=receive				

Radio-communication activities have a significant impact on power consumption and lifetime sensor nodes, when compared to power consumption due to WSN applications being used. Table 2.4 describes the activity of radio communication, which affects the different energy consumption of each level and node sensor status. Each component in the node may have different power usage modes. Some types of sensor nodes can have active, idle or sleep state, and on the radio can transmit, receive, standby or off mode. Each node with sleep status has a combination with different power consumption.

2.1.5. Power Resource Node

The design of WSN Node depends on the function, range, capacity and location of the placement. The impact of this design, affect to the market price of the WSN node. Some nodes are designed to use only disposable, because the placement in a location that is impossible to do maintenance. The average consumption of WSN power is measured by units of micro amps, the ultra-low-power operation is obtained only through a combination of low-power hardware components and low duty-cycle operation techniques (Jason Lester Hill, 2003). Power source on the node is the most important part to support lifetime operation longer. Batteries such as AA or AAA alkaline cells, lithium thionyl chloride, lithium coin cells, or a host of other chemistries with supply output power ranging from 3.3 volts to 5 volts are generally used.

Some nodes allow the supply of energy from main power because it may be placed adjacent to the building or building that has been integrated with the power source. But several it is impossible to obtain a source power from main power so that its operation depends on the power of the battery attached to it. In fact some of the nodes placement in areas that are unreached by humans (Habib F. Rashvand., 2017) and there is not possibility to perform maintenance such as replacement battery routinely. For the current scenario of implementation, for energy supply node sensors are very extreme placement of self-powered where the node has the ability to perform scavenging energy through the device within the sensor itself (Ozel, Tutuncuoglu, Yang, Ulukus, & Yener, 2011).

For placement locations that allow the application of renewable energy technology, some wireless nodes may extend the lifetime through energy scavenging (Tobergte & Curtis, 2010), (Roundy, Wright, & Rabaey, 2003), (Murata, 2018). For harvesting energy, the source is obtained by vibration, heat, wind, light or other sources. This energy conversion is better known as transducers. A transducer is a device that converts energy from one form to another. The most widely used transducer types for energy harvesting such as photovoltaics are also known as solar cells that convert light to electrical power, electrostatic or electromagnetic obtained from vibration, Thermoelectric converts differential to electrical power, Piezoelectric converts mechanical movement to electrical power, RF and Inductive performs the conversion of magnetic power to electrical power. Table 2.5 describes scavenging energy for some energy sources.

Table 2.5. Energy harvesting transducer comparisons (Cymbet Corporation, 2011)

Energy Source	Challenge	Typical Electrical Impedance	Typical Voltage	Typical Power Output
Light (Sun light)	Conform to small surface area; wide input voltage range	Varies with light input Low kΩ to 10s of kΩ	DC: 0.5V to 5V [Depends on number of cells in array]	10µW-15mW (Outdoors: 0.15mW-15mW) (Indoors:<500µW)
Vibrational	Variability of vibrational frequency	Constant impedance 10s of kΩ to 100kΩ	AC: 10s of volts	1µW-20mW
Thermal	Small thermal gradients; efficient heat sinking	Constant Impedance 1Ω to 100s of Ω	DC: 10s of mV to 10V	0.5mW-10mW (20°C gradient)
RF & Inductive	Coupling & rectification	Constant impedance Low kΩs	AC: Varies with distance and power 0.5V to 5V	Wide range

Table 2.6 below shows the comparison of advantages and disadvantages for source power sensors using wired, battery or energy harvesting.

Table 2.6. Power Source Trade-offs in Sensors (PSMA Energy Harvesting, 2012)

Energy Source Sensor Type	Cost	Implementation
Wired Sensors	Highest initial cost Average operating cost	Simple Reliable Very high installation cost
Battery Powered Wireless Sensors	Lowest initial cost Highest operating cost	Simple Cheaper than wired Constant battery replacement
Energy Harvesting Wireless Sensors	High initial cost Lowest operating cost	More complex engineering Lowest lifetime costs

In node sensors the radio communication unit is known to consume the greatest energy, especially in systems operating online and real-time updates for streaming data. The solution to reduce power consumption on radio communications can be done by reducing data transmission cycles or by on-board-mechanism process (Tanner et al., 2002), (Kargupta et al., 2004), this concept does not send all data capture by sensors over time, but passes data processing on the sensor node when the data is captured and the results are sent at a specified time period. Figure 2.5 shows the power consumption saving solution through the node sensor activity and status settings (Freescale, 2015).

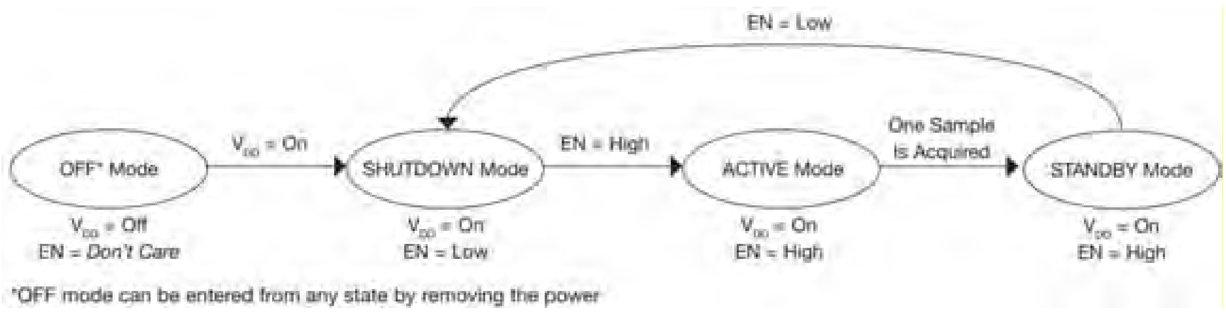
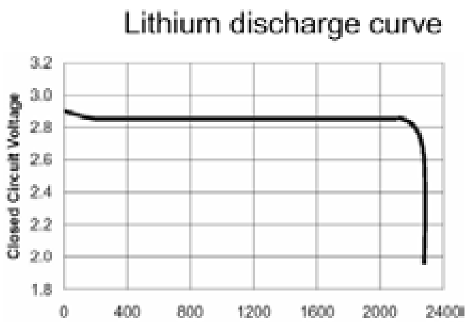
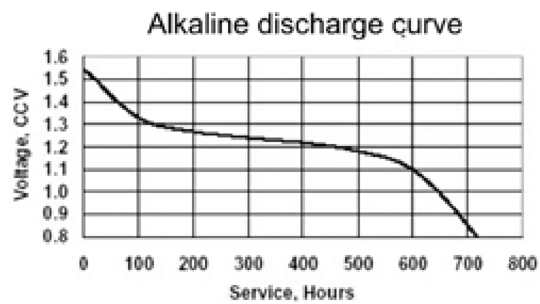


Figure 2.5. Achieving the Lowest Sensor Power Consumption

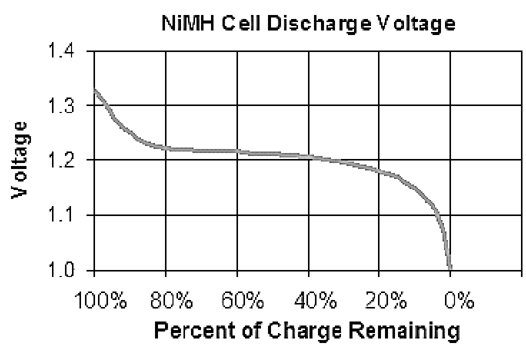
Generally there are three types of batteries used for WSN such as; Alkaline, lithium (Jason Lester Hill, 2003) and Nickel Metal Hydride (NiMH) (Energizer, 2010), (Onbowpower, 2014). Figure 2.6. AA alkaline battery with a voltage of 1.5V, but during its operation ranges from 1.65 to 8 V and it's rated at 2850mAh, with a volume of just 8.5 cm^3, it has an energy density of approx. 1500 Joules/cm^3.





a. Lithium

b. Alkaline



c. NiMH

Figure 2.6. Battery discharge Curve for WSN

Power consumption of single-node sensor resources, commonly used for data acquisition, data processing and data transmission. When the energy saving solution is applied to the node, it is most important to determine the energy consumption of each part of the sensor node, including the energy consumption of the analog circuit. In the data transmission process, the communication module usually sends signals to the routing node and this is the highest energy consumption. In the sensor network, nodes interact with each other through the communication protocol and in the case of node sensor this mechanism affects the lifetime network. Figure 2.7 shows some standard wireless communication protocols and their relationship between energy consume versus data rate (Chaoqing, Tang., Habib, F, 2017).

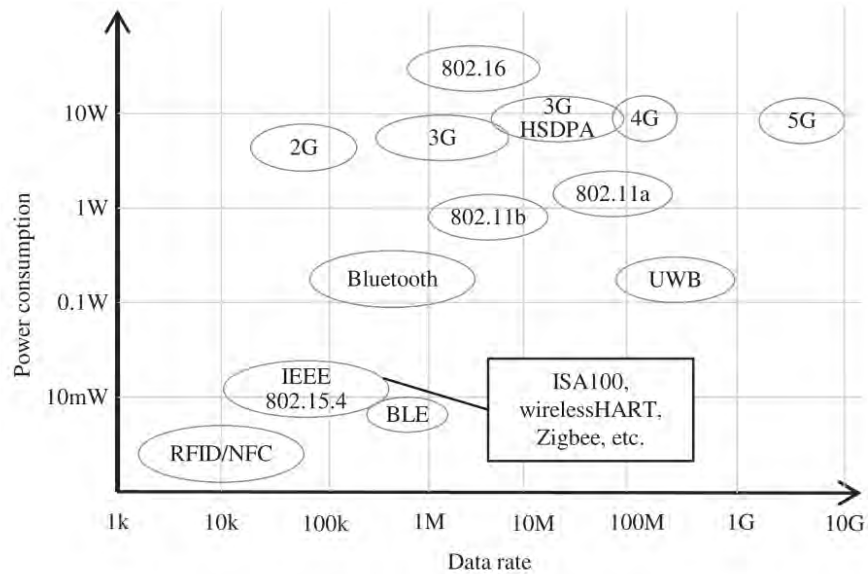


Figure 2.7. Energy consume wireless communication versus data rate

Raspberry pi is widely used by researchers for the implementation of the IoT concept associated with sensors according to the research requirements. The biggest challenge is because the operational raspberry pi is the highest power consume if implemented on the IoT system using the battery as a power source. Table 2.7. Below is the comparing the amount of power drawn in A (amps) under different situations and Raspberry pi types. (Power, 2018).

Table 2.7. Power Consume under different situations

Activity	Status	Pi1 (B+)	Pi2 B	Pi3 B (amps)	Zero (amps)
Boot	Max	0.26	0.40	0.75	0.20
	Avg	0.22	0.22	0.35	0.15
Idle	Avg	0.20	0.22	0.30	0.10
Video playback	Max	0.30	0.36	0.55	0.23
	Avg	0.22	0.28	0.33	0.16
Stress	Max	0.35	0.82	1.34	0.35
	Avg	0.32	0.75	0.85	0.23

2.2. Basic of Data Stream

Stream data is based on an order of magnitude of data generated continuously at high speed. Data streams are different from traditional static datasets that are distributed continuously with no restrictions and data distribution based on time. One of the characteristics of the data stream, allowing it to be updated in real time and the data arrives one at a time. Another characteristic of data streams is streaming data items at high speed. This data rate could be higher than the computing capability.

So to handle this case, it takes a tool stream generator that is able to handle the characteristics of this type of data. The basic concept of data in the data stream is known as Ordinary data or Ordinal data, this type of data can be calculated, so that the value can be placed one by one and corresponding to positive integers. While data values are often implemented as integers, or the same type as bytes. The concept can be exemplified as follows (J. M. Parenreng, 2010).

a. The data file system is only known in bytes (1 *byte* = 8 *bits*) which means it consists of a number of bits of files when the file will be sent and read again.
b. The process of writing *BitOutputStream* has an *outputStream* used to write bytes, ie the user writes the bit to *BitOutputStream*, and *BitOutputStream* writes byte to *outputStream*.
c. Each *BitOutputStream* has a stream to write bytes, and a *buffer* that is one byte. The process of writing bits is described as follows, figure 2.8.

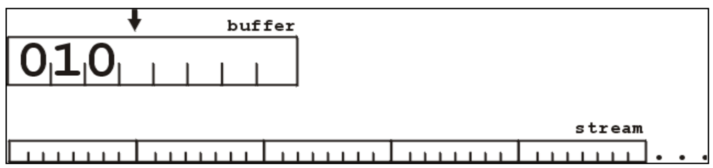


Figure 2.8. Writing *Bits* to *Buffers*

d. After 8 *bits* the *buffer* is full so no more *bits* can be saved.
e. Next *BitOutputStream* writes full *byte* to *OutputStream*. Shows in figure 2.9.

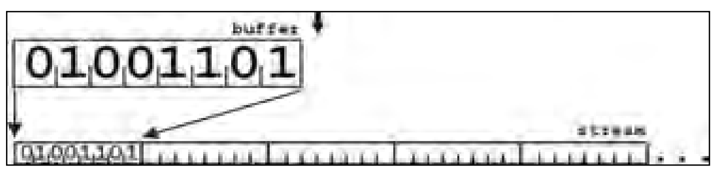


Figure 2.9. The *Buffer* writes the full *stream byte* to the *OutputStream*

f. The *buffer* is empty, and the cursor resets after the writing process to *OutputStream*.
g. Thus the process is repeated until all the data is written. Furthermore, the process of reading again to *bits* of new data coming.
h. The process of reading *bit stream*, as well as *BitOutputStream*. *BitInputStream* also has an *inputStream* and has a *buffer*.
i. To note is the *InputStream* showed after the data is done. This is because *InputStream* is the bit source for *BitInputStream*. And the amount of data depends on the contents of *InputStream*.
j. When the user first calls through the *readBit()* method, there are no *bits* in the *buffer*. So *BitInputStream* must first read a single byte from *InputStream* and save it to *buffer*. Shows in figure 2.10.

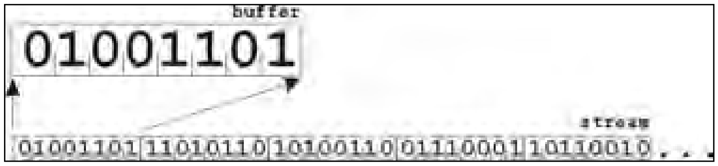


Figure 2.10. Filling *Buffer* before *bit* reading, from *InputStream*

k. Next, the *buffer* contains several *bits* and ejects one by one based on the call. To know is the position of the next cursor. And this continues until all data is read with the recall of *readBit()* repeatedly.
l. And so on, then move to the next *byte* by using *readBit()*. Shows in figure 2.11.

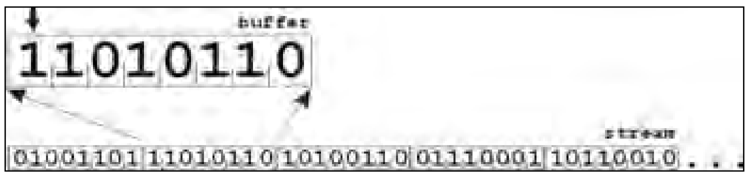


Figure 2.11. Filling *Buffer* from *InputStream* to *Buffer*

2.3. Mining Data Stream

Digital data of the world is experiencing rapid development, data in 2013 the size of digital data 4.4ZB and 2020 later this data is estimated at 44 ZB, with the largest data contribution by the Internet of Things. This is because IoT globally migrates analog functions to digital functions by implementing computerized systems, software and intelligence. Almost all devices such as cars, toys, airplanes, household appliances, turbines and even a dog necklace, although not as a whole connected directly to the internet (EMC Digital Universe, 2014). With this huge data potential, and the data will continue to grow, the next challenge is the storage media. Mining data is one of the data storage solutions in the updated data from time to time by doing mining on-board data (Tanner et al., 2002).

The most common problem of data stream mining is the amount of data rate during streaming data (Gaber, Krishnaswamy, & Zaslavsky, 2004a). Other challenges such as Infinite memory needs, this is because the data elements that come continuously. It takes some Algorithm Mining to pass the data stream and this can't be used because of the high data rate of the data stream. Data streams are obtained from sensor nodes and other wireless data sources. So it takes a large resource from the sensor node to transfer the data set to the server center for analysis.

For the solution of the above problems, there are several strategies of stream mining in the data for this technique (Gaber, Krishnaswamy, & Zaslavsky, 2003), (Gaber & Yu, 2006), (Phung, Gaber, & Roehm, 2007), (Werner-Allen et al., 2006), (Mainwaring, Culler, Polastre, Szewczyk, & Anderson, 2002), (Mainwaring et al., 2002), such as;

a. Adaptation Input Data Rate: This approach uses sampling, filtering, aggregation, and load shedding. For Sampling, the selection process is done statistically on the data stream elements that arrive and will be analyzed. For

Filtering, the process is similar to the sampling whose data elements are marked by necessity, for example in the coming data, whether to be analyzed or not. Aggregation is done by way of aggregating a set of data elements using some statistical measurements such as finding the average value of the data. And the last one is load shedding mechanism by making termination or limiting data elements that come continuously.

b. Output Level Concept: The concept of data mining that tries to overcome the problem of high data rate, by categorizing incoming data based on the matching criteria desired such as size or type of data. The problem with this model makes the CPU work continuously. The advantages of this model is able to overcome the limitations of memory capacity owned by the sensor node.
c. Approximate algorithms: This model mining data estimates the desired end result by providing acceptable error tolerance.
d. On-Board Analysis: The data processing of this model performs data computing on a data stream source, and this model becomes familiarly applied to devices with limited resources, this is because it is more flexible and versatile. this concept contributes a lot to various research applications including natural hazards detection and prediction, early warning system, intelligence sensor control and generate data product that the user needs. The main purpose of this model is to avoid the transfer of data in very large amounts, so that the mining process on the data is done at the location of the data source. Several projects have implemented this concept such as, VEDAS project (Kargupta et al., 2004), EVE project (Tanner et al., 2002) and Diamond Eye project (Michael C, Burl., Charless, Fowlkes., Joe, Roden., Andre, Stechert., Saleem, 1999).
e. Output Granularity Algorithm: This concept uses a data rate output controller that is based on the availability of memory and the remaining time. Mining on the data stream will try to find the trend of data at certain period of time.
f. Exploit in-network processing; this concept is developed for data processing on the network, i.e. by exploit in-network processing. By applying compress, data mining and time capture data settings to reduce communication bandwidth, and utilizing local storage as temporary storage of data for short periods of time (Jason Lester Hill, 2003).

In the wireless sensor network distribution environment, there are three ways to manage wireless sensor devices; peer-to-peer, ad-hoc and hub. In a peer-to-peer or ad-hoc network, each sensor allows to access its neighbors and form a random graph of the network as a whole. In a network hub, the network forms a tree structure where the tree arm is the sensor, and the root of the tree is a computing device that can act as a regular sensor such as a root node, or a computer (McConnell & Skillicorn, 2005).

2.4. Resources Aware

Resource aware is an adaptation of node sensor resource conditions when one of its resources is critical. With RA implementation, critical resources can be recovered and above the threshold value. For sensor nodes that use the battery as a power source then when the battery is critical, it will trigger the battery adaptation system. Because the battery becomes the most important requirement, so the main purpose of battery adaptation is power conservation to extend lifetime (I.F. Akyildiz et al., 2002), (Archana, Bharathidasan., Vijay, Anand, Sai, 2003), (Uwe & Tse, 2008).

To overcome the problem of sensor node resources, it needs adaptation solution to resource availability through efficient use of resource sensor node. The solution is like reducing the amount of data communication by moving the data processing algorithm to the sensor node. Another solution is to combine data communications and data processing. To reduce the cost of data communications that occur, required data reduction techniques such as by implementing data mining algorithms on the sensor node. Then for the efficiency of resource use, the adaptation is based on resource-level which gradually decreases, as does the availability of battery, CPU and Memory (Uwe & Tse, 2008), (Shiddiqi, 2009b), (J. M. Parenreng & Kitagawa, 2017). The basic concept of adaptation resources is described in figure 2.12.

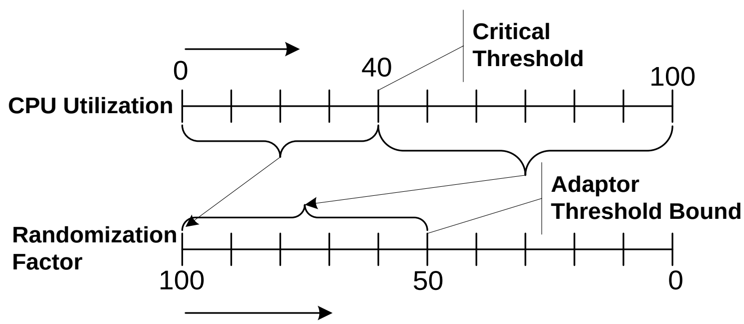


Figure 2.12. Adaptation Mechanism (Phung, Gaber, & Röhm, 2007)

Previous research proposes a method that sets up resource availability for stream mining data, i.e.; Algorithm Granularity Setting (AGS). The algorithm consists of three settings (Gaber, 2006): for Input Setting called Algorithm Input Granularity (AIG), this section sets the Input for the change in sampling rate or data structure of the data stream used by the stream mining algorithm in the data. Output Setting called Algorithm Output Granularity (AOG), this section performs settings for the size change Output of the algorithm for example the number of clusters formed through the clustering algorithm. And Process setting called Algorithm Process Granularity (APG), this section sets the random factor change of algorithm to make the power consumption reduce.

Still part of previous research, this study attempted to maximize the use of limited resources on sensor nodes, this Resource-Aware (RA) study (Shiddiqi, 2009b) formulated some resource adaptation formulas for Battery, CPU and Memory. The implementation is done with a radius threshold (RT) for memory, random factor (FR) for CPU and sampling interval (IS) for battery.

a. The implementation of the Radius Threshold (RT) is performed on memory, by determining the range of the classification and the maximum threshold distance of the center (mean) of a classification. For the adaptation process to resource availability, if the resource reaches critical threshold then the parameter radius will be recalculated based on the availability of memory so that with the recalculation result will be adjusted to the new threshold radius, the purpose is to prevent the formation of new class.

b. Random Factor (RF) is performed on the CPU, by adapting to CPU resource availability. If the CPU reaches a critical threshold, then the adaptation via Factor Random will adjust. The goal is to make the CPU not random and check the data as a whole, so the CPU can save resources.
c. The sampling interval (IS) is performed on the battery, by monitoring the availability of the power battery. If the battery resource reaches a critical threshold then the sampling interval will be recalculated to make adjustments.

2.5. Security Aware

Security and data networks are the main areas of particular concern to support the reliability and sustainability of a system's operations. WSN technology is updated and expanding every day, including hardware components that offer variants of technology, size, application tools and various implementations, the biggest challenge is wireless security. This is because wireless media is very limited security on the wide open medium. WSN is known as a device that has limited resources, while the use of strong security may adversely affect system performance with limited resources, even a new threat, such as exhaustion of resources, availability and inefficiency. In addition, other effects of excessive security estimation will increase the complexity of the system that will affect the implementation. While imposing security parameters that limit operations, will make the system inflexible and even reduce its function (Bogdan Ksiezopolski., 2009). A suitable solution for such a case is the security level (Ksiezopolski et al., 2010), (Xie, Qin, & Sung, 2005), the higher the security level data means the greater the energy consumption for cryptographic data functions (Potlapally et al., 2006), (Sen, 2009), (Raghunathan, Schurgers, Park, & Srivastava, 2002). Security level data basically to offset the use of resources on WSN when resource availability has entered a critical phase. The effect of the policy of applying a high level of data security to each data output will affect the lifetime, this is because high data security levels require large CPU and memory resources, and the effect of increased battery consumption, and a reduced lifetime system (Potlapally et al., 2006). Table 2.8. Shows a security level based on some hash function algorithms (Xiong, Zhao, & Xu, 2007).

Table 2.8 Hash Function Overhead

Hash Functions	s^g**: Security Level**	$u^g(s^g)$ **: KB/ms**
MD4	0.1	23.90
MD5	0.2	17.90
RIPEMD	0.3	12.00
RIPEMD-128	0.4	9.73
SHA-1	0.5	6.88
RIPEMD-160	0.6	5.69
Tiger	0.7	4.36
Snefru-128	0.8	0.75
Snefru-256	0.9	0.50

In cryptography, indirectly to improve the quality of security can be done through block size and key size, because the greater the block size will improve the quality of security, complexity and performance, but in fact it is more costly to implement through. Simple explanation, a block cipher with a specific key shuffle and flips the bits of a block. If you have 8 bit blocks there are 8! (40320) ways to shuffle them. For 64 bit blocks, 64! (1.2e89). for 128 bit blocks, 128! (3.8e215). For AES-256, there are 3.8e215 ways to shuffle the block and only 1.1e77 different keys (shuffling used). 3DES and Blowfish always work on 64 bit blocks, regardless of key size. AES always works on 128 bit blocks, regardless of key size. We now know 64 bit blocks are insecure (Stack, 2016), (Stack, 2017).

Selection of cryptography for WSN is an important part, because this device has limitations. The cryptography type used by node sensors should evaluate code size, data size, processing time and power consume (Sen, 2009). Table 2.9. Indicates some attacks on WSN and the mechanism of defense.

Table 2.9. Attacks on WSN and countermeasures (Wang, Attebury, Ramamurthy, & -Lincoln Wang, 2006)

Network	**Attacks**	**Defense**
Physical	Jamming	Spread-spectrum, priority messages, lower duty cycle, region mapping, mode change
	Tampering	Tamper-proofing, hiding
Link	Collision	Error-correcting code
	Exhaustion	Rate limitation
	Unfairness	Small frames
Network and routing	Spoofed, altered or replayed routing information and Selective forwarding	Egress filtering, authentication, monitoring
	Sinkhole	Redundancy, probing
	Sybil	Authentication, monitoring, redundancy
	Wormholes	Authentication, probing
	Hello flood attacks	Authentication, packet leashes by using geographic and temporal information
	Acknowledgment spoofing, flooding	Authentication, verify the bidirectional link authentication
Transport	Flooding	Client puzzles
	Desynchronization	Authentication

Wireless intrusion detection has two categories of attack, the first attack targeting fixed part of wireless network, such as MAC spoofing, IP spoofing and DoS. The second category is an attack that targets the data communications part or radio part of wireless networks, such as access point (AP), noise flooding and wireless network sniffing. And this second category is a rather difficult attack because the way to detect it is done by tracing back from the beginning in order to know the cause of the attack and the solution to the problem (trace-back). Security aware or adaptable security, Implementation on protocol and widely applied to real-time system by using packet scheduling (Qin et al., 2008), by using dynamic level data packet security based on security application needs, it is expected to maximize the achievement of high security quality and increase guarantee ratio of security. Another research is Improve security-aware packet scheduling algorithm (ISAPS) (Zhu, Guo, Liang, & Yang, 2012), its main priority is to schedule real-time data packet systems while on a heavy workload, but when the system is on a light workload, ISAPS is trying to increase the security level of the packet real-time data until it reaches the highest level of security. Other studies, discussing the quality of protection (QoP) that defines the security level is based on security parameters. The parameters are like; a key length, the length and contents of an encrypted block of data (Chui Sian Ong, 2003). Other studies, discussing the quality of protection (QoP) that defines the security level is based on security parameters. The parameters are like; a key length, the length and contents of an encrypted block of data (Phyllis, A. Schneck., Karsten, 1997).

2.6. Sensor for Environmental Extremes

The extreme environment is a hostile environment for normal life in general, the environment is like space, underwater, and underground. This extreme environment is affecting the climate change of the earth and the environment around it, so this is the biggest challenge for researchers to learn more and can be an early warning when disaster impacts. Researchers believe that research space, underwater, and underground will remain expensive, slow and will take a long time (Habib F. Rashvand., 2017). Another challenge is the design of sensors that will be placed in the extreme area and the supporting electronic components must be able to operate normally, for example in environments with very fluctuating temperatures from cryogenic to very high, high radiation, high moisture, high pressure, vibration, wet and other (Ali Abedi, 2017).

In extreme environments, wireless sensor systems (WSSs) use terms such as wireless sensors and network actuators, wireless smart intelligent sensing, wirelessly connected distributed smart sensing, and unmanaged aerial vehicles (UAVs). The use of new technologies such as smart sensors will provide many possibilities for creating new technological systems and services. In order to arrive at the implementation stage, deploy technology must meet four parameters, such as; Trust, Objectivity, Security, Sustainability. Objectivity here means offering a new product or service, which is able to provide solutions unconventional condition. So the product may offer a distinct service, which may be used in the vacuum of space, in the oceans, very low, and highly variable temperatures, humidity, winds and pressure (Habib F. Rashvand., 2017).

2.6.1. Space

Basically this WSN technology deployment can be implemented in various fields and will be continuously and periodically, monitoring and assessment. For the implementation of WSN technology in space, many found for example the sensor for the space shuttle, the sensor variant as shown in Figure 2.13 (Hendra, Kesuma., Johannes, Sebald., Steffen, 2017).

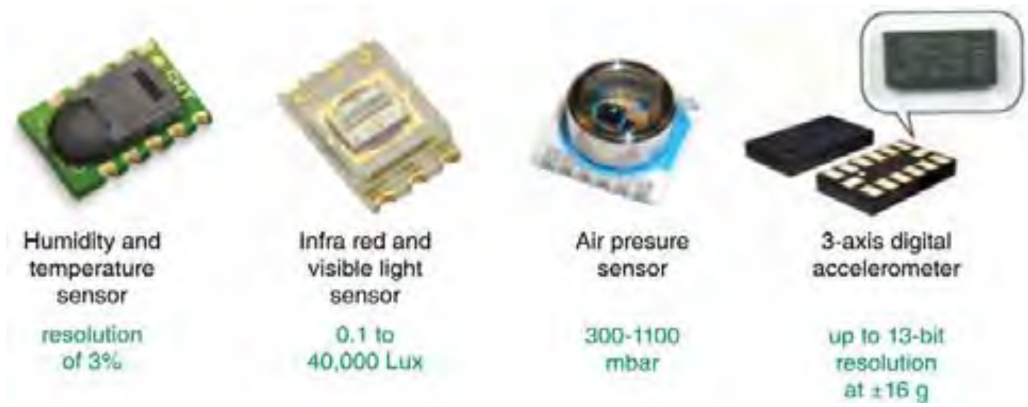


Figure 2.13. Smart sensor for the telemetry subsystem on WSN

Figure 2.14. Wireless sensor technology placement and deployment plan for Ariane 5's upper stage

Other implementations are commonly used for monitoring structures such as bridges, pipelines, railways, offshore oilrigs and aircraft wings, so that performance and security structures can be monitored and evaluated continuously. With these sensors the ability to detect damage not only reduces costs and minimizes routine maintenance and inspection but also early prevention of accidents, and it is very useful for self-monitoring material structures integrated with smart systems, as shows in figure 2.14. This sensor requirement, usually using piezoelectric lead zirconate titanate (PZT) sensor, combined with WSN network system, so this technology promises guarantee of fast, accurate and low-cost structural monitoring solution, Figure 2.15 shows examples of PZT sensor implementation on UAV or jet (Xuewu, Dai., Shang, Gao., Kewen, Pan., Jiwen, Zhu., 2017).

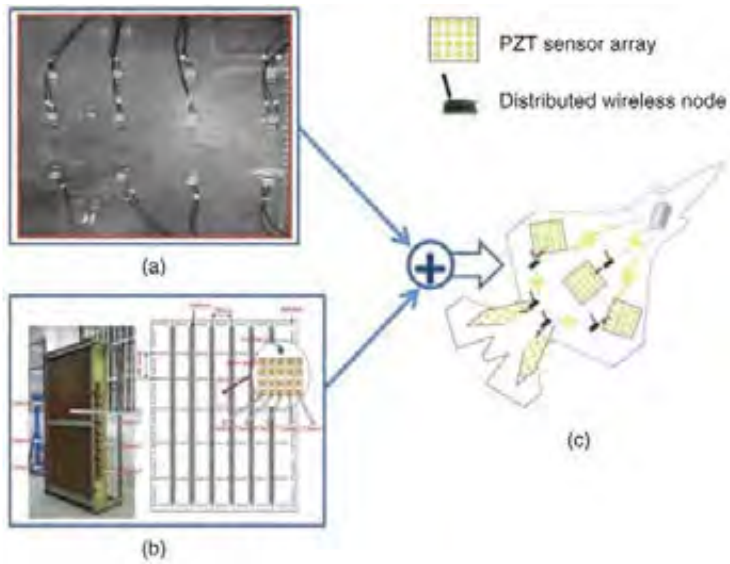


Figure 2.15. Application of PZT sensor networks: (a) Wired PZT sensor network in UAV wing box; (b) High-throughput wireless data acquisition system; (c) Next-generation wireless active PZT sensor system.

2.6.2. Underwater

The surface of the earth is mostly water that certainly has a lot of potential and interesting to be studied, which has been unreachable by humans. The latest research uses a new smart sensor, with these sensors allowing underwater researchers to observe deeper ocean depths in more detail, closer look, interact and learn more about the biological, geological and chemical processes of the ocean that directly affect Earth's life and climate (D.M. Toma, J. d. Río, N. Carreras, L. Corradino, P. Braulte, E. Delory, 2015). With this knowledge it helps us to understand the sustainability of life on the surface of the earth and life on it. Figure 2.16 shows the implementation of WSN technology for deep sea communication.

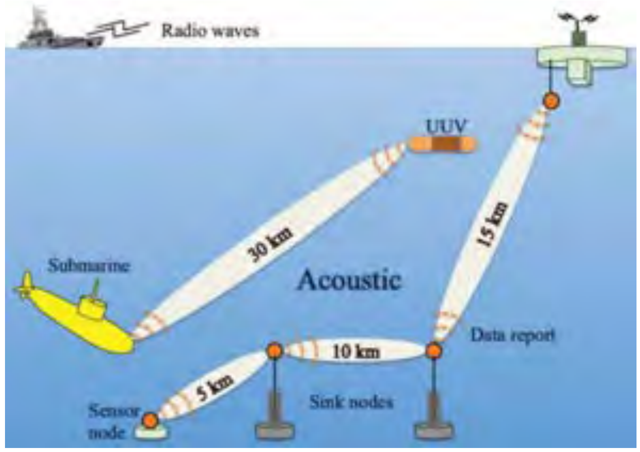


Figure 2.16. Underwater communicating nodes using acoustic links (L. Emokpae, 2013)

Some future research for underwater, such as; Generic geographical and biological monitoring underwater environment and climate change, RFID for collecting and classification temperature and pressure measurement, prediction of natural disasters such as seismic signal and hurricane measurement Detection of underwater bomb objects integrated with robotic removals Underwater cultivation and food-resource project and planning, marine science and technology, fisheries research and so on), underwater pipe leak detection integrated with robotic repair and maintenance, buoys for communication as warning on ships and underwater vehicles, underwater treasure hunt and leisure activity (underwater treasure hunt and activities recreation), underwater manned vehicle guidance and rescue, underwater mineral, oil and gas resources projects and planning.

2.6.3. Underground

Communication between underground sensor devices is also an interesting theme, the use of WSN in this field to communicate efficiently between network sensors in various applications such as; monitoring of soil conditions, earthquake prediction, communication on mines, tunnels, refineries and oil storage, construction health monitoring, localization interact underground for human and machines.

The development of research in the field of underground by some researchers said to slow down, one of the slowing factor is the evolution of wireless underground sensor network (UWSNs). The challenge of underground communication channel is very influential on heterogeneity of soil, which may consist of stone, sand and even water, in addition that the water content in the soil greatly affect the performance of UWSNs, soil moisture changes, magnetic induction which causes path loss (Steven, Kisseleff., IanF.Akyildiz., 2017). Figure 2.17 shows the implementation underground sensors.

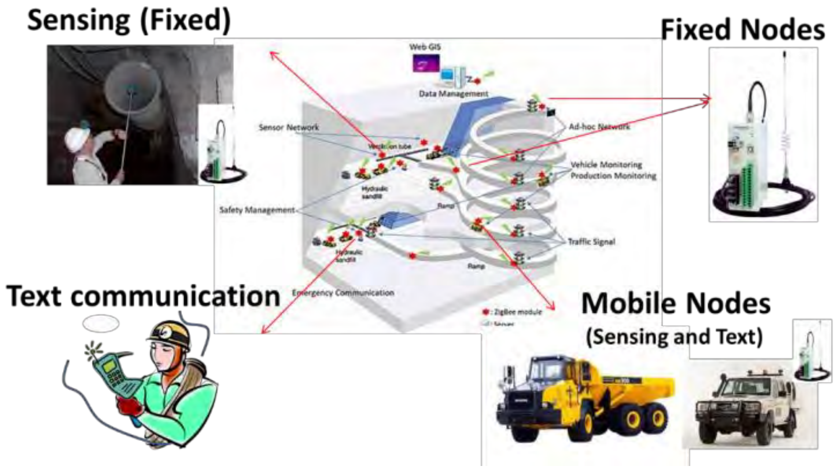


Figure 2.17. Underground sensor monitoring (KawamuraLab., 2018)

Chapter 3. A Framework of Security Adaptation for Limited Resources in Wireless Sensor Network

Wireless sensor network (WSN) technology enables continuous monitoring, tracking, and control. WSN technology is the basis for acquiring information with which to make decisions and take actions on, for example, weather forecasts, traffic information, currency movements, and public transportation schedules. It can even be used to monitor states and places that are inaccessible to humans, such as the movements of tectonic plates deep underground, volcanic activity, and radiation levels in areas affected by nuclear accidents.

WSN devices must be small and have exceptional functionality. They must have the ability to receive data, process the data, and send the results. To monitor a large area, WSN devices are supported by the network and other devices throughout it. To avoid unnecessary detections and storage of data, a filtering mechanism using data mining algorithms should be implemented in each node (Gaber & Yu, 2006), (Gaber et al., 2003) so that only the most important data is saved (Gaber, Krishnaswamy, & Zaslavsky, 2004b).

WSN devices have limited resources, such as battery capacity, memory, CPU, and radio communication capacity (Phung, Gaber, & Roehm, 2007), (Shiddiqi, 2009a), (Karl, Holger., Andreas, 2005). Not all WSN devices have sufficient data processing or storage capabilities, and few have good batteries. In addition, security threats are a major concern; data obtained by a WSN may be of little use if there is no guarantee of its security. The security-aware concept described in this study gives a WSN the ability to adapt the level of security to the workload (Son, Zimmerman, & Hansson, 2000), (Walters & Liang, 2006), (Zhu et al., 2012) and balance resource utilization and the level of data security (Ksiezopolski & Kotulski, 2007), (Ksiezopolski et al., 2010).

3.1. Components Model

3.1.1. Resource of WSN Node

Resource availability is a very important consideration for a WSN. (Jason Lester Hill, 2003) states that the resources of a WSN consist of a battery, radio, processor, and sensor. The author goes on to describe how resources can be combined to make possible thousands of applications for the public good. (Karl, Holger., Andreas, 2005) describe WSN resources as consisting of a controller, memory, sensors, actuators, communication capacity, and a power supply. In particular, the battery or power supply is necessary for the other WSN equipment to operate so that their availability can be maintained (Penella, Albesa, & Gasulla, 2009).

To maintain the availability of a resource, researchers have tried to modify the algorithm in use. In particular, (Gaber & Yu, 2006) discuss how the battery, CPU, and memory can be utilized in ways that can increase the lifetime of the network. They use a resource monitoring scheme to track resources of nodes. Their scheme works by monitoring the conditions of availability of the main resources. Significant changes to the availability affect the adaptation performance (Shiddiqi, 2009a), (J. Parenreng, Syarif, Djanali, & Shiddiqi, 2011).

A gradually changing resource availability is a challenge, because the availability of the battery resource especially determines whether or not the system continues operation (Penella et al., 2009). WSN states such as active, idle, and off, consume battery power. In particular, the idle state has been found to consume10 mW (Shih et al., 2001), while the off state consumes 0.016 mW (Schurgers, Member, Tsiatsis, & Member, 2002).

The algorithm granularity have described (Gaber et al., 2003), that is, putting settings on input by using an input algorithm, putting settings on processes by using a process algorithm and putting settings on output by using a output algorithms. All of this, with the aim to save battery, CPU, and memory (Shiddiqi, 2009a), (Shiddiqi & Gaber, n.d.), (J. Parenreng, Djanali, & Shiddiqi, 2010), (J. Parenreng et al., 2011). Figure 2.12 shows the adaptation mechanism.

3.1.2. Resource Awareness

The input algorithm (Gaber & Yu, 2006) controls the availability of battery resources. Adaptation is done in sampling intervals (SI) (Shiddiqi & Gaber, n.d.). In previous research (J. Parenreng et al., 2010), if the battery capacity is 100%, each data stream is checked, but if the battery capacity drops to a critical level, then data is checked only in certain intervals decided on the basis of the availability of the battery resource, which is calculated using the sampling interval formula. The sampling interval (SI) formula 3.1 is as follows (Shiddiqi & Gaber, n.d.):

$$IS = ub - battery \frac{ub - lb}{batt\_crit\_threshold} \quad \text{..(3.1)}$$

Here, ub is an upper bound for the maximum availability of a battery resource, lb is a lower bound for the minimum availability of a battery resource, battery is the availability of the battery capacity at the time, and batt_crit_threshold is the threshold availability of a battery in a critical condition.

Process Algorithm (Gaber & Yu, 2006) controls the availability of the processor resources (CPU). Adaptation is done through the random factor (RF) calculation such as formula 3.2 below (Shiddiqi & Gaber, n.d.). Here, if the CPU capacity is 100%, then each data stream is checked to determine the proximity of the data. If the CPU resource has reached a critical level, the data streams are checked randomly (J. Parenreng et al., 2010).

$$RF = \frac{10.000 - cpu\_crit\_threshold * lb - (100 - lb) * cpu}{100 - cpu\_crit\_threshold} \quad \text{............(3.2)}$$

Here, cpu_crit_threshold is the critical threshold of the CPU, cpu is the CPU resource capacity at the time, and 100 is the maximum utility of the CPU.

The output algorithm (Gaber & Yu, 2006) controls the availability of the memory resources. The adaptation is done through the radius threshold (RT) calculation such as formula 3.3 below (Shiddiqi & Gaber, n.d.); if the available memory drops below the critical limit, then the system will reduce the usage of memory by limiting the number of clusters or counter formed, in order to free up memory space (J. Parenreng et al., 2010).

$$RT = ub - memory \frac{ub - lb}{mem\_crit\_threshold} \quad \text{.....................................(3.3)}$$

Here, radius is a radius threshold that is the maximum distance threshold, memory is the total memory used at that time, and mem_crit_threshold is the critical limit of memory.

The monitoring system described above is updated by the resource monitor (Gaber & Yu, 2006), (Phung, Gaber, & Roehm, 2007) so that the processes that occur are always based on the current state of the device resources.

3.1.3. Mining Data

Mining data with WSN technology is still a relatively new idea. Here, data mining is performed on data sources in real time, so that the results of a process will have an impact on decision-making. This is a very challenging task for researchers because WSNs have limited computation and radio communication resources, and the volume of data generated by the WSN varies (Mahmood, Shi, Khatoon, & Xiao, 2013). Another challenge is data mining of high-speed data streams (Gaber & Yu, 2006), (Gaber et al., 2003), (Gaber et al., 2004b), (Shiddiqi & Gaber, n.d.).

Researchers previously tried mining data sources using WSN devices, to find the latest information in a collection of data in real time. They did so by using data analysis techniques to extract useful information for the end user (Azhar Mahmood., Ke Shi., 2012). There are several ways of mining data, such as by using clustering algorithms (Gaber & Yu, 2006), (C. C. Aggarwal & Wang, 2007), classification algorithms (Shiddiqi & Gaber, n.d.), (Shiddiqi, 2009b), frequent pattern algorithms (J. Parenreng et al., 2010), (S. Orlando, P.Palmerini, R. Perego, 2002), and association rules algorithms (Agrawal & Srikant, 2008).

3.1.4. Resource-Aware and Mining Data Algorithm

3.1.4.1. Resource-Aware Cluster Algorithm

The resource-aware clustering algorithm (RA-Cluster), introduced by (Gaber et al., 2003), has two main components. The resource aware (RA) component uses adaptation techniques to obtain data on high-speed data streams with maximum accuracy based on the availability of data. The algorithm begins by examining the minimum data rate. If the algorithm can operate at the minimum data rate, the RA component tries to find a solution that is able to maximize accuracy through the increased data rate. Otherwise the algorithm sends requests to the data mining server in order to achieve minimum accuracy (Gaber et al., 2004a). The second component is a clustering algorithm, whose steps are as follows (Gaber et al., 2003), (Gaber et al., 2004b), (Gaber et al., 2004a).

a) The data items arrive in the order of the data rate.
b) The algorithm determines a starting point as a data center.
c) It compares this center with each new data item with a central point to get the distance to that data.
d) If the distance to all centers is greater than the threshold, the new items become a new center. If not, the weights for the data center point to the closest data item are raised, and the new center is equal to the weighted average.
e) Repeat step c and d,
f) If value centers = k (based on available memory), create a new centers vector,
g) Repeat step c, d, e and f,
h) If memory is full, then re-cluster.

3.1.4.2. Resource-Aware Classification Algorithm

The resource-aware classification algorithm (RA-Class) was also introduced by (Gaber et al., 2003), (Shiddiqi & Gaber, n.d.), (Shiddiqi, 2009b). Initially, the algorithm determines the number of instances based on the availability of memory. When the element class of the data arrives, the algorithm seeks a nearby instance that has been in the memory, on the basis of a certain threshold distance. The algorithm uses this threshold to determine whether two or more elements are similar. If so, the algorithm checks the class labels. If the class labels are the same, the weights are increased by 1. If not, the weights are reduced by one. If the weight decreases to zero, the corresponding element is removed from memory. This algorithm changes the distance threshold from time to time in order to cope with the speed of the incoming data.

3.1.4.3. Resource-Aware Frequent Item Algorithm

The resource aware frequent item algorithm (RA-Frequent Item) calculates the number of frequent data items on the basis of the availability of memory (Gaber et al., 2004b). This value is continuously updated to deal with high data rates. The algorithm represents the number of frequent items as a counter that is reset after the time limit is reached, to cope with the changing nature of the data stream. The algorithm receives data elements one by one and tries to find a counter for each new data, and if it succeeds, it increases the number of items for the same data. If all counters have been filled, some of the new items are ignored and the counter is reduced by one, until the algorithm reaches the specified time limit. A counter with the least frequent data is ignored, and the counter is reset to zero. If a new item is the same as a data item in memory based on the similarity threshold, the average value of both items is allocated and the counter is incremented by one. The main parameters including time threshold and number of counter items affect the accuracy of the algorithm. When the threshold time is reached, the algorithm deletes the remaining items and resets the counters (Gaber et al., 2003), (J. Parenreng et al., 2010), (S. Orlando, P.Palmerini, R. Perego, 2002), (Chang, Li, & Peng, 2012).

3.1.5. Security Awareness

In the past, data models were manually developed at great expense; it took a long time, requiring hardcopy documentation and a large physical storage space. Today, WSN devices are able to create more detailed models faster and more efficiently that can be updated at any time.

Maintenance and control devices are highly dependent on the placement and function of the WSN. Sensors may be placed in areas that are too humid, dusty, or hot to do maintenance. WSNs can economically monitor extreme environments that are inaccessible to humans (Ian F. Akyildiz, Weilian Su, Yogesh Sankarasubramaniam, 2002). Despite their extraordinary abilities, WSNs have disadvantages, i.e., limited resources, unreliable communications, and unattended operation (Walters & Liang, 2006). In particular, the data exchange mechanism, which uses wireless media communication, is vulnerable to valid and invalidated data packets, data conflicts, and errors in data transfer. Latency may also trigger failures when synchronization between sensor nodes is important. Other study (Ksiezopolski & Kotulski, 2007) describes how to assign a protection level to a transaction and assign a proper security level on transaction data to improve system performance.

3.1.6. Security Level

Security adaptation based on resource availability is very helpful to optimize security (Ksiezopolski & Kotulski, 2007). Efficient resource usage has a direct impact on operation of WSN devices. The higher the security level, the greater the cost and impact on processing time resources (Son et al., 2000).

Other study (Xie et al., 2005) assign security levels (0.1-0.9) based on a hash function for integrity. (Ksiezopolski et al., 2010) assign five levels of security: very low, low, medium, high, and very high. The challenge for them was optimization of security in mobile devices.

3.1.7. Workload

Discussions regarding workload always involve optimization and efficiency paired with the concept of scheduling. (Zeng, Dong, Liu, & Lu, 2012) schedule transmissions of data packets on each node on the basis of the workload node concept. Another study that uses the concept of the workload node is reported by (Wu, 2012), which proposes workload-aware channel assignment (WACA) algorithm for lossy channels in urban networks. (Xie et al., 2005) discuss a workload-aware MAC protocol (W-MAC) for the heterogeneous environments of WSNs, where each sensor node generates data with a different capacity. The scheduling concept and workload-aware time slice allocation mechanism minimize the power consumption of the node, to cope with delay of the data and adjust the schedule to the variable data rate due to the changing network topology.

3.2. Adaptable Resource and Security (ARSy) Framework

The term ARSy Framework is an adaptable resource and security framework. The framework describes the relationship between blocks, as shown in Figure 3.1. The details of this process are explained below.

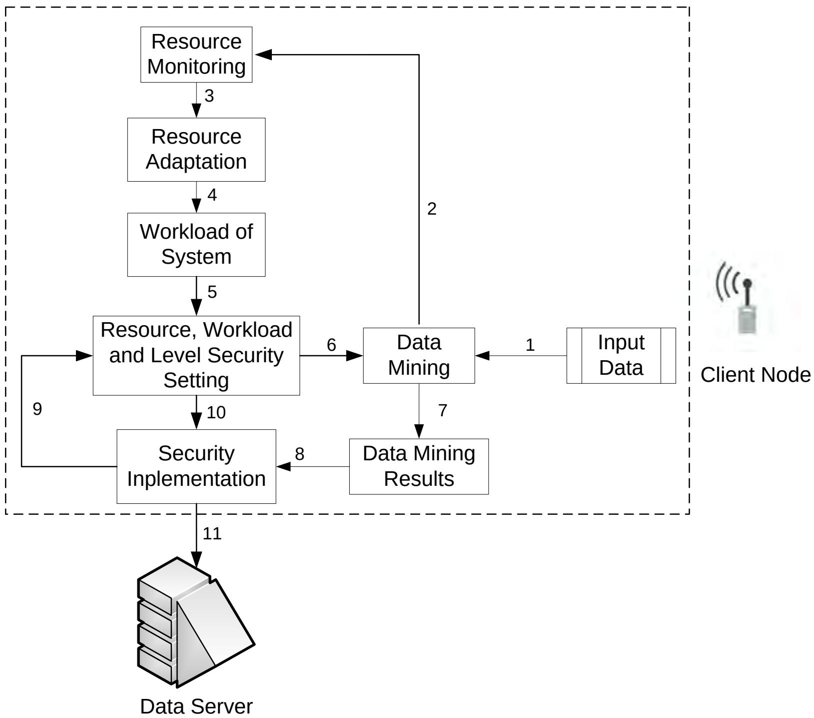


Figure 3.1. ARSy framework.

The ARSy Framework consists of three main blocks. The first is the Client Node, which is equipped with resources to perform data processing. The second block processes the data. The third block is called the Server Data block which is in different area from the node and this research is done until to the delivery of the results of the node as the final destination of all the data.

3.2.1. Data Input

The data input block was developed in previous research (J. Parenreng et al., 2010). It receives the data streams to be processed. It executes a data mining process that determines which of the data are similar (Gaber & Yu, 2006).

3.2.2. Resource Monitor

The resource monitoring block keeps track of the availability of resources such as memory, CPU, and battery. There are two alternative models. The first reports the resources to be used by the data mining block. The monitor does not report all resource changes that occur to the data mining block, only those in which resource availability decreases by more than 5% (>5%). If such a resource decrease occurs, it updates its information sent to the resource, workload, and security level settings block. Then the data mining block processes the data with the available resources. The process continues until the resource reaches a critical threshold, at which time the adaptation system react, for e.g., battery via IS, CPU via RF and memory via RT.

In the second model, changes in a resource are not addressed by the system resource adaptation until the resource is in a critical condition. The resource monitoring block sends an update on resource availability to the resource, workload and security level settings block when resource of nodes are in a critical condition. This adaptation applies equally to all types of resources until a resource is completely exhausted and the system no longer functions.

3.2.3. Resource Adaptation

3.2.3.1. Battery

In battery adaptation through the sampling interval (SI), stream data is continuously processed. If the battery is the maximum resource, each data is processed to determine its type, similarity with previous data, and new counters are created for each piece of new data is not similar to other data. When the battery capacity falls below a certain threshold, data is collected at a specified interval based on the amount of resource remaining. The degradation of resource availability affects the interval and data processing until the battery completely runs out.

```
Algorithm 1 : Battery Adaptation Policy
//Resource Battery Adaptation
//Assumption Battery Capacity 100%
START
Input data stream
IF(Available BAT > IS_BAT)
       IS_BAT = IS_Lower_Bound
       Process all data stream
       Save mining result [maximum counter]
       Setting resource monitor Battery
       Output monitoring resource Battery
ELSE
       Calculate IS_BAT
       Implement Battery adaptation
       Save mining [minimum counter]
       Setting resource monitor battery
       Output monitoring resource Battery
END IF
STOP
```

Figure 3.2. Pseudocode for battery adaptation.

Figure 3.2 shows the battery adaptation algorithm is described as follows. The system accepts an input data stream, if the resource battery availability is greater than the value of the sampling interval and the sampling interval of the battery is equal to the lowest threshold adaptation of the battery, this condition is ideal, so that the system does not implement adaptation policies. System update its latest battery setting, processing of all data passing and stores the results of the data mining process. Other conditions when the battery resource falls below the minimum value for the sampling interval, the value of sampling interval is recalculated, update on the latest battery resource value to the resource monitoring block then implement values adaptation and stores the results of the data mining process.

3.2.3.2. CPU

CPU adaptation through the Random Factor (RF). If the CPU resource availability is above the critical threshold, all data passed to the CPU is processed. When the resource falls below a critical threshold, the data to be processed is drawn randomly.

```
Algorithm 2 : CPU Adaptation Policy
//Resource CPU Adaptation
//Assumption CPU Capacity 100%
START
Input data stream
IF(Available CPU > RF_CPU)
       RF_CPU = 100%
       Random all data stream
       Save mining result [maximum counter]
       Setting resource monitor CPU
       Output monitoring resource CPU
ELSE
       Calculate RF_CPU
       Implement CPU adaptation
       Save mining [minimum counter]
       Setting resource monitor CPU
       Output monitoring resource CPU
END IF
STOP
```

Figure 3.3. Pseudocode for CPU adaptation.

Figure 3.3 shows the CPU adaptation algorithm is describe as follows. The system accept an input data stream, if the resource CPU availability is greater than the value of the random factor CPU, its mean the threshold of the CPU (RF_CPU) is 100%, system update its latest CPU setting and all data are randomized to determine their similarity to existing counters, then stores the result of the data mining process. If the resource availability falls below the critical threshold of RF_CPU, RF_CPU is recalculated and used as a reference value for CPU adaptation policies.

3.2.3.3. Memory

Memory adaptation using the radius threshold (RT) is performed on the basis of proximity data. The results of the data mining process in a specific time period are stored in memory. Figure 3.4 shows the pseudocode for memory adaptation.

```
Algorithm 3 : Memory Adaptation Policy
//Resource CPU Adaptation
//Assumption Memory Capacity 100%
START
Input data stream
IF(Available MEM > RT_MEM)
      RT_MEM = RT_Lower_Bound
      Save mining result [maximum counter]
      Setting resource monitor memory
      Output monitoring resource memory
ELSE
      Calculate RT_MEM
      Implement Memory adaptation
      Save mining [minimum counter]
      Setting resource monitor memory
      Output monitoring resource memory
END IF
STOP
```

Figure 3.4. Pseudocode for memory adaptation.

Memory adaptation does not occur if the available memory is greater than the radius threshold. All the data mining results are stored. When the available memory capacity falls below the radius threshold, the radius threshold is recalculated, the resource monitor updates its resource memory information and the data mining results are sent to a minimum counter.

The radius threshold grows and shrinks according to resource availability. If the available memory capacity is larger, more counters of data mining results are stored in a data mining period. But if the memory capacity falls below the threshold, only the minimum number of counters is stored in a data mining period.

3.2.4. Workload System

Nodes could be placed in extreme environments and have heavy workloads. The conditions in which the device has to operate is an important consideration. Here, a heavy workload condition means that one of the resources such as battery, CPU or memory has reached a critical condition, and adaptation occurs. A light workload means that the resources are in a normal condition or at maximum, and there is no resource adaptation, the algorithm shows in Figure 3.6.

3.2.5. Resource, Workload and Security Level Setting

Battery and memory on a resource node will decrease over a certain period of time. Information on resource availability during a specific time period is a reference for the data mining process to decide amount of resource that it uses. The resource availability information is updated continuously.

There are three setting operations. The first is the resource settings for memory, CPU and battery, which uses information sent by the resource monitor. These settings are used as input parameters for the data mining process. The second is the workload setting determining a heavy workload or a light workload. The third is the security setting, which determines the level of security to be applied to each of the data mining output based on the conditions of the resources and workload at the time. Adjustment resource and security level shows in table 3.1.

Table 3.1. Lists adaptations based on resources, workload and level of security

Resource	Workload	Security Level	Average Resource (%)
Maximum	Light	High	75-100
Maximum	Light	Medium	50-75
Minimum	Heavy	Low	20-50
Minimum	Heavy	Very Low	0-20

3.2.6. Data Mining and Output

Figure 3.5 shows the lightweight frequent item (LWF) algorithm (J. Parenreng et al., 2010), (S. Orlando, P.Palmerini, R. Perego, 2002) operates on the received data streams and considers the availability of battery, CPU, and memory. The results are placed in a counter determined by the category of the data and are limited to a specific time period. When the time limit expires, only a counter that has the highest data frequency is used to store data. The results of this process are the final output.

```
Algorithm 4 : Light Weight Frequent Item (LWF Algorithm)
//Algoritma for Mining Data Process
START
Set the number of the top frequent items to K.
Set a counter for each K.
Repeat
       a. Receive the item
       b. If the item is new and one of the K counters are 0
          Then
             Put this and increase the counter by 1.
          Else
             If the item is already in one of the K counters.
          Then
             Increase the counter by 1.
          Else
             If the item is new and all the counters are full
          Then
             Check the time
             If the time > Threshold Time
             Then
             Re-set number of least n of K counters to 0
             Put the new item and increase the counters by 1
          Else
             Ignore the item
          Decrease all the counters by 1
Until Done
STOP
```

Figure 3.5. Light Weight Frequent Item Algorithm (Gaber et al., 2003)

3.2.7. Security Level

Ideally, data has the maximum security level. The higher security level is, the greater the resources are needed (Son et al., 2000) to maintain it, and thus, limited resource availability means that such a level cannot always be maintained in WSNs (Xie et al., 2005). The security level is also representative of the amount of resources required by the device. The security levels are high, medium, low, and very low. ARSy framework applies security level prediction, based on resource availability.

3.3. Solution and Evaluation

3.3.1. Workload Solution

The workload of a WSN may vary over time. When the WSN is in an overloaded condition, the condition may resolve itself or ends with a deadlock. Workload detection is done by checking the state of the battery, CPU, and memory. If the memory resource is above the average level of 50%, the condition of the resource is considered a maximum, so the workload is considered to be light and no resource adaptation occurs. When the resource falls below 50%, the workload is heavy and an adaptation policy is applied to the critical resource. The system updates the workload conditions that affect the level of security of the data before it is sent to the server. Figure 3.6 shows the pseudocode for workload detection.

```
Alhorithm 5 : Workload Detection
//Algorithm for Workload Detection WSN
//Workload status Light or Heavy
START
Check available Resource (BAT, CPU, MEM)
IF(Resource > Threshold BAT, CPU, MEM)
       System light workload
       System without adaptable
       Update workload setting
ELSE(Resource < Threshold BAT,CPU,MEM)
       System heavy workload
       Implement policy adaptable resource
       Update workload setting
END IF
STOP
```

Figure 3.6. Pseudocode for Workload Detection

To determine workload conditions, all resources have a maximum value of 100%. The average total value of battery, CPU and memory is Σ 〚Resource = (Battery + CPU + Memory)/3〛. If one of the resources is in a critical condition, but the average resource is greater than 50%, the node status is still considered to be a light workload. However, if the resource average is less than 50%, the node is considered to have a heavy workload and resource adaptation is implemented.

3.3.2. Security Level Solution

In the first condition, the resource is maximum and workload is light, and the system applies a high-level security policy, assuming the average resource availability equal to 75% - 100%. In the second condition, the resource is maximum and workload heavy, and the system applies a medium level security policy, assuming the average resource availability equal to 50% - 75%. In the third condition, the resource is minimum and workload light, and the system implements a low-level security policy, assuming the average resource availability equal to 20% - 50%. In the fourth condition, the resource is minimum and workload heavy, and the system applies a very low level security policy, assuming an average resource availability equal to 0% - 20%. Figure 3.7 shows the pseudocode for security level adaptation.

```
Algorithm 6 : Security Level Implementation
//Algorithm for Level Security Data
//Level Security Very Low, Low, Medium, and High
START
Input Average resource info
Input workload info
IF(Average Resource ≥ 75%)
       Security level = HIGH
ELIF(Average Resource ≥ 50%)
       Security level = MEDIUM
ELIF(Average Resource ≥ 20%)
       Security level = LOW
ELIF(Average Resource < 20%)
       Security level = VERY LOW
END IF
STOP
```

Figure 3.7. Pseudocode for Security Level Adaptation

The security level is the last adjustment. The system receives information on resource availability and workload conditions from the resource, workload and security level block. If the average resource is greater than the threshold, the resource condition is considered to be maximum. If there was no resource adaptation, the workload is considered light, so the security policy applied to the data is high level. If a heavy workload is detected, a medium security level is implemented. When the resource is minimum, which means that the average availability of all the resources is below the threshold of the particular resource at that time when no adaptation has been implemented, the workload is categorized as light and the level of security is low. When all the resources are minimum and the workload heavy, adaptation occurs and the security level is low. This condition continues until the WSN resources run out.

Chapter 4. Effectiveness Model of Resource and Security Adaptation for Wireless Sensor Network

Wireless Sensor Networks (WSNs) enable the monitoring and controlling of the physical environment from a remote location with high accuracy. Supporting technology is applied to various domains such as monitoring of environmental, agricultural, healthcare, public-safety, military, industrial, transportation systems (Rault et al., 2014), and smart homes for appliances (Batalla, Vasilakos, & Gajewski, 2017). Early detection of natural disasters, such as tsunamis, earthquakes, landslides, flash floods, fires, and hurricanes, is very important. The main supporting technology for early-warning-detection systems involves integrating sensors into a network, which can be wired or wireless.

WSNs are usually composed of components that are smaller than those in wired networks, low-cost, and applicable for a wide range of applications. The main components are sensing, processing, communication, and power units (Raghunathan et al., 2002). With these WSNs, it is possible to collect, process, and analyze data and send the results; therefore, their placement can be flexible (Jason Lester Hill, 2003). These advantages make WSNs very powerful; however, they also have many limitations, such as dependence on batteries as energy sources, smaller central processing unit (CPU) and memory capacity (Archana, Bharathidasan., Vijay, Anand, Sai, 2003), security vulnerabilities (CHELLI, 2015), (Zou, Zhu, Wang, & Hanzo, 2015), and radio inference (Jordi Mongay Batalla, George Mastorakis, Constandinos X. Mavromoustakis, 2016), (Yang, Xu, & Gidlund, 2011). Because of these limitations, a resource-aware policy (Gaber & Yu, 2006), (J. Parenreng et al., 2011), (Phung, Gaber, & Röhm, 2007), (Uwe & Tse, 2008) for adaptation mechanisms and security-aware policy (Ksiezopolski et al., 2010), (Xie et al., 2005), (Son et al., 2000), (Ksiezopolski & Kotulski, 2007) for data security based on the available resources of sensor nodes are required.

The placement of a sensor node is not always in an area that is easy to reach and sometimes placed in extremely dangerous areas (Habib F. Rashvand., 2017). It is difficult to maintain a sensor node that has been deployed to monitor an area where routine maintenance, such as changing batteries, cannot be undertaken. Hence, WSNs must operate over long periods, and their resources must be used as efficiently as possible (Raghunathan et al., 2002). The regulation of energy consumption via adaptation is a method for increasing the lifetime of a sensor node (Archana, Bharathidasan., Vijay, Anand, Sai, 2003), (Habib F. Rashvand., 2017), (I.F. Akyildiz et al., 2002).

This study is a continuation of our previous research in which we proposed an Adaptable Resource and Security (ARSy) Framework (J. M. Parenreng & Kitagawa, 2017), which implements resource and security adaptations. Resource adaptation is used to manage battery, CPU, and memory use of a sensor node, and security adaptation is used to implement a certain security level to compensate for the excessive use of resources. Security adaptation works on the basis of resource availability. If the average use of a resource is above a critical threshold, the security of the generated data is at a high or medium level; however, if resource availability decreases beyond the threshold, the security of such data is at a low level or even very low level.

4.1. Resource and Security in WSN

There were challenges in previous studies on data processing in a sensor node because data mining was executed on data streams (Gaber & Yu, 2006), (J. Parenreng et al., 2011). Online and real-time data storage and processing are executed with limited computing capabilities (Phung, Gaber, & Röhm, 2007), (C. Aggarwal, 2006), (J. Parenreng et al., 2010). To overcome energy inefficiency in WSNs, the first solution is to reduce the amount of data communication by moving the data-processing algorithm to the sensor network, and the second solution is to combine data-processing and communication units (Uwe & Tse, 2008).

Data mining is required to reduce the amount of data that must be transmitted through data communications (J. Parenreng et al., 2010), (Mahmood et al., 2013). There are many algorithms for mining data such as clustering (C. C. Aggarwal & Wang, 2007), classification (Moharned, Medhat, Gaber., Arkady, Zaslavsky., Shonali, 2007), and frequent items (Jin & Agrawal, 2007). To avoid massive data transfers, a sensor node is implemented for on-board analysis, with which data are processed at the source location. Previous projects, such as VEDAS (Kargupta et al., 2004), EVE (Tanner et al., 2002), and Diamond Eye (Michael C, Burl., Charless, Fowlkes., Joe, Roden., Andre, Stechert., Saleem, 1999), have used this method.

Security systems offer as much protection as possible; thus, power consumption will increase and the lifetime of the system will decrease. System services are reduced to decrease power consumption, which decreases the lifetime of the system (Caviglione & Merlo, 2012). In fact, security is almost always higher than potential threats. When security is very strong, it affects the overall performance of the system, excessive protection will reduce reliability and availability and affect security globally. An appropriate level of security can be estimated in terms of providing different security-quality protection models for each type of data (Bogdan Ksiezopolski., 2009).

The concept of green security (Pokrandt, 2011) or re-engineering of security (Caviglione & Merlo, 2012) can be an alternative solution, but it requires time and money to implement. Secure smart home concept using Home Area Network (HAN) (Batalla et al., 2017), and Home Automation System (HAS) using Virtual Machines (Jordi Mongay Batalla, George Mastorakis, Constandinos X. Mavromoustakis, 2016) make it easier to manage the security system. Previous studies focused on a security policy to model the security level of data that may have different outputs generated over time because determining the security level of data is based on the availability of resources. With a better availability of resources, the security level of data becomes higher (Ksiezopolski et al., 2010), (J. M. Parenreng & Kitagawa, 2017).

The absolute requirement of a security system is the guarantee of high data security; however, in cases in which WSNs are used, high data security affects the performance and lifetime of the system because a higher data-security level means greater energy consumption for cryptographic data functions (Raghunathan et al., 2002), (Potlapally et al., 2006), (Sen, 2009). The solution is to balance the use of resources through the security level of data (Ksiezopolski et al., 2010), (Xie et al., 2005), which is basically used to offset the use of resources when their availability has entered a critical phase. The policy of applying a high level of security to each output affects the lifetime of a WSN because higher security levels of data put greater demands on the CPU and increase battery consumption (Potlapally et al., 2006).

4.2. System Design

Initially, hardware systems were designed with embedded sensor devices to guarantee the compatibility of the sensor and system. The largest obstacle is finding a device that can integrate the battery, memory, CPU, and communication units. Large-capacity CPU and memory are required because data processing is done on-board. After reviewing several types of components, a Raspberry Pi 3 Model B and DS18B20 temperature sensor were chosen for our laboratory testing.

The Raspberry Pi 3 Model B was chosen because it is a single-board model, simple, and lightweight. The model has built-in Wi-Fi, eliminating the need for extra USB Wi-Fi adapters (Monk, 2015). Another advantage is its compatibility with several operating systems and its plug-and-play compatibility with a variety of equipment. The specifications for this model are listed in Table 4.1.

Table 4.1. Hardware system specifications

Components	**Specifications**
Raspberry Pi 3 Model B (Monk, 2015)	Single-board, 1.2 GHz, 64-bit quad core, 1-GB RAM Wi-Fi, micro SD, HDMI, USB, GPIO Power usage 5.19 V, 2.5 A maximum
DS18B20 (Maxim Integrated, 2015)	Single-wire digital temperature sensor Minimum −55°C Maximum 125°C Power consumption DC 3.0–5.5 V

Devices with the Raspberry Pi 3 Model B pose challenges. One challenge involves memory sharing between a CPU and graphic processing unit (GPU) (McManus, 2014). Some programs are not as demanding on the CPU, and some also run on the GPU such as Blu-ray video playback. A GPU is powerful enough to handle applications. The second challenge is with the power-supply-management system.

The DS18B20 temperature sensor is a single-wire digital sensor (Maxim Integrated, 2015) that uses only one cable for communication with the CPU and for grounding. The sensor can derive power directly from the data line. The specifications are also listed in Table 4.1.

4.2.1. Architecture System

We conducted our laboratory testing on a single node; however, future work will involve integrating the node with a wider network system, such as the architecture system shown in Figure 4.1. The data collected by each node are processed with local node resources in accordance with the conditions of the resource node. The output data are sent at certain times to the server, which is the final destination of the data.

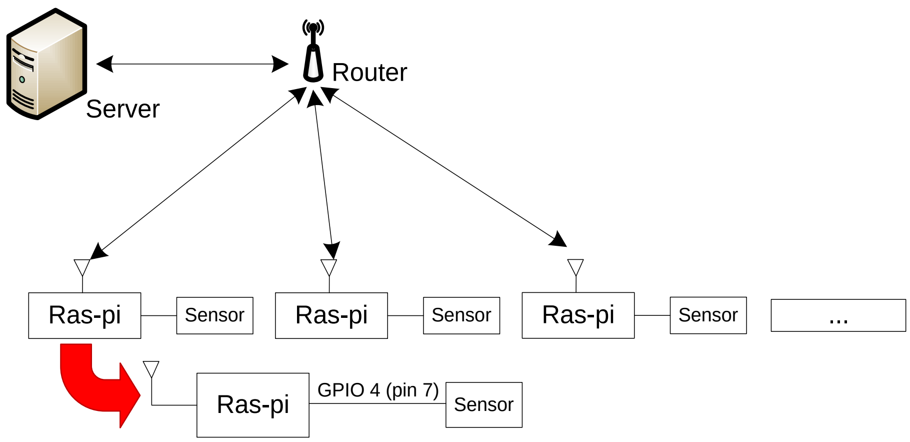


Figure 4.1. Architecture system

4.2.2. ARSy Framework

Generally, our ARSy framework (J. M. Parenreng & Kitagawa, 2017) consists of two parts, i.e., a client node, which applies the method of collecting data on-board (Tanner et al., 2002), and a data server, which stores sensor-node results, as shown in Figure 3.1.

The client node is a worker node. The process that occurs on the client node is divided into the following process blocks. Details of the relationship between the resources and security level of this process are listed in Section 3.2.3.

- Data-input block: This block collects data. The collection time was every second in our study. Before the data are processed by the data-mining block, the system checks the conditions of the battery, CPU and memory resources in the resource-monitoring block.
- Resource-monitoring block: This block reports the latest update of the average amount of the sensor node’s resources. This information is then input for the resource-adaptation block.
- Resource-adaptation block: This block updates the resource condition with two modes, the first is the status of the resource under adaptation conditions and the second is the status of the resource not under such conditions.
- Workload-system block: This block provides the workload status of the sensor node if the resources system has a heavy or light workload; heavy workload status if information resources received from resource adaptation blocks under adaptation conditions and light workload status if resource information from the resource-adaptation block is not under adaptation conditions.
- Resource-, workload-, and security-level-setting block: This block contains the summary of the all the system’s resource conditions, such as amount of

resources that can be used to execute data mining, security-level status that will be given at data output, and overall system workload.

- Data-mining block: This block involves mining data based on light-weight frequent algorithm (J. Parenreng et al., 2010), (Gaber et al., 2003). The data-mining process is carried out by creating counter data. All the same data are placed on the same counter data and new counter data are created for new data types.
- Data-mining-result block: This block temporarily stores the results of data mining whose time-limited, before the data-mining-result sent to the Security-implementation block.
- Security-implementation block: This block implements the appropriate security level based on the resource-sensor-node condition, then the results are sent to the data server, i.e., the final destination of all data.

4.2.2.1. Resource Adaptation

The battery, CPU, and memory are the main resources; therefore, resource availability must be maintained. This is achieved through adaptation (J. Parenreng et al., 2011), (Phung, Gaber, & Röhm, 2007), whereas the parameters data and process are maintained based on our ARSy framework. Each resource in a security system is limited by the critical threshold. If the threshold is exceeded, adaptation will be triggered to reduce excessive resource usage.

We divided resource adaptation of the sensor node into three mechanisms, i.e., input, process, and output. Input adaptation is triggered using the battery resource, process adaptation is triggered using the CPU resource, and output adaptation is triggered using the memory resource. The resource-adaptation formulas are listed in Table 4.2.

Table 4.2. Resource-adaptation formulas

Resource	Definition	Parameters
Battery (Phung, Gaber, & Röhm, 2007),(J. M. Parenreng & Kitagawa, 2017)(J. Parenreng et al., 2011)	$SI = ub - (bat\_available) * \left(\frac{ub - lb}{batt\_crit\_threshold} \right)$	SI: Sampling Interval, bat_available: free battery, ub: upper bound, lb: lower bound. RF: Random Factor, cpu_crit_threshold: critical thres cpu, RT: Radius Threshold, mem_crit_thres: critical thres mem.
CPU	$RF = (100 - CPU\_used) * \left(\frac{ub - lb}{100 - cpu\_crit\_threshold} \right)$	
Memory	$RT = (100 - mem\_used) * \left(\frac{ub - lb}{100 - mem\_crit\_threshold} \right)$	

When an adaptation occurs in one of the sensor-node resources by applying the specific adaptation policy to that resource (see Table 4.2). These mechanisms are described in more detail as follows (Phung, Gaber, & Röhm, 2007), (Gaber & Yu, 2006).

- Input: Battery adaptation is triggered on the input side and is based on battery resource availability via the sampling interval (SI). If the battery usage exceeded the threshold, adaptation will be triggered. Before battery-resource adaptation occurs, the input-data-collection time is normal (does not exceed the threshold), but adaptation is triggered when the input-data-collection time changes based on the available resources.
- Process: CPU adaptation is triggered on the process-data side and is based the availability of the processor resource (CPU) via the random factor (RF). If the CPU usage does not exceed the threshold, all the collected data will be maintained on the counter data; otherwise, the system only stores some counter data with priority based on dominant and non-dominant counter data. Some non-dominant counter data will be eliminated to relieve the CPU; its value will be based on the RF value.
- Output: Memory adaptation is triggered on the output-data side and is based on the availability of the memory resource via the radius threshold (RT). When the resource memory is normal (not exceeding the threshold), the final result is sent to the data server; as much as 50% of all counter data is saved. If the memory usage exceeds the threshold, the system will reduce memory utilization by limiting the amount of counter data created, and the counter data are stored as output data based on the RT presentation value.

4.2.2.2. Security Adaptation

The adaptation of resources affects the security level of data. The security-adaptation model we applied is for estimating the security level of output data based on the resource condition. When the resource condition does not exceed the threshold, the output data have the maximum security level, but when resource availability falls below the threshold, the security level changes (J. M. Parenreng & Kitagawa, 2017), as shown in Table 3.1.

4.3. Results

Our testing was limited to single node, and the goal was to observe the differences in resource behavior and time efficiency when a security system operates under normal and stressful conditions and implementing an ARSy framework and a non-ARSy framework.

The testing design is illustrated in Figure 4.2. Testing with the ARSy framework involved combining resource adaptation and security adaptation in the security system, while testing with the non-ARSy framework involved resources that do not adapt under critical conditions and all security output data are generated with a high security level.

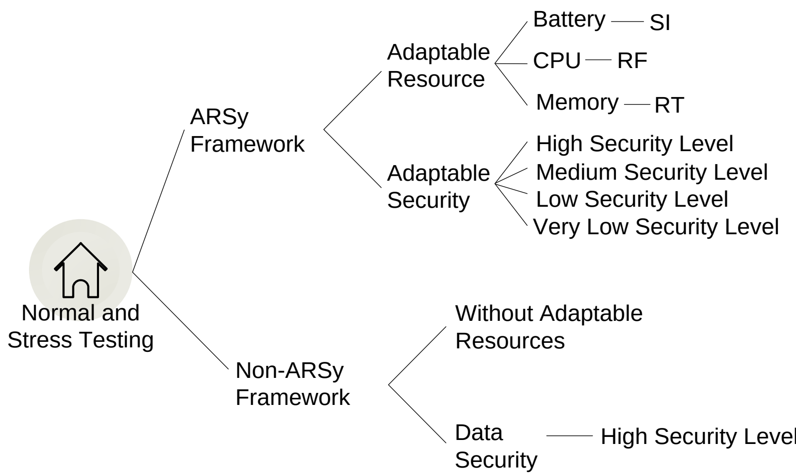


Figure 4.2. Testing design

4.3.1. Testing Scenario

We tested under two scenarios: normal and stress. Normal testing was conducted by allowing the system to run normally without any intervention or special treatment that would cause the CPU to become busier than usual. Stress testing was conducted by making the CPU busier, such as by playing games, browsing websites, and streaming videos. The sensor was touched so that variants data could be collected; otherwise, there would be too few data variants. Stress testing continued until the resources were completely exhausted. The uniform testing parameters are listed in Table 4.3.

Table 4.3. Testing parameters

Parameter	**Value**
Critical threshold of Battery, CPU, and Memory	55% capacity in use
Time for data collection	1 s
Time for data release	30 s
	60 s
	120 s
Battery capacity	30 mAh
	100 mAh
	1,000 mAh
Tests	Normal
	Stress
Sensor treatment	Touched
	Untouched

Critical threshold of battery, CPU, and memory: The resource used exceeded the threshold and triggered resource adaptation. Data capture: the time of collecting data was every second. Release data: The data results to be sent to the data server, the time of which was set according to the requirement testing. Battery capacity: The battery capacity differed depending on the test, as shown in Table 4.4. Testing scenarios: Normal and stress. Sensor treatment: because we used a temperature sensor, then to see the variation of data capture, treatment with the sensor is touched and untouched to show the data-mining functions for variants data captured, as described in Section 4.3.2.

4.3.2. Collecting and Data Mining

Data collected by the sensors are processed by an on-board mechanism (Kargupta et al., 2004), (Tanner et al., 2002), (Michael C, Burl., Charless, Fowlkes., Joe, Roden., Andre, Stechert., Saleem, 1999), i.e., by directly applying a data-mining algorithm known as the Lightweight Frequent Item Algorithm (J. M. Parenreng & Kitagawa, 2017), (J. Parenreng et al., 2010), (Gaber et al., 2003). The data are placed on the counter data based on the similarity of the data and new counter data are created if the collected data differ from those previously formed on the counter data. This data-mining process continues until the time limit is reached.

Figure 4.3 compares the three types of data collected after the data-mining process, the release period of the data-mining result was every 30 s: (1) total_item, all data collected by sensors that were limited by the timer; (2) total_variant, the number of data variants obtained during the data-mining period; and (3) send_to_server, the final data to be sent to the data server.

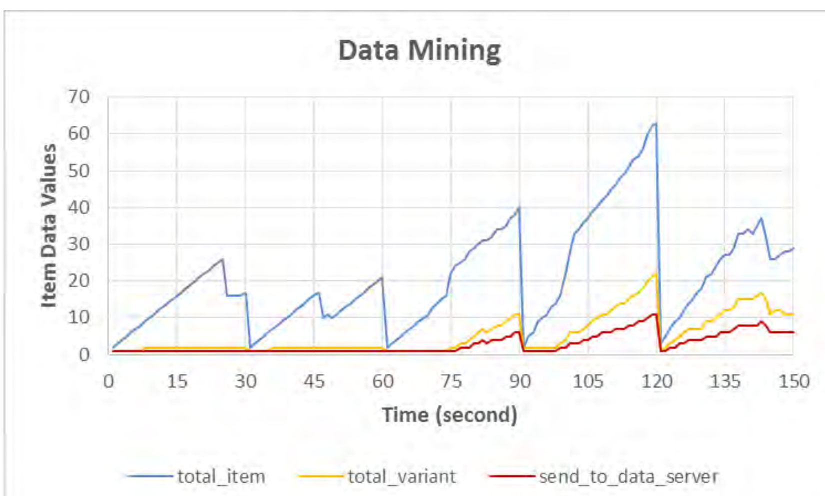


Figure 4.3. Collecting and mining data.

For example, the data in this graph are at 120 s, total_item 63 data, total_variant 22 data, and send_to_server 11 variant data. This graph is based on our ARSy framework and shows the difference between total_item, total_variant, and send_to_server. During data mining, a large amount of data were captured by the sensor (total_item 63), but the data-mining mechanism filters by grouping similar collected data (varian_data 22). For the final result after processing (send_to_server

11), only some of the data with the most variants were sent to the data server as the final result due to the adaptation policy of the system.

4.3.3. Resources

The resource activities of a WSN are interrelated. In general, battery consumption is strongly affected by the activity of the CPU, i.e., busy, normal, or idle. Increased CPU activity increases battery consumption (Potlapally et al., 2006).

4.3.3.1. Battery

Figure 4.4 shows the battery slowly entering the critical phase and exceeding the threshold until the battery is completely discharged. The system's policy before the battery exceeded the threshold significantly affected the sensor's data-input process. Data were collected every second when the battery was not in the adaptation phase, as shown in Figure 4.5, and gradually changed as the battery entered the critical phase. Adaptation of the battery through the input data affected the data-collection time. Under normal battery-resource availability, the data-collection time was 1 s per datum and gradually changed when the availability of the battery resource was running low.

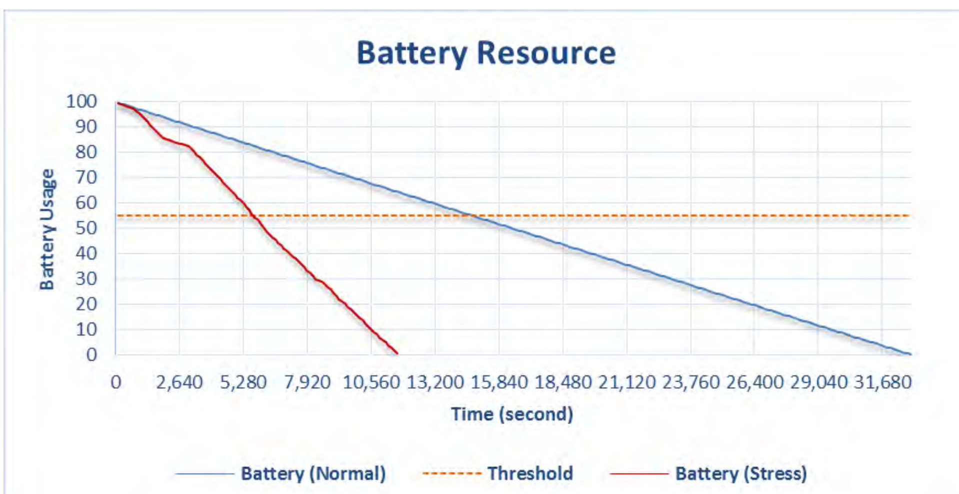


Figure 4.4. Battery consumption during normal and stress testing.

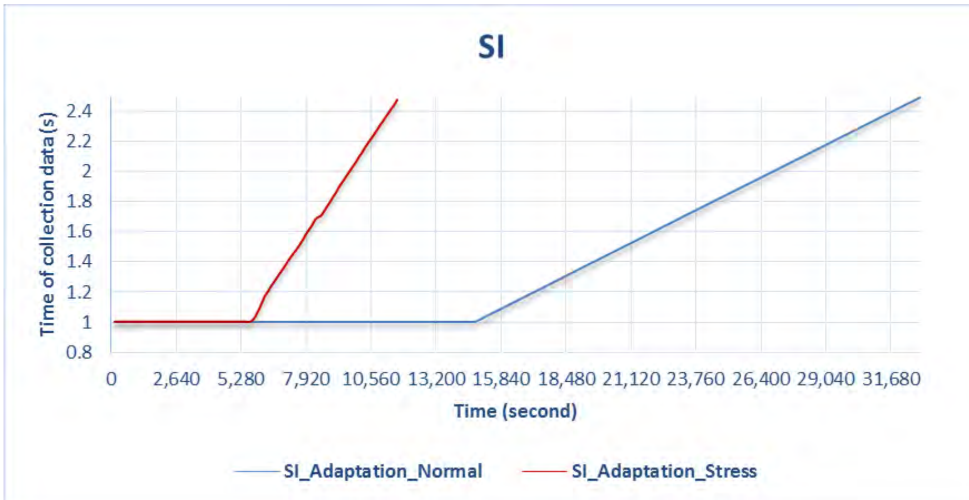


Figure 4.5. Battery adaptation during normal and stress testing.

As shown in Figure 4.5, when the adaptation began to trigger battery consumption, data collection gradually decreased because data input did not occur every second, but was based on the SI adaptation value. The time between one instance of data collection and the next was up to 2.5 s. When the data-collection time changed, CPU performance became more lightweight.

4.3.3.2. CPU

The results from testing under CPU stress conditions are shown in Figure 4.6. Testing was conducted by making the CPU busier than usual by playing games, browsing websites, and streaming videos. This was done because Raspberry Pi 3 Model B has a large CPU capacity (see Table 4.1). Testing was conducted by allowing the CPU to run normally, and the results indicate that the CPU activity never exceeded the threshold, as shown in Figure 4.7.

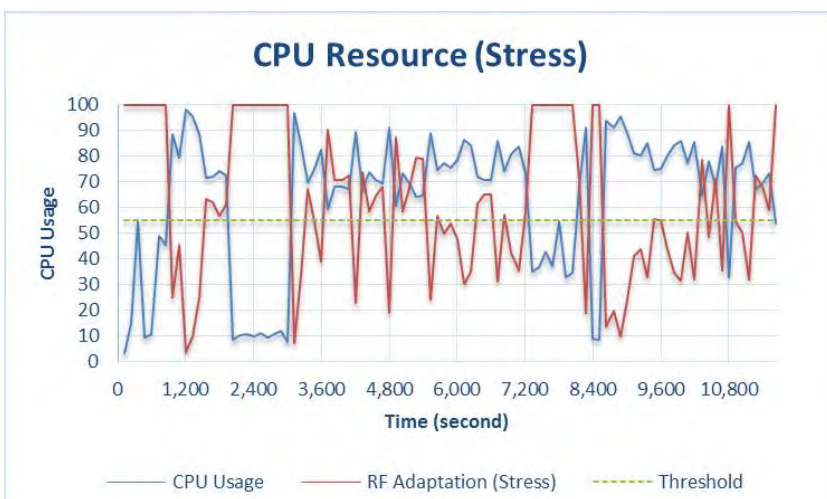


Figure 4.6. CPU resource and adaptation during stress testing.

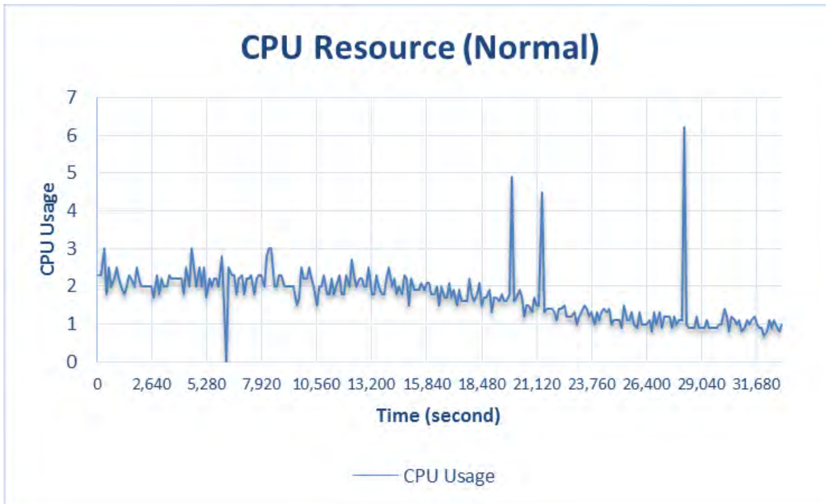


Figure 4.7. CPU resource during normal testing.

When the CPU did not exceed the threshold, the RF did not initiate adaptation; therefore, all the collected data were processed. However, when resource availability decreased below the threshold under critical conditions, CPU adaptation through the RF was triggered on the basis of the amount of CPU used, as shown in Figure 4.6. In 7200 s, the CPU_used capacity was 73.6% and CPU adaptation was 58.6%. This means that the CPU only processed 58.6% of the total data on the counter. Another condition at 7320 s was when CPU_used was 35.2% and CPU adaptation (RF) was 100%, i.e., the CPU processed all the data. In general, when system is in the adaptation phase, all the data collected through data mining will not be stored, but only some of the data that have more dominant data variants than others. For more details, see Section 4.2.2.1. Resource Adaptation.

The results shown in Figure 4.7 are for normal testing, where CPU_used was greatest at 6.2% at 28,200 s. This did not exceed the 55% critical threshold, so the system was not in the resource-adaptation phase.

4.3.3.3. Memory

As mentioned above, the memory of Raspberry Pi 3 Model B is shared by the CPU and GPU. It is very difficult to monitor the memory exceeding the threshold value, so the procedure for testing the CPU was also conducted for the memory. Figures 4.8 and 4.9 show the results of the stress and normal testing of the memory, respectively.

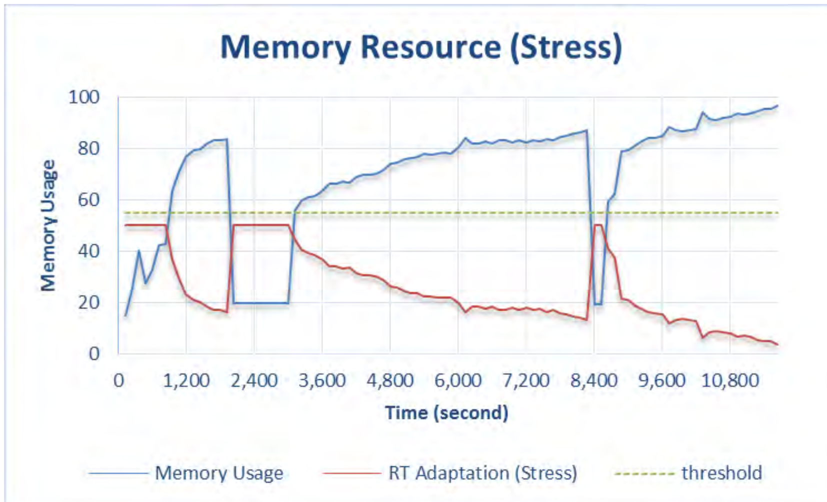


Figure 4.8. Memory resource and adaptation during stress testing.

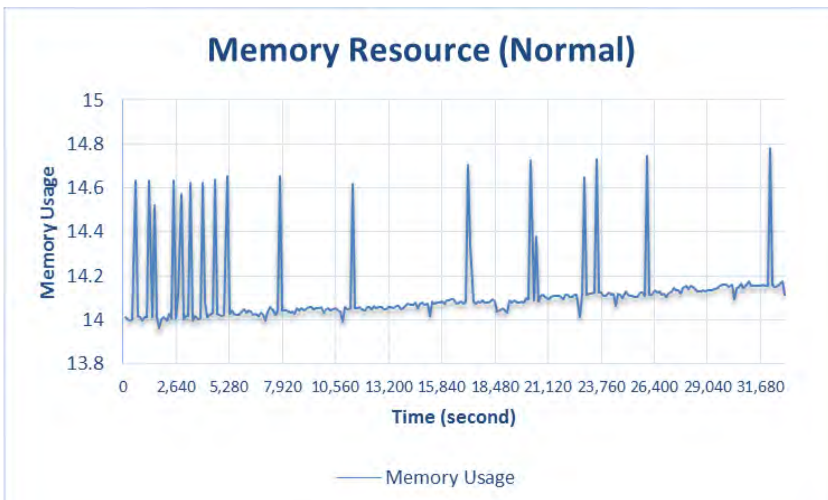


Figure 4.9. Memory resource during normal testing.

As shown in Figure 4.8, the memory initially ran normally without adaptation because usage did not yet exceed the threshold. Under this condition, the data were processed by the memory and stored. The applied system policy adaptations will save 50% of the most dominant counter data, which are the final data sent to the server. However, when the memory usage exceeded the threshold, the amount of final data sent to the data server was calculated on the basis of the value of memory adaptation through the RT.

For example, at 2400 s, memory_usage was 19.5%, which means no adaptation was triggered and the default RT adaptation value was 50%, so half the total amount of counter data was saved and sent to the data server. Furthermore, at 6000 s, memory_usage was 80.4%, which exceeded the threshold, so adaptation was triggered. The data to be stored constituted 19.6%.

Figure 4.9 shows the results of memory usage during normal testing. Memory usage at 32,160 s, resulted in memory_usage being 14.78%, which did not exceed the memory threshold, so memory adaptation was not triggered.

4.3.4. Security Level

Determining the security level (Xie et al., 2005) is the last stage before data are sent to the data server. There are four security levels based on the availability of resources (see Table 3.1): level 3 is high security level, which is the most ideal because the output data sent to the data server have the maximum level of security, with the average resource availability of the network being 75–100%; level 2 is medium security level with the average resource availability being 50–75%; level 1 is low security level with average resource availability being 20–50%; and level 0 is very-low security level with average resource availability being 0–20%.

Figure 4.10 shows the security levels during stress and normal testing. During stress testing, the security level of the data output fluctuated and reflected the current conditions. Normal testing showed more stable results at the high and medium security levels. Hence, maintaining resource stability can also stabilize the security level at the maximum average condition.

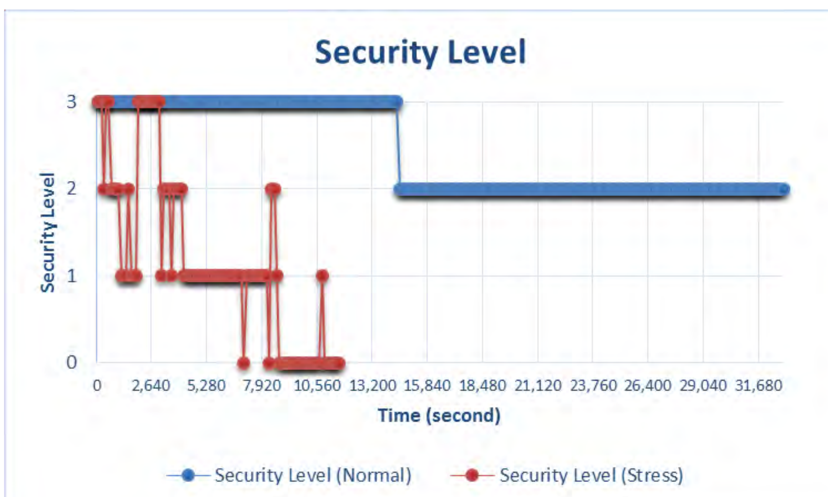


Figure 4.10. Security level of data output during stress and normal testing.

4.3.5. Operating System

Time operation is the duration or the length of operation time that measured in second units. Battery consumption (Power, 2018) was divided into several modes, such as boot, idle, video playback, normal operation, and stress. The testing was conducted on an ARSy framework and a non-ARSy framework under normal and stress operating conditions. The results are listed in Table 4.4. The battery capacities were 30, 100, and 1000-mAh and release times were 30, 60, and 120 s. Details of this testing scenario are summarized in Table 4.3. With the ARSy framework for 1000-mAh battery capacity during normal testing, the operating duration reached 9.19 h, whereas during stress testing, the duration reached only 2.76 h. With the non-ARSy framework for 1000-mAh battery capacity during normal testing, the duration reached 3.44 h, and during stress testing, the duration reached 2.74 h.

Table 4.4. Operation duration.

Battery Capacity [mAh]	Release Time [s]	ARSy		Non-ARSy	
		Normal [s]	Stress [s]	Normal [s]	Stress [s]
30	30	948	249	355	223
100	60	3265	1468	1222	900
1000	120	33,085	9971	12,397	9877

4.4. Discussion

The availability of resources and data security on WSN devices is an absolute requirement, but resource capacity is very limited. The limited battery, CPU, and memory resources of WSN devices force the devices to use the resources as efficiently as possible. Security is the largest resource used when the highest security is required for the output security data. Resource-adaptation and security-adaptation solutions on sensors nodes are extremely important, particularly if they are used to monitor extreme areas where maintenance, such as replacing batteries or just checking the proper position of the device, is very difficult.

We implemented the ARSy Framework investigated in our previous study using Raspberry Pi 3 Model B and DS18B20 temperature sensor. The advantage of Raspberry Pi 3 Model B is that it has large CPU and memory capacities. With these advantages, are highly manageable of resources and allow integration of several types of sensors in one Raspberry Pi unit. The weakness of Raspberry Pi 3 Model B is sharing memory between a CPU and GPU; therefore, it was difficult for us to analyze in more detail the cost of memory during our testing, as shown in Table 4.5, where memory consume during operation in normal and stress. It was difficult to distinguish the causes of memory fluctuations due to the CPU or GPU processes. Another weakness Raspberry Pi 3 Model B is it consumes a large amount of energy. In this case, using a battery as an energy source becomes an option because other alternatives use energy harvesting or the main power source based on the design requirements.

Table 4.5. Memory consumption during normal and stress testing

Time	Consumption under Normal (Bytes)		Consumption under Stress (Bytes)	
	Memory Free	**Memory Consume**	**Memory Free**	**Memory Consume**
2	810,692,608	(53,248)	807,817,216	1,134,592
3	810,627,072	65,536	805,052,416	2,764,800
4	810,639,360	(12,288)	799,571,968	5,480,448
5	810,614,784	24,576	797,908,992	1,662,976
6	810,532,864	81,920	793,935,872	3,973,120
…	…	…	…	…
125	809,201,664	49,152	377,528,320	1,806,336
126	809,259,008	(57,344)	380,477,440	(2,949,120)
127	809,103,360	155,648	380,395,520	81,920
128	809,250,816	(147,456)	376,307,712	4,087,808
129	809,201,664	49,152	376,213,504	94,208
…	…	…	…	…
241	808,214,528	(204,800)	221,683,712	2,981,888
242	808,194,048	20,480	219,455,488	2,228,224
243	808,202,240	(8192)	216,629,248	2,826,240
244	808,214,528	(12,288)	217,247,744	(618,496)
245	808,218,624	(4096)	213,950,464	3,297,280

Sending all collected data to the server is not a solution. This will consume the limited resources. Selecting data collected by a sensor is done through data mining. The data-mining is done on-board, each datum is collected by the sensor directly, and selection is done with the data-mining algorithm at the board node. The final result is then sent to the data server.

For security, data in this research is collected by estimating security-level based on average resources availability in sensor node. The more average resource availability, the higher the security level that will be implemented in the output data. The discussion in this research has not yet implemented cryptography.

Radio communication is also one of the main resources of a sensor node and consumes the largest amount of resources. However, in this study implement the ARSy framework, we limited resource adaptation to the battery, CPU, and memory because the implementation and testing were on a single node.

Chapter 5. Concluding Remarks

5.1. Conclusion

The limited battery, CPU, and memory resources of WSN devices force such devices to use resources as efficiently as possible. Resource saving is very important when a WSN has limited resource availability and is deployed in extreme environments without any chance for maintenance. In addition, while maximizing data security is a good idea, the level of security should be determined through prediction in a way that considers the limited resources of the WSN, so that it can survive for long period of time. A higher security level imposes a greater cost on and shortens the lifetime of the WSN devices

We evaluated a security adaptation for limited resources in a WSN through the ARSy framework. By mining data on-board and applying resource and security adaptation, the operation duration can be tripled. Normal testing showed that the result is more stable at the high and medium security levels. Therefore, maintaining resource stability can also stabilize the security level under the maximum average condition. The comparison of the ARSy framework and a non-ARSy framework showed significant results during operation time.

5.2. Future Work

To conserve the battery of the sensor node, harvesting energy can be the best solution, depending on the area where the system is deployed. Because our testing was conducted on a single node, for the future work testing should be conducted on several nodes integrated with a network system involving energy harvesting as the power source and implement security level based on cryptography.

Publication List

1. Parenreng, J.M., Kitagawa, A. (2017). A Model of Security Adaptation for Limited Resources in Wireless Sensor Network. *Journal of Computer and Communications*, **5**, 10-23. doi: 10.4236/jcc.2017.53002

2. Parenreng, J.M., Kitagawa, A. (2018). Resource Optimization Techniques and Security Levels for Wireless Sensor Networks Based on the ARSy Framework. *Sensors* 2018, *18*, 1594. https://doi.org/10.3390/s18051594

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Appendix

Appendix A. Data Sheet Raspberry Pi 3 Model B

Raspberry Pi

Raspberry Pi 3 Model B

Product Name	**Raspberry Pi 3**
Product Description	The Raspberry Pi 3 Model B is the third generation Raspberry Pi. This powerful credit-card sized single board computer can be used for many applications and supersedes the original Raspberry Pi Model B+ and Raspberry Pi 2 Model B. Whilst maintaining the popular board format the Raspberry Pi 3 Model B brings you a more powerful processer, 10x faster than the first generation Raspberry Pi. Additionally it adds wireless LAN & Bluetooth connectivity making it the ideal solution for powerful connected designs.
RS Part Number	**896-8660**

www.rs-components.com/raspberrypi

Raspberry Pi

Raspberry Pi 3 Model B

Specifications	
Processor	Broadcom BCM2387 chipset 1.2GHz Quad-Core ARM Cortex-A53 802.11 b/g/n Wireless LAN and Bluetooth 4.1 (Bluetooth Classic and LE)
GPU	Dual Core VideoCore IV® Multimedia Co-Processor. Provides Open GL ES 2.0, hardware-accelerated OpenVG, and 1080p30 H.264 high-profile decode Capable of 1Gpixel/s, 1.5Gtexel/s or 24GFLOPs with texture filtering and DMA infrastructure
Memory	1GB LPDDR2
Operating System	Boots from Micro SD card, running a version of the Linux operating system or Windows 10 IoT
Dimensions	85 x 56 x 17mm
Power	Micro USB socket 5V1, 2.5A

Connectors:	
Ethernet	10/100 BaseT Ethernet socket
Video Output	HDMI (rev 1.3 & 1.4 Composite RCA (PAL and NTSC)
Audio Output	Audio Output 3.5mm jack, HDMI USB 4 x USB 2.0 Connector
GPIO Connector	40-pin 2.54 mm (100 mil) expansion header: 2x20 strip Providing 27 GPIO pins as well as +3.3 V, +5 V and GND supply lines
Camera Connector	15-pin MIPI Camera Serial Interface (CSI-2)
Display Connector	Display Serial Interface (DSI) 15 way flat flex cable connector with two data lanes and a clock lane
Memory Card Slot	Push/pull Micro SDIO

Key Benefits

- Low cost
- 10x faster processing
- Consistent board format
- Added connectivity

Key Applications

- Low cost PC/tablet/laptop
- Media centre
- Industrial/Home automation
- Print server
- Web camera
- Wireless access point
- Environmental sensing/monitoring (e.g. weather station)
- IoT applications
- Robotics
- Server/cloud server
- Security monitoring
- Gaming

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Appendix B. Data Sheet Temperature Sensor DS18B20

DS18B20 — **Programmable Resolution 1-Wire Digital Thermometer**

General Description

The DS18B20 digital thermometer provides 9-bit to 12-bit Celsius temperature measurements and has an alarm function with nonvolatile user-programmable upper and lower trigger points. The DS18B20 communicates over a 1-Wire bus that by definition requires only one data line (and ground) for communication with a central microprocessor. In addition, the DS18B20 can derive power directly from the data line ("parasite power"), eliminating the need for an external power supply.

Each DS18B20 has a unique 64-bit serial code, which allows multiple DS18B20s to function on the same 1-Wire bus. Thus, it is simple to use one microprocessor to control many DS18B20s distributed over a large area. Applications that can benefit from this feature include HVAC environmental controls, temperature monitoring systems inside buildings, equipment, or machinery, and process monitoring and control systems.

Applications

- Thermostatic Controls
- Industrial Systems
- Consumer Products
- Thermometers
- Thermally Sensitive Systems

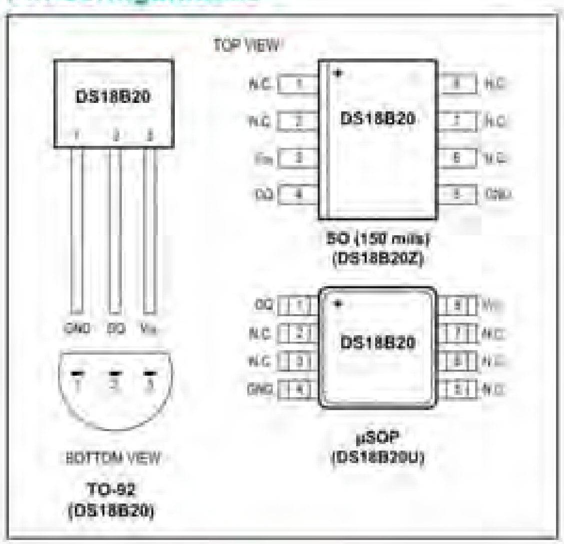
Ordering Information ***appears at end of data sheet.***

1-Wire is a registered trademark of Maxim Integrated Products, Inc.

Benefits and Features

- Unique 1-Wire® Interface Requires Only One Port Pin for Communication
- Reduce Component Count with Integrated Temperature Sensor and EEPROM
  - Measures Temperatures from -55°C to +125°C (-67°F to +257°F)
  - ±0.5°C Accuracy from -10°C to +85°C
  - Programmable Resolution from 9 Bits to 12 Bits
  - No External Components Required
- Parasitic Power Mode Requires Only 2 Pins for Operation (DQ and GND)
- Simplifies Distributed Temperature-Sensing Applications with Multidrop Capability
  - Each Device Has a Unique 64-Bit Serial Code Stored in On-Board ROM
- Flexible User-Definable Nonvolatile (NV) Alarm Settings with Alarm Search Command Identifies Devices with Temperatures Outside Programmed Limits
- Available in 8-Pin SO (150 mils), 8-Pin µSOP, and 3-Pin TO-92 Packages

Pin Configurations



Absolute Maximum Ratings

Voltage Range on Any Pin Relative to Ground ....-0.5V to +6.0V
Operating Temperature Range .... -55°C to +125°C
Storage Temperature Range .... -55°C to +125°C
Solder Temperature .... Refer to the IPC/JEDEC J-STD-020 Specification

These are stress ratings only and functional operation of the device at those or any other conditions above those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

DC Electrical Characteristics

(-55°C to +125°C; V_{DD} = 3.0V to 5.5V)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Voltage	V_{DD}	Local power (Note 1)		+3.0		+5.5	V
Pullup Supply Voltage	V_{PU}	Parasite power	(Notes 1, 2)	+3.0		+5.5	V
		Local power		+3.0		V_{DD}	
Thermometer Error	t_{ERR}	-10°C to +85°C	(Note 3)			±0.5	°C
		-55°C to +125°C				±2	
Input Logic-Low	V_{IL}	(Notes 1, 4, 5)		-0.3		+0.8	V
Input Logic-High	V_{IH}	Local power	(Notes 1,6)	+2.2		The lower of 5.5 or V_{DD} + 0.3	V
		Parasite power		+3.0			
Sink Current	I_L	$V_{I/O}$ = 0.4V		4.0			mA
Standby Current	I_{DDS}	(Notes 7, 8)			750	1000	nA
Active Current	I_{DD}	V_{DD} = 5V (Note 9)			1	1.5	mA
DQ Input Current	I_{DQ}	(Note 10)			5		µA
Drift		(Note 11)			±0.2		°C

Note 1: All voltages are referenced to ground.
Note 2: The Pullup Supply Voltage specification assumes that the pullup device is ideal, and therefore the high level of the pullup is equal to V_{PU}. In order to meet the V_{IH} spec of the DS18B20, the actual supply rail for the strong pullup transistor must include margin for the voltage drop across the transistor when it is turned on; thus: $V_{PU\_ACTUAL} = V_{PU\_IDEAL} + V_{TRANSISTOR}$.
Note 3: See typical performance curve in Figure 1.
Note 4: Logic-low voltages are specified at a sink current of 4mA.
Note 5: To guarantee a presence pulse under low voltage parasite power conditions, V_{ILMAX} may have to be reduced to as low as 0.5V.
Note 6: Logic-high voltages are specified at a source current of 1mA.
Note 7: Standby current specified up to +70°C. Standby current typically is 3µA at +125°C.
Note 8: To minimize I_{DDS}, DQ should be within the following ranges: GND ≤ DQ ≤ GND + 0.3V or V_{DD} – 0.3V ≤ DQ ≤ V_{DD}.
Note 9: Active current refers to supply current during active temperature conversions or EEPROM writes.
Note 10: DQ line is high ("high-Z" state).
Note 11: Drift data is based on a 1000-hour stress test at +125°C with V_{DD} = 5.5V.

AC Electrical Characteristics–NV Memory

(-55°C to +125°C; V_{DD} = 3.0V to 5.5V)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
NV Write Cycle Time	t_{WR}			2	10	ms
EEPROM Writes	N_{EEWR}	-55°C to +55°C	50k			writes
EEPROM Data Retention	t_{EEDR}	-55°C to +55°C	10			years

AC Electrical Characteristics

(-55°C to +125°C; V_{DD} = 3.0V to 5.5V)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Temperature Conversion Time	t_{CONV}	9-bit resolution	(Note 12)			93.75	ms
		10-bit resolution				187.5	
		11-bit resolution				375	
		12-bit resolution				750	
Time to Strong Pullup On	t_{SPON}	Start convert T command issued				10	µs
Time Slot	t_{SLOT}	(Note 12)		60		120	µs
Recovery Time	t_{REC}	(Note 12)		1			µs
Write 0 Low Time	t_{LOW0}	(Note 12)		60		120	µs
Write 1 Low Time	t_{LOW1}	(Note 12)		1		15	µs
Read Data Valid	t_{RDV}	(Note 12)				15	µs
Reset Time High	t_{RSTH}	(Note 12)		480			µs
Reset Time Low	t_{RSTL}	(Notes 12, 13)		480			µs
Presence-Detect High	t_{PDHIGH}	(Note 12)		15		60	µs
Presence-Detect Low	t_{PDLOW}	(Note 12)		60		240	µs
Capacitance	$C_{IN/OUT}$					25	pF

Note 12: See the timing diagrams in Figure 2.
Note 13: Under parasite power, if t_{RSTL} > 960µs, a power-on reset can occur.

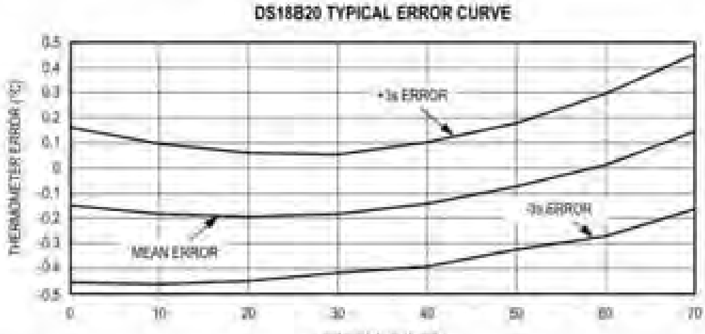


Figure 1. Typical Performance Curve

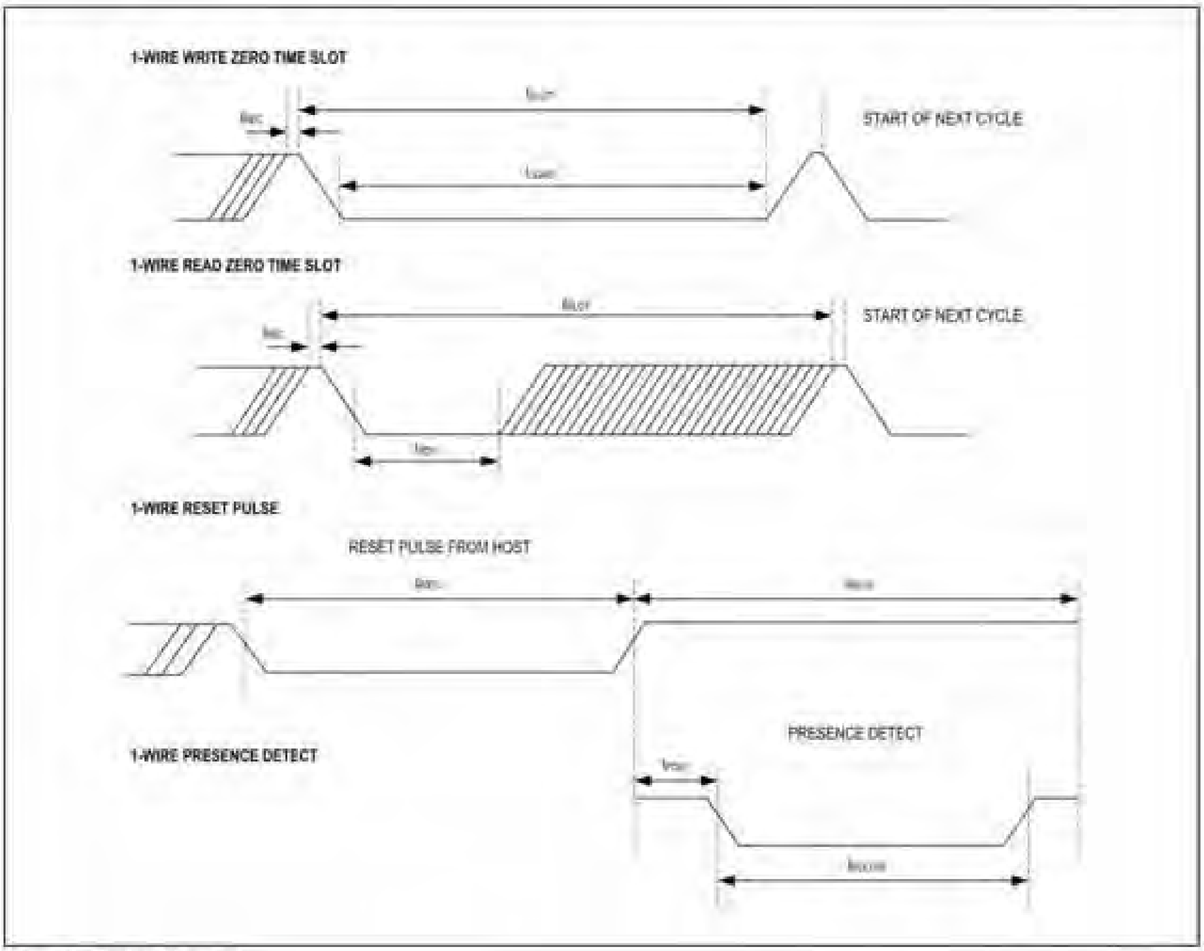
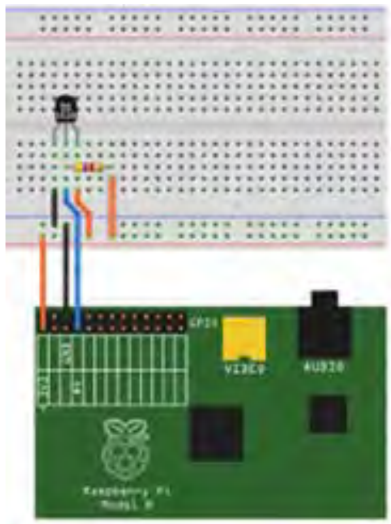


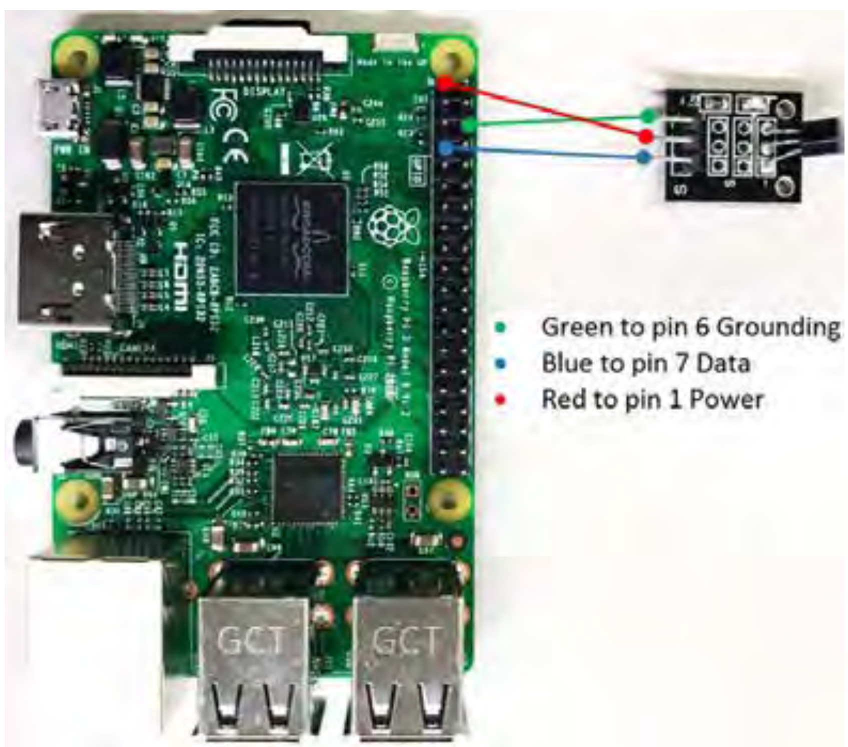
Figure 2. Timing Diagrams

Pin Description

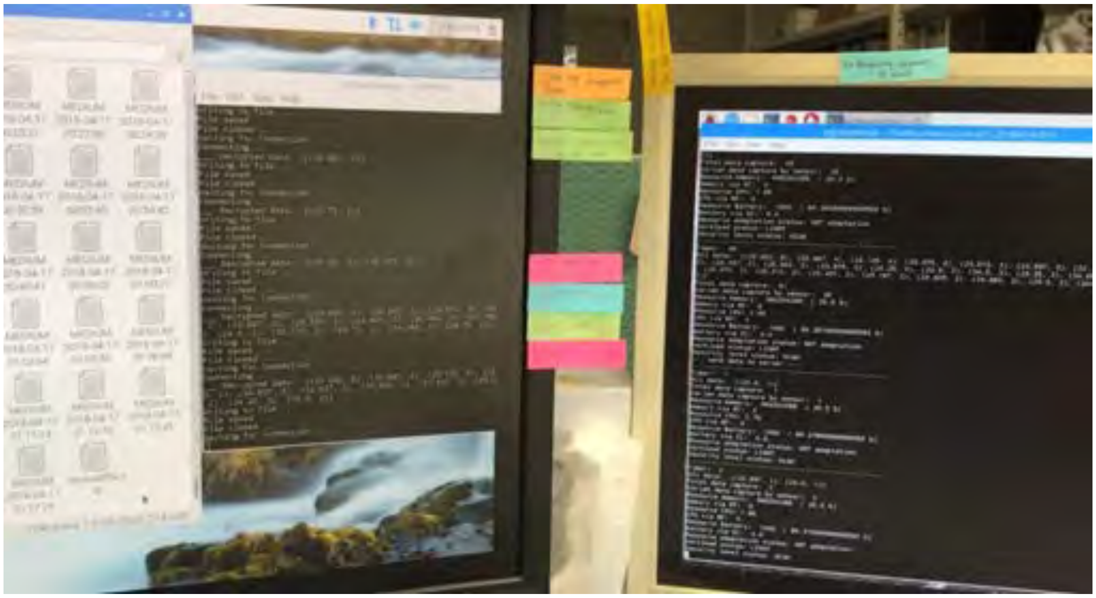
PIN			NAME	FUNCTION
SO	μSOP	TO-92		
1, 2, 6, 7, 8	2, 3, 5, 6, 7	—	N.C.	No Connection
3	8	3	V_{DD}	Optional V_{DD}. V_{DD} must be grounded for operation in parasite power mode.
4	1	2	DQ	Data Input/Output. Open-drain 1-Wire interface pin. Also provides power to the device when used in parasite power mode (see the *Powering the DS18B20* section.)
5	4	1	GND	Ground

Appendix C. Capture Hardware Hookup

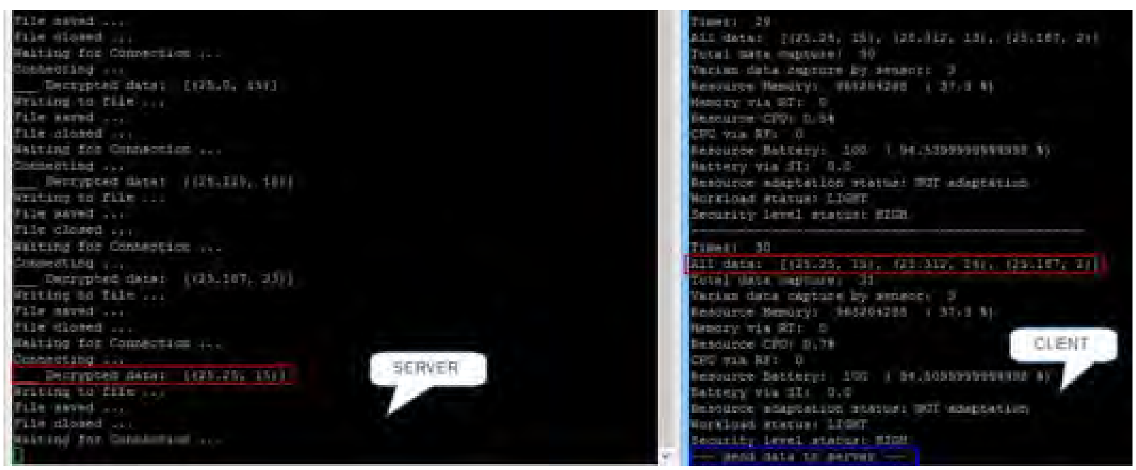




Appendix D. Capture View Desktop

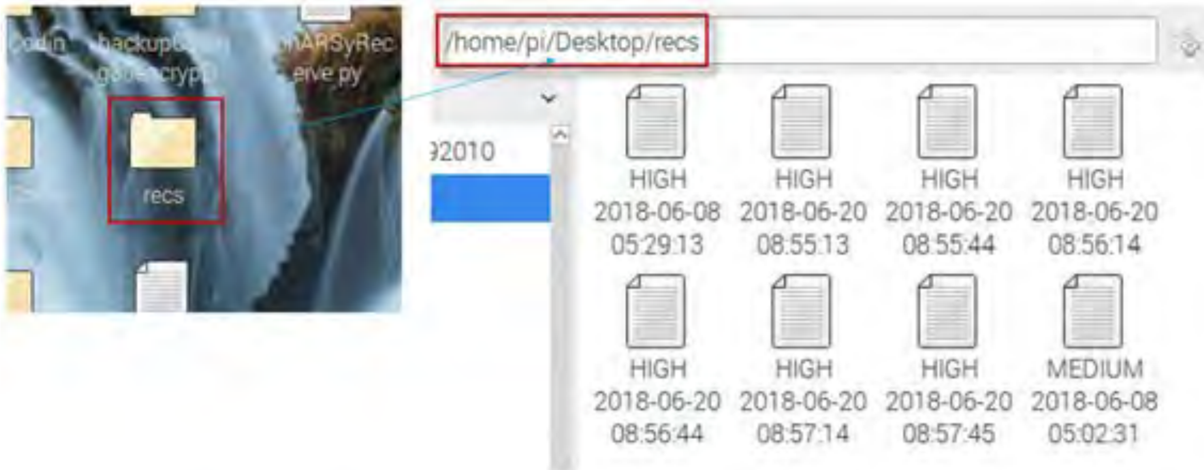


Ap.D1. View processes mining data whose results are sent to the server



Ap.D2. Releases mining data after the limit time, and data is sent to the server. Not all captured data is sent, but only a few counters are based on memory policy.

By default the data that appears, can't be read if not in the PC server because the data sent is encrypted.



Ap. D3. On the server side, all data is recorded with the security level (log file).

Appendix E. Log File Normal Test 30 mAh and 30s release data to server

timer_rilis	timer	temp_cap	total_ite	total_var	cpu_tot	cpu_free	cpu_usage	mem_total	mem_free	mem_usage	batt_total	batt_free	bat_usage	avg_res	res_conditi	work_condi	rilis_data_to_server	res_adapt	secu_updt	si	rf	rt
1	1	26.437	1	1	100	99.5	0.5	968204288	810,639,360	157,564,928	30	29.91	0.09	5.7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
2	2	26.437	2	1	100	99.3	0.7	968204288	810,692,608	157,511,680	30	29.88	0.12	5.8	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
3	3	26.5	3	2	100	99.5	0.5	968204288	810,627,072	157,577,216	30	29.85	0.15	5.76667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
4	4	26.5	4	2	100	98	2	968204288	810,639,360	157,564,928	30	29.82	0.18	6.3	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
5	5	26.5	5	2	100	97.7	2.3	968204288	810,614,784	157,589,504	30	29.79	0.21	6.43333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
6	6	26.5	6	2	100	99.2	0.8	968204288	810,532,864	157,671,424	30	29.76	0.24	5.96667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
7	7	26.5	7	2	100	99	1	968204288	810,037,248	158,167,040	30	29.73	0.27	6.06667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
8	8	26.5	8	2	100	99.5	0.5	968204288	810,147,840	158,056,448	30	29.7	0.3	5.93333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
9	9	26.5	9	2	100	99	1	968204288	810,049,536	158,154,752	30	29.67	0.33	6.13333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
10	10	26.5	10	2	100	99.5	0.5	968204288	810,049,536	158,154,752	30	29.64	0.36	6	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
11	11	26.5	11	2	100	98.7	1.3	968204288	810,172,416	158,031,872	30	29.61	0.39	6.3	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
12	12	26.5	12	2	100	98.5	1.5	968204288	810,049,536	158,154,752	30	29.58	0.42	6.4	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
13	13	26.5	13	2	100	99	1	968204288	810,172,416	158,031,872	30	29.55	0.45	6.26667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
14	14	26.5	14	2	100	98.8	1.2	968204288	810,049,536	158,154,752	30	29.52	0.48	6.36667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
15	15	26.437	15	2	100	99	1	968204288	810,172,416	158,031,872	30	29.49	0.51	6.33333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
16	16	26.437	16	2	100	99.3	0.7	968204288	810,049,536	158.154.752	30	29.46	0.54	6.26667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
17	17	26.375	17	3	100	99.2	0.8	968204288	809,717,760	158,486,528	30	29.43	0.57	6.36667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
18	18	26.375	18	3	100	98.5	1.5	968204288	809,766,912	158,437,376	30	29.4	0.6	6.63333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
19	19	26.375	19	3	100	99.5	0.5	968204288	809,693,184	158,511,104	30	29.37	0.63	6.33333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
20	20	26.375	20	3	100	98.5	1.5	968204288	809,766,912	158,437,376	30	29.34	0.66	6.7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
21	21	26.375	21	3	100	98.5	1.5	968204288	809.717.760	158.486.528	30	29.31	0.69	6.73333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
22	22	26.375	22	3	100	99	1	968204288	809,672,704	158,531,584	30	29.28	0.72	6.6	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
23	23	26.312	23	4	100	99.2	0.8	968204288	809,807,872	158,396,416	30	29.25	0.75	6.56667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
24	24	26.312	24	4	100	99.2	0.8	968204288	809,709,568	158,494,720	30	29.22	0.78	6.6	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
25	25	26.312	25	4	100	99.5	0.5	968204288	809,807,872	158,396,416	30	29.19	0.81	6.53333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
26	26	26.375	26	4	100	99	1	968204288	809,816,064	158,388,224	30	29.16	0.84	6.73333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
27	27	26.375	27	4	100	99	1	968204288	809,717,760	158,486,528	30	29.13	0.87	6.76667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
28	28	26.375	28	4	100	98.8	1.2	968204288	809,816,064	158,388,224	30	29.1	0.9	6.86667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
29	29	26.375	29	4	100	99	1	968204288	809,816,064	158,388,224	30	29.07	0.93	6.83333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
30	30	26.375	30	4	100	99.2	0.8	968204288	809,840,640	158,363,648	30	29.04	0.96	6.8	MINIMUM	LIGHT	[(26.5, 12), (26.375, 11)]	NOT Adaptation	HIGH	0	0	O
1	31	26.375	1	1	100	70.8	29.2	968204288	809,824,256	158,380,032	30	29.01	0.99	16.3	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
2	32	26.375	2	1	100	98	2	968204288	809,750,528	158,453,760	30	28.98	1.02	7.26667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
3	33	26.375	3	1	100	99.5	0.5	968204288	809,750,528	158,453,760	30	28.95	1.05	6.8	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
4	34	26.375	4	1	100	98.8	1.2	968204288	809,676,800	158,527,488	30	28.92	1.08	7.06667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
5	35	26.375	5	1	100	99.2	0.8	968204288	809,562,112	158,642,176	30	28.89	1.11	6.96667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
6	36	26.375	6	1	100	99.2	0.8	968204288	809,730,048	158,474,240	30	28.86	1.14	7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
7	37	26.375	7	1	100	99.5	0.5	968204288	809,656,320	158,547,968	30	28.83	1.17	6.93333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
8	38	26.375	8	1	100	98.8	1.2	968204288	809,730,048	158,474,240	30	28.8	1.2	7.2	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
9	39	26.375	9	1	100	99.2	0.8	968204288	809,656,320	158,547,968	30	28.77	1.23	7.1	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
10	40	26.375	10	1	100	98.2	1.8	968204288	809,402,368	158,801,920	30	28.74	1.26	7.46667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
11	41	26.375	11	1	100	100	0	968204288	809,480,192	158,724,096	30	28.71	1.29	6.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
12	42	26.437	14	2	100	99	1	968204288	809,414,656	158,789,632	30	28.62	1.38	7.33333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
13	43	26.437	15	2	100	97.2	2.8	968204288	809,418,752	158,785,536	30	28.59	1.41	7.96667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
14	44	26.437	16	2	100	99.5	0.5	968204288	809,525,248	158,679,040	30	28.56	1.44	7.23333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
15	45	26.437	17	2	100	97.5	2.5	968204288	809,476,096	158,728,192	30	28.53	1.47	7.93333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
16	46	26.437	18	2	100	94	6	968204288	809,373,696	158,830,592	30	28.5	1.5	9.13333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
17	47	26.437	19	2	100	93.2	6.8	968204288	809,156,608	159,047,680	30	28.47	1.53	9.43333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
18	48	26.437	20	2	100	95.5	4.5	968204288	809,218,048	158,986,240	30	28.44	1.56	8.7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
19	49	26.437	21	2	100	95.5	4.5	968204288	809,259,008	158,945,280	30	28.41	1.59	8.73333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
20	50	26.437	22	2	100	94.4	5.6	968204288	809,160,704	159,043,584	30	28.38	1.62	9.13333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
21	51	26.437	23	2	100	98.7	1.3	968204288	809,267,200	158,937,088	30	28.35	1.65	7.73333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
22	52	26.437	24	2	100	97.8	2.2	968204288	809,267,200	158,937,088	30	28.32	1.68	8.06667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
23	53	26.437	25	2	100	94	6	968204288	809,349,120	158,855,168	30	28.29	1.71	9.36667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
24	54	26.437	26	2	100	96.5	3.5	968204288	809,168,896	159,035,392	30	28.26	1.74	8.56667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
25	55	26.437	27	2	100	99.2	0.8	968204288	809,291,776	158,912,512	30	28.23	1.77	7.7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O

26	56	26.437	28	2	100	99.3	0.7	968204288	809,291,776	158,912,512	30	28.2	1.8	7.7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
27	57	26.5	29	3	100	99.7	0.3	968204288	809,267,200	158,937,088	30	28.17	1.83	7.6	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
28	58	26.5	30	3	100	98.2	1.8	968204288	809,275,392	158,928,896	30	28.14	1.86	8.13333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
29	59	26.437	31	3	100	98	2	968204288	809,267,200	158,937,088	30	28.11	1.89	8.23333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
30	60	26.437	32	3	100	98.5	1.5	968204288	809,259,008	158,945,280	30	28.08	1.92	8.1	MINIMUM	LIGHT	[(26.437, 19)]	NOT Adaptation	HIGH	0	0	0
1	61	26.437	1	1	100	73.6	26.4	968204288	809,299,968	158,904,320	30	28.05	1.95	16.4333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
2	62	26.437	2	1	100	99.5	0.5	968204288	809,230,336	158,973,952	30	28.02	1.98	7.83333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
3	63	26.437	3	1	100	99.3	0.7	968204288	809,279,488	158,924,800	30	27.99	2.01	7.93333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
4	64	26.437	4	1	100	92.2	7.8	968204288	809,029,632	159,174,656	30	27.96	2.04	10.3333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
5	65	26.437	5	1	100	89.2	10.8	968204288	809,283,584	158,920,704	30	27.93	2.07	11.3667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
6	66	26.437	6	1	100	98.7	1.3	968204288	809,234,432	158,969,856	30	27.9	2.1	8.23333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
7	67	26.437	7	1	100	98	2	968204288	809,283,584	158,920,704	30	27.87	2.13	8.5	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
8	68	26.437	8	1	100	99.2	0.8	968204288	809,234,432	158,969,856	30	27.84	2.16	8.13333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
9	69	26.437	9	1	100	99.2	0.8	968204288	809,283,584	158,920,704	30	27.81	2.19	8.16667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
10	70	26.437	10	1	100	99	1	968204288	809,193,472	159,010,816	30	27.78	2.22	8.26667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
11	71	26.437	11	1	100	99.2	0.8	968204288	809,283,584	158,920,704	30	27.75	2.25	8.23333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
12	72	26.5	12	2	100	98.8	1.2	968204288	809,209,856	158,994,432	30	27.72	2.28	8.4	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
13	73	26.5	13	2	100	99	1	968204288	809,308,160	158,896,128	30	27.69	2.31	8.36667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
14	74	26.5	14	2	100	98.5	1.5	968204288	809,279,488	158,924,800	30	27.66	2.34	8.56667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
15	75	26.5	15	2	100	99.2	0.8	968204288	809,181,184	159,023,104	30	27.63	2.37	8.36667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
16	76	26.5	16	2	100	99.2	0.8	968204288	809,213,952	158,990,336	30	27.6	2.4	8.4	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
17	77	26.5	17	2	100	98.8	1.2	968204288	809,213,952	158,990,336	30	27.57	2.43	8.56667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
18	78	26.5	18	2	100	99.5	0.5	968204288	809,287,680	158,916,608	30	27.54	2.46	8.36667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
19	79	26.5	19	2	100	98.8	1.2	968204288	809,287,680	158,916,608	30	27.51	2.49	8.63333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
20	80	26.5	20	2	100	99.2	0.8	968204288	809,299,968	158,904,320	30	27.48	2.52	8.53333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
21	81	26.5	21	2	100	99	1	968204288	809,226,240	158,978,048	30	27.45	2.55	8.63333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
22	82	26.5	22	2	100	99.2	0.8	968204288	809,275,392	158,928,896	30	27.42	2.58	8.6	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
23	83	26.5	23	2	100	99	1	968204288	809,275,392	158,928,896	30	27.39	2.61	8.7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
24	84	26.5	24	2	100	99	1	968204288	809,304,064	158,900,224	30	27.36	2.64	8.73333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
25	85	26.5	25	2	100	99.2	0.8	968204288	809,230,336	158,973,952	30	27.33	2.67	8.7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
26	86	26.5	26	2	100	99.2	0.8	968204288	809,304,064	158,900,224	30	27.3	2.7	8.73333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
27	87	26.5	27	2	100	98.8	1.2	968204288	809,185,280	159,019,008	30	27.27	2.73	8.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
28	88	26.5	28	2	100	99	1	968204288	809,185,280	159,019,008	30	27.24	2.76	8.86667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
29	89	26.5	29	2	100	99	1	968204288	809,185,280	159,019,008	30	27.21	2.79	8.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
30	90	26.5	30	2	100	99	1	968204288	809,193,472	159,010,816	30	27.18	2.82	8.93333	MINIMUM	LIGHT	[(26.5, 19)]	NOT Adaptation	HIGH	0	0	0
1	91	26.5	1	1	100	82	18	968204288	809,177,088	159,027,200	30	27.12	2.88	14.6667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
2	92	26.5	2	1	100	93.5	6.5	968204288	809,086,976	159,117,312	30	27.09	2.91	10.8667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
3	93	26.5	3	1	100	99.5	0.5	968204288	808,882,176	159,322,112	30	27.06	2.94	8.93333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
4	94	26.5	4	1	100	99.5	0.5	968204288	808,890,368	159,313,920	30	27.03	2.97	8.96667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
5	95	26.5	5	1	100	99	1	968204288	809,144,320	159,059,968	30	27	3	9.13333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
6	96	26.5	6	1	100	99.5	0.5	968204288	809,095,168	159,109,120	30	26.97	3.03	9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
7	97	26.5	7	1	100	99.5	0.5	968204288	809,148,416	159,055,872	30	26.94	3.06	9.03333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
8	98	26.5	8	1	100	99.2	0.8	968204288	809,156,608	159,047,680	30	26.91	3.09	9.16667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
9	99	26.5	9	1	100	97	3	968204288	809,254,912	158,949,376	30	26.88	3.12	9.93333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
10	100	26.5	10	1	100	97.2	2.8	968204288	809,156,608	159,047,680	30	26.85	3.15	9.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
11	101	26.5	11	1	100	96	4	968204288	809,123,840	159,080,448	30	26.82	3.18	10.3333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
12	102	26.5	12	1	100	97.2	2.8	968204288	809,123,840	159,080,448	30	26.79	3.21	9.96667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
13	103	26.5	13	1	100	99.3	0.7	968204288	809,132,032	159,072,256	30	26.76	3.24	9.3	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
14	104	26.5	14	1	100	95.9	4.1	968204288	808,976,384	159,227,904	30	26.73	3.27	10.4667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
15	105	26.5	15	1	100	93.5	6.5	968204288	809,148,416	159,055,872	30	26.7	3.3	11.3	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
16	106	26.5	16	1	100	93.4	6.6	968204288	809,050,112	159,154,176	30	26.67	3.33	11.3667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
17	107	26.5	17	1	100	94.5	5.5	968204288	809,148,416	159,055,872	30	26.64	3.36	11.0333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
18	108	26.5	18	1	100	93	7	968204288	809,172,992	159,031,296	30	26.61	3.39	11.5667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
19	109	26.5	19	1	100	94.5	5.5	968204288	809,148,416	159,055,872	30	26.58	3.42	11.1	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
20	110	26.562	20	2	100	93	7	968204288	809,148,416	159,055,872	30	26.55	3.45	11.6333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
21	111	26.562	21	2	100	94.9	5.1	968204288	809,148,416	159,055,872	30	26.52	3.48	11.0333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0

22	112	26.5	22	2	100	94	6	968204288	809,148,416	159,055,872	30	26.49	3.51	11.3667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
23	113	26.562	23	2	100	96	4	968204288	809,148,416	159,055,872	30	26.46	3.54	10.7333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
24	114	26.562	24	2	100	96.2	3.8	968204288	809,148,416	159,055,872	30	26.43	3.57	10.7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
25	115	26.562	25	2	100	93.7	6.3	968204288	809,148,416	159,055,872	30	26.4	3.6	11.5667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
26	116	26.562	26	2	100	99	1	968204288	809,148,416	159,055,872	30	26.37	3.63	9.83333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
27	117	26.5	27	2	100	99	1	968204288	809,148,416	159,055,872	30	26.34	3.66	9.86667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
28	118	26.5	28	2	100	98	2	968204288	809,148,416	159,055,872	30	26.31	3.69	10.2333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
29	119	26.562	29	2	100	96	4	968204288	809,148,416	159,055,872	30	26.28	3.72	10.9333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
30	120	26.562	30	2	100	94.7	5.3	968204288	809,074,688	159,129,600	30	26.25	3.75	11.4	MINIMUM	LIGHT	[(26.5, 22)]	NOT Adaptation	HIGH	0	0	0
1	121	26.5	1	1	100	74.7	25.3	968204288	809,209,856	158,994,432	30	26.22	3.78	18.1	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
2	122	26.5	2	1	100	97	3	968204288	809,209,856	158,994,432	30	26.19	3.81	10.7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
3	123	26.5	3	1	100	94.9	5.1	968204288	808,947,712	159,256,576	30	26.16	3.84	11.4333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
4	124	26.5	4	1	100	93.5	6.5	968204288	809,250,816	158,953,472	30	26.13	3.87	11.9333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
5	125	26.562	5	2	100	95.3	4.7	968204288	809,201,664	159,002,624	30	26.1	3.9	11.3667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
6	126	26.562	6	2	100	93.9	6.1	968204288	809,259,008	158,945,280	30	26.07	3.93	11.8667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
7	127	26.562	7	2	100	95.7	4.3	968204288	809,103,360	159,100,928	30	26.04	3.96	11.3	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
8	128	26.562	8	2	100	96.7	3.3	968204288	809,250,816	158,953,472	30	26.01	3.99	11	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
9	129	26.562	9	2	100	96.7	3.3	968204288	809,201,664	159,002,624	30	25.98	4.02	11.0333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
10	130	26.562	10	2	100	93.5	6.5	968204288	809,103,360	159,100,928	30	25.95	4.05	12.1333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
11	131	26.562	11	2	100	95.2	4.8	968204288	809,103,360	159,100,928	30	25.92	4.08	11.6	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
12	132	26.562	12	2	100	99.2	0.8	968204288	809,201,664	159,002,624	30	25.89	4.11	10.3	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
13	133	26.5	13	2	100	98	2	968204288	809,201,664	159,002,624	30	25.86	4.14	10.7333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
14	134	26.5	14	2	100	96	4	968204288	809,201,664	159,002,624	30	25.83	4.17	11.4333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
15	135	26.562	15	2	100	95.7	4.3	968204288	809,218,048	158,986,240	30	25.8	4.2	11.5667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
16	136	26.5	16	2	100	97.5	2.5	968204288	809,218,048	158,986,240	30	25.77	4.23	11	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
17	137	26.5	17	2	100	94.9	5.1	968204288	809,218,048	158,986,240	30	25.74	4.26	11.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
18	138	26.5	18	2	100	94.5	5.5	968204288	809,234,432	158,969,856	30	25.71	4.29	12.0667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
19	139	26.5	19	2	100	94.5	5.5	968204288	809,500,672	158,703,616	30	25.68	4.32	12.1	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
20	140	26.5	20	2	100	95.7	4.3	968204288	809,598,976	158,605,312	30	25.65	4.35	11.7333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
21	141	26.5	21	2	100	94.5	5.5	968204288	809,598,976	158,605,312	30	25.62	4.38	12.1667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
22	142	26.5	22	2	100	93.7	6.3	968204288	809,676,800	158,527,488	30	25.59	4.41	12.4667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
23	143	26.5	23	2	100	94.2	5.8	968204288	809,324,544	158,879,744	30	25.56	4.44	12.3333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
24	144	26.5	24	2	100	94.8	5.2	968204288	809,607,168	158,597,120	30	25.53	4.47	12.1667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
25	145	26.5	25	2	100	93	7	968204288	809,517,056	158,687,232	30	25.5	4.5	12.8	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
26	146	26.5	26	2	100	94.5	5.5	968204288	809,328,640	158,875,648	30	25.47	4.53	12.3333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
27	147	26.5	27	2	100	93.2	6.8	968204288	810,176,512	158,027,776	30	25.44	4.56	12.7667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
28	148	26.5	28	2	100	94.2	5.8	968204288	810,151,936	158,052,352	30	25.41	4.59	12.4667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
29	149	26.5	29	2	100	96.5	3.5	968204288	810,151,936	158,052,352	30	25.38	4.62	11.7333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
30	150	26.5	30	2	100	93.7	6.3	968204288	810,225,664	157,978,624	30	25.35	4.65	12.7	MINIMUM	LIGHT	[(26.5, 21)]	NOT Adaptation	HIGH	0	0	0
1	151	26.5	1	1	100	77.4	22.6	968204288	810,143,744	158,060,544	30	25.32	4.68	18.1667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
2	152	26.5	2	1	100	97.2	2.8	968204288	809,660,416	158,543,872	30	25.29	4.71	11.6333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
3	153	26.5	3	1	100	99	1	968204288	809,684,992	158,519,296	30	25.26	4.74	11.0667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
4	154	26.5	4	1	100	98.3	1.7	968204288	809,537,536	158,666,752	30	25.23	4.77	11.3333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
5	155	26.5	5	1	100	98	2	968204288	809,635,840	158,568,448	30	25.17	4.83	11.5	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
6	156	26.5	6	1	100	99	1	968204288	809,611,264	158,593,024	30	25.14	4.86	11.2	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
7	157	26.5	7	1	100	99.5	0.5	968204288	809,611,264	158,593,024	30	25.11	4.89	11.0667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
8	158	26.5	8	1	100	99.2	0.8	968204288	809,611,264	158,593,024	30	25.08	4.92	11.2	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
9	159	26.5	9	1	100	100	0	968204288	809,611,264	158,593,024	30	25.05	4.95	10.9667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
10	160	26.5	10	1	100	98.2	1.8	968204288	808,931,328	159,272,960	30	25.02	4.98	11.6333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
11	161	26.5	11	1	100	98.5	1.5	968204288	809,123,840	159,080,448	30	24.99	5.01	11.5333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
12	162	26.5	12	1	100	98.7	1.3	968204288	809,074,688	159,129,600	30	24.96	5.04	11.5	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
13	163	26.5	13	1	100	99	1	968204288	809,123,840	159,080,448	30	24.93	5.07	11.4333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
14	164	26.5	14	1	100	95.2	4.8	968204288	808,456,192	159,748,096	30	24.9	5.1	12.7667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
15	165	26.5	15	1	100	89.6	10.4	968204288	808,398,848	159,805,440	30	24.87	5.13	14.6667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
16	166	26.5	16	1	100	89	11	968204288	808,484,864	159,719,424	30	24.84	5.16	14.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
17	167	26.562	17	2	100	91.7	8.3	968204288	808,341,504	159,862,784	30	24.81	5.19	14.0333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0

18	168	26.562	18	2	100	88.2	11.8	968204288	808,468,480	159,735,808	30	24.78	5.22	15.2333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
19	169	26.562	19	2	100	89.2	10.8	968204288	808,448,000	159,756,288	30	24.75	5.25	14.9333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
20	170	26.562	20	2	100	86.9	13.1	968204288	803,491,840	164,712,448	30	24.72	5.28	15.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
21	171	26.562	21	2	100	89.4	10.6	968204288	802,500,608	165,703,680	30	24.69	5.31	15.1333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
22	172	26.562	22	2	100	94	6	968204288	808,325,120	159,879,168	30	24.66	5.34	13.4333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
23	173	26.562	23	2	100	90.8	9.2	968204288	807,923,712	160,280,576	30	24.63	5.37	14.5667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
24	174	26.562	24	2	100	89.3	10.7	968204288	807,923,712	160,280,576	30	24.6	5.4	15.1	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
25	175	26.5	25	2	100	86.9	13.1	968204288	802,131,968	166,072,320	30	24.57	5.43	16.1333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
26	176	26.5	26	2	100	85.8	14.2	968204288	808,046,592	160,157,696	30	24.54	5.46	16.3	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
27	177	26.5	27	2	100	94.7	5.3	968204288	807,944,192	160,260,096	30	24.51	5.49	13.4	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
28	178	26.5	28	2	100	98.2	1.8	968204288	807,972,864	160,231,424	30	24.48	5.52	12.2333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
29	179	26.562	29	2	100	98.2	1.8	968204288	807,972,864	160,231,424	30	24.45	5.55	12.2667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
30	180	26.5	31	2	100	97.8	2.2	968204288	807,944,192	160,260,096	30	24.42	5.58	12.4667	MINIMUM	LIGHT	[(26.5, 21)]	NOT Adaptation	HIGH	0	0	0
1	181	26.5	1	1	100	50.4	49.6	968204288	807,964,672	160,239,616	30	24.39	5.61	28.3	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0
2	182	26.5	2	1	100	97.8	2.2	968204288	807,944,192	160,260,096	30	24.36	5.64	12.5333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
3	183	26.5	3	1	100	98.5	1.5	968204288	807,981,056	160,223,232	30	24.33	5.67	12.3	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
4	184	26.5	4	1	100	98.2	1.8	968204288	807,944,192	160,260,096	30	24.3	5.7	12.4667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
5	185	26.5	5	1	100	98.2	1.8	968204288	807,981,056	160,223,232	30	24.27	5.73	12.4667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
6	186	26.5	6	1	100	98	2	968204288	807,989,248	160,215,040	30	24.24	5.76	12.5667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
7	187	26.5	7	1	100	98	2	968204288	807,989,248	160,215,040	30	24.21	5.79	12.6	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
8	188	26.5	8	1	100	98	2	968204288	807,997,440	160,206,848	30	24.18	5.82	12.6333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
9	189	26.562	9	2	100	96.5	3.5	968204288	807,981,056	160,223,232	30	24.15	5.85	13.1667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
10	190	26.562	10	2	100	99	1	968204288	807,989,248	160,215,040	30	24.12	5.88	12.3667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
11	191	26.562	11	2	100	94.3	5.7	968204288	802,029,568	166,174,720	30	24.09	5.91	14.2	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
12	192	26.562	12	2	100	95.2	4.8	968204288	807,989,248	160,215,040	30	24.06	5.94	13.7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
13	193	26.562	13	2	100	98	2	968204288	807,952,384	160,251,904	30	24.03	5.97	12.8333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
14	194	26.562	14	2	100	99.5	0.5	968204288	807,989,248	160,215,040	30	24	6	12.3333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
15	195	26.562	15	2	100	99.5	0.5	968204288	807,989,248	160,215,040	30	23.97	6.03	12.3667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
16	196	26.562	16	2	100	99	1	968204288	807,989,248	160,215,040	30	23.94	6.06	12.5667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
17	197	26.562	17	2	100	99	1	968204288	807,993,344	160,210,944	30	23.91	6.09	12.6	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
18	198	26.562	18	2	100	99.5	0.5	968204288	808,001,536	160,202,752	30	23.88	6.12	12.4667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
19	199	26.562	19	2	100	99.2	0.8	968204288	808,001,536	160,202,752	30	23.85	6.15	12.6	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
20	200	26.562	20	2	100	99.2	0.8	968204288	808,001,536	160,202,752	30	23.82	6.18	12.6333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
21	201	26.562	21	2	100	98.8	1.2	968204288	808,017,920	160,186,368	30	23.79	6.21	12.8	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
22	202	26.562	22	2	100	99.5	0.5	968204288	808,017,920	160,186,368	30	23.76	6.24	12.6	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
23	203	26.562	23	2	100	99.3	0.7	968204288	808,009,728	160,194,560	30	23.73	6.27	12.7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
24	204	27.25	24	3	100	98.7	1.3	968204288	808,009,728	160,194,560	30	23.7	6.3	12.9333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
25	205	27.25	25	3	100	95	5	968204288	802,177,024	166,027,264	30	23.67	6.33	14.4	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
26	206	27.875	26	4	100	86.6	13.4	968204288	807,915,520	160,288,768	30	23.64	6.36	17.0667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
27	207	27.875	27	4	100	91	9	968204288	807,899,136	160,305,152	30	23.61	6.39	15.6333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
28	208	27.687	28	5	100	98.2	1.8	968204288	807,907,328	160,296,960	30	23.58	6.42	13.2667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
29	209	27.687	29	5	100	97.7	2.3	968204288	807,899,136	160,305,152	30	23.55	6.45	13.4667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
30	210	28.25	30	6	100	97.7	2.3	968204288	807,907,328	160,296,960	30	23.52	6.48	13.5	MINIMUM	LIGHT	[(26.562, 15), (26.5, 8), (2	NOT Adaptation	HIGH	0	0	0
1	211	29.562	1	1	100	80.7	19.3	968204288	807,948,288	160,256,000	30	23.46	6.54	19.2333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
2	212	29.562	2	1	100	97.5	2.5	968204288	807,944,192	160,260,096	30	23.43	6.57	13.6667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
3	213	29.312	3	2	100	98.2	1.8	968204288	807,972,864	160,231,424	30	23.4	6.6	13.4333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
4	214	29.312	4	2	100	98.2	1.8	968204288	807,981,056	160,223,232	30	23.37	6.63	13.4667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
5	215	28.875	5	3	100	98	2	968204288	807,849,984	160,354,304	30	23.34	6.66	13.6	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
6	216	28.875	6	3	100	98	2	968204288	807,849,984	160,354,304	30	23.31	6.69	13.6333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
7	217	28.625	7	4	100	98.2	1.8	968204288	807,858,176	160,346,112	30	23.28	6.72	13.6	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
8	218	28.625	8	4	100	98.2	1.8	968204288	807,849,984	160,354,304	30	23.25	6.75	13.6333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
9	219	28.375	9	5	100	98	2	968204288	807,985,152	160,219,136	30	23.22	6.78	13.7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
10	220	28.375	10	5	100	98.2	1.8	968204288	807,956,480	160,247,808	30	23.19	6.81	13.7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
11	221	28.187	11	6	100	97.5	2.5	968204288	807,956,480	160,247,808	30	23.16	6.84	13.9667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
12	222	28.187	12	6	100	97.7	2.3	968204288	808,108,032	160,096,256	30	23.13	6.87	13.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
13	223	28.062	13	7	100	97.7	2.3	968204288	808,120,320	160,083,968	30	23.1	6.9	13.9333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0

14	224	28.062	14	7	100	98	2	968204288	808,091,648	160,112,640	30	23.07	6.93	13.8667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
15	225	27.937	15	8	100	97.8	2.2	968204288	808,136,704	160,067,584	30	23.04	6.96	13.9667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
16	226	27.812	16	9	100	98	2	968204288	808,136,704	160,067,584	30	23.01	6.99	13.9333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
17	227	27.812	17	9	100	98.2	1.8	968204288	808,108,032	160,096,256	30	22.98	7.02	13.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
18	228	27.687	18	10	100	98	2	968204288	808,136,704	160,067,584	30	22.95	7.05	14	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
19	229	27.687	19	10	100	98.2	1.8	968204288	808,144,896	160,059,392	30	22.92	7.08	13.9667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
20	230	27.625	20	11	100	98	2	968204288	808,140,800	160,063,488	30	22.89	7.11	14.0667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
21	231	27.625	21	11	100	97	3	968204288	808,144,896	160,059,392	30	22.86	7.14	14.4333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
22	232	27.562	22	12	100	97.5	2.5	968204288	808,144,896	160,059,392	30	22.83	7.17	14.3	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
23	233	27.562	23	12	100	97.8	2.2	968204288	808,144,896	160,059,392	30	22.8	7.2	14.2333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
24	234	27.5	24	13	100	98	2	968204288	808,083,456	160,120,832	30	22.77	7.23	14.2	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
25	235	27.5	25	13	100	97.7	2.3	968204288	808,124,416	160,079,872	30	22.74	7.26	14.3333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
26	236	27.437	26	14	100	97.5	2.5	968204288	808,132,608	160,071,680	30	22.71	7.29	14.4333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
27	237	27.437	27	14	100	97.5	2.5	968204288	808,124,416	160,079,872	30	22.68	7.32	14.4667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
28	238	27.375	28	15	100	98	2	968204288	808,095,744	160,108,544	30	22.65	7.35	14.3333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
29	239	27.375	29	15	100	97.3	2.7	968204288	808,132,608	160,071,680	30	22.62	7.38	14.6	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
30	240	27.375	30	15	100	98.2	1.8	968204288	808,009,728	160,194,560	30	22.59	7.41	14.3333	MINIMUM	LIGHT	[(27.375, 3), (27.437, 2), (	NOT Adaptation	HIGH	0	0	0-
1	241	27.375	1	1	100	70.1	29.9	968204288	808,214,528	159,989,760	30	22.53	7.47	23.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0-
2	242	27.312	2	2	100	98.5	1.5	968204288	808,194,048	160,010,240	30	22.5	7.5	14.3333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
3	243	27.312	3	2	100	98	2	968204288	808,202,240	160,002,048	30	22.47	7.53	14.5333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
4	244	27.25	4	3	100	97.7	2.3	968204288	808,214,528	159,989,760	30	22.44	7.56	14.6667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
5	245	27.25	5	3	100	98	2	968204288	808,218,624	159,985,664	30	22.41	7.59	14.6	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
6	246	27.25	6	3	100	98	2	968204288	808,226,816	159,977,472	30	22.38	7.62	14.6333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
7	247	27.25	7	3	100	98	2	968204288	808,235,008	159,969,280	30	22.35	7.65	14.6667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
8	248	27.187	8	4	100	98	2	968204288	808,214,528	159,989,760	30	22.32	7.68	14.7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
9	249	27.187	9	4	100	98	2	968204288	808,185,856	160,018,432	30	22.29	7.71	14.7333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
10	250	27.187	10	4	100	98	2	968204288	808,054,784	160,149,504	30	22.26	7.74	14.7667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
11	251	27.125	11	5	100	97.5	2.5	968204288	808,062,976	160,141,312	30	22.23	7.77	14.9667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
12	252	27.125	12	5	100	98	2	968204288	808,067,072	160,137,216	30	22.2	7.8	14.8333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
13	253	27.062	13	6	100	98	2	968204288	808,075,264	160,129,024	30	22.17	7.83	14.8667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
14	254	27.062	14	6	100	97.7	2.3	968204288	808,083,456	160,120,832	30	22.14	7.86	15	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
15	255	27	15	7	100	97.8	2.2	968204288	808,099,840	160,104,448	30	22.11	7.89	15	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
16	256	27	16	7	100	98.2	1.8	968204288	808,108,032	160,096,256	30	22.08	7.92	14.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
17	257	27	17	7	100	98	2	968204288	808,062,976	160,141,312	30	22.05	7.95	15	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
18	258	27	18	7	100	97.7	2.3	968204288	808,099,840	160,104,448	30	22.02	7.98	15.1333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
19	259	27	19	7	100	98	2	968204288	808,099,840	160,104,448	30	21.99	8.01	15.0667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
20	260	27	20	7	100	97.8	2.2	968204288	808,079,360	160,124,928	30	21.96	8.04	15.1667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
21	261	27	21	7	100	97.7	2.3	968204288	808,108,032	160,096,256	30	21.93	8.07	15.2333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
22	262	27	22	7	100	97.7	2.3	968204288	808,112,128	160,092,160	30	21.9	8.1	15.2667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
23	263	26.937	23	8	100	98.2	1.8	968204288	808,083,456	160,120,832	30	21.87	8.13	15.1333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
24	264	26.937	24	8	100	98.2	1.8	968204288	808,083,456	160,120,832	30	21.84	8.16	15.1667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
25	265	26.937	25	8	100	97.7	2.3	968204288	808,128,512	160,075,776	30	21.81	8.19	15.3667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
26	266	26.937	27	8	100	97.5	2.5	968204288	808,091,648	160,112,640	30	21.78	8.22	15.4667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
27	267	26.937	28	8	100	97.8	2.2	968204288	808,095,744	160,108,544	30	21.75	8.25	15.4	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
28	268	26.875	29	9	100	96.4	3.6	968204288	808,259,584	159,944,704	30	21.72	8.28	15.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
29	269	26.875	30	9	100	98	2	968204288	808,259,584	159,944,704	30	21.69	8.31	15.4	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
30	270	26.875	31	9	100	99.3	0.7	968204288	808,136,704	160,067,584	30	21.66	8.34	15	MINIMUM	LIGHT	[(27.0, 8), (26.937, 6), (27.	NOT Adaptation	HIGH	0	0	0-
1	271	26.875	1	1	100	49.2	50.8	968204288	802,304,000	165,900,288	30	21.6	8.4	31.9667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0-
2	272	26.812	2	2	100	96.5	3.5	968204288	808,194,048	160,010,240	30	21.57	8.43	16.0333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
3	273	26.812	3	2	100	98.2	1.8	968204288	802,226,176	165,978,112	30	21.54	8.46	15.7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
4	274	26.812	4	2	100	99	1	968204288	803,241,984	164,962,304	30	21.51	8.49	15.4333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
5	275	26.812	5	2	100	97.3	2.7	968204288	802,242,560	165,961,728	30	21.48	8.52	16.0667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
6	276	26.812	6	2	100	98.2	1.8	968204288	802,250,752	165,953,536	30	21.45	8.55	15.8	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
7	277	26.812	7	2	100	98.2	1.8	968204288	802,258,944	165,945,344	30	21.42	8.58	15.8333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
8	278	26.812	8	2	100	98	2	968204288	802,619,392	165,584,896	30	21.39	8.61	15.9333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-
9	279	26.812	9	2	100	98.5	1.5	968204288	805,810,176	162,394,112	30	21.36	8.64	15.7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0-

10	280	26.812	10	2	100	97	3	968204288	802,373,632	165,830,656	30	21.33	8.67	16.3333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
11	281	26.812	11	2	100	96.5	3.5	968204288	802,635,776	165,568,512	30	21.3	8.7	16.5333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
12	282	26.75	12	3	100	98	2	968204288	802,754,560	165,449,728	30	21.27	8.73	16.0667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
13	283	26.75	13	3	100	98.2	1.8	968204288	802,627,584	165,576,704	30	21.24	8.76	16.0333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
14	284	26.75	14	3	100	98.5	1.5	968204288	808,599,552	159,604,736	30	21.21	8.79	15.7667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
15	285	26.75	15	3	100	97	3	968204288	804,671,488	163,532,800	30	21.18	8.82	16.4333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
16	286	26.75	16	3	100	97.8	2.2	968204288	803,901,440	164,302,848	30	21.15	8.85	16.2333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
17	287	26.75	17	3	100	98.5	1.5	968204288	805,171,200	163,033,088	30	21.12	8.88	15.9667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
18	288	26.75	18	3	100	97.5	2.5	968204288	806,830,080	161,374,208	30	21.09	8.91	16.3	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
19	289	26.75	19	3	100	98.2	1.8	968204288	808,599,552	159,604,736	30	21.06	8.94	16.0333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
20	290	26.75	20	3	100	98	2	968204288	805,687,296	162,516,992	30	21.03	8.97	16.2333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
21	291	26.75	21	3	100	97.5	2.5	968204288	807,092,224	161,112,064	30	21	9	16.3667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
22	292	26.75	22	3	100	97.8	2.2	968204288	808,603,648	159,600,640	30	20.97	9.03	16.2667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
23	293	26.75	23	3	100	98.5	1.5	968204288	808,603,648	159,600,640	30	20.94	9.06	16.0667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
24	294	26.75	24	3	100	98.5	1.5	968204288	808,620,032	159,584,256	30	20.91	9.09	16.1	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
25	295	26.75	25	3	100	97.7	2.3	968204288	808,624,128	159,580,160	30	20.88	9.12	16.4	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
26	296	26.75	26	3	100	98.5	1.5	968204288	808,624,128	159,580,160	30	20.85	9.15	16.1667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
27	297	26.75	27	3	100	98	2	968204288	808,591,360	159,612,928	30	20.82	9.18	16.3667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
28	298	26.75	28	3	100	98.3	1.7	968204288	808,562,688	159,641,600	30	20.79	9.21	16.3	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
29	299	26.75	29	3	100	97.8	2.2	968204288	808,591,360	159,612,928	30	20.76	9.24	16.5	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
30	300	26.75	30	3	100	98	2	968204288	808,591,360	159,612,928	30	20.73	9.27	16.4667	MINIMUM	LIGHT	[(26.75, 19)]	NOT Adaptation	HIGH	0	0	O
1	301	26.75	1	1	100	75	25	968204288	808,595,456	159,608,832	30	20.7	9.3	24.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	O
2	302	26.75	2	1	100	98.2	1.8	968204288	808,574,976	159,629,312	30	20.67	9.33	16.4667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
3	303	26.75	3	1	100	97.8	2.2	968204288	808,562,688	159,641,600	30	20.61	9.39	16.6667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
4	304	26.75	4	1	100	98.5	1.5	968204288	808,542,208	159,662,080	30	20.58	9.42	16.4667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
5	305	26.687	5	2	100	97.8	2.2	968204288	808,574,976	159,629,312	30	20.55	9.45	16.7333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
6	306	26.687	6	2	100	97.8	2.2	968204288	808,574,976	159,629,312	30	20.52	9.48	16.7667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
7	307	26.687	7	2	100	98.2	1.8	968204288	808,554,496	159,649,792	30	20.49	9.51	16.6667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
8	308	26.687	8	2	100	98.2	1.8	968204288	808,574,976	159,629,312	30	20.46	9.54	16.7	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
9	309	26.687	9	2	100	97.3	2.7	968204288	808,554,496	159,649,792	30	20.43	9.57	17.0333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
10	310	26.687	10	2	100	98.2	1.8	968204288	808,562,688	159,641,600	30	20.4	9.6	16.7667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
11	311	26.687	11	2	100	98	2	968204288	808,583,168	159,621,120	30	20.37	9.63	16.8667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
12	312	26.687	12	2	100	98	2	968204288	808,591,360	159,612,928	30	20.34	9.66	16.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
13	313	26.687	13	2	100	98.2	1.8	968204288	808,570,880	159,633,408	30	20.31	9.69	16.8667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
14	314	26.687	14	2	100	97.5	2.5	968204288	808,591,360	159,612,928	30	20.28	9.72	17.1333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
15	315	26.687	15	2	100	98.2	1.8	968204288	808,595,456	159,608,832	30	20.25	9.75	16.9333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
16	316	26.687	16	2	100	98.2	1.8	968204288	808,566,784	159,637,504	30	20.22	9.78	16.9667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
17	317	26.687	17	2	100	98.2	1.8	968204288	808,574,976	159,629,312	30	20.19	9.81	17	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
18	318	26.687	18	2	100	97.7	2.3	968204288	808,554,496	159,649,792	30	20.16	9.84	17.2	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
19	319	26.687	19	2	100	98	2	968204288	808,525,824	159,678,464	30	20.13	9.87	17.1333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
20	320	26.687	20	2	100	98	2	968204288	808,562,688	159,641,600	30	20.1	9.9	17.1667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
21	321	26.687	21	2	100	97.5	2.5	968204288	808,534,016	159,670,272	30	20.07	9.93	17.3667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
22	322	26.687	22	2	100	97.7	2.3	968204288	808,538,112	159,666,176	30	20.04	9.96	17.3333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
23	323	26.687	23	2	100	97.7	2.3	968204288	808,574,976	159,629,312	30	20.01	9.99	17.3667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
24	324	26.687	24	2	100	98.2	1.8	968204288	808,435,712	159,768,576	30	19.98	10.02	17.2333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
25	325	26.687	25	2	100	97.5	2.5	968204288	808,456,192	159,748,096	30	19.95	10.05	17.5	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
26	326	26.687	26	2	100	98	2	968204288	808,443,904	159,760,384	30	19.92	10.08	17.3667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
27	327	26.625	28	3	100	97.8	2.2	968204288	808,456,192	159,748,096	30	19.89	10.11	17.4667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
28	328	26.625	29	3	100	98	2	968204288	808,448,000	159,756,288	30	19.86	10.14	17.4333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
29	329	26.625	30	3	100	98	2	968204288	808,427,520	159,776,768	30	19.83	10.17	17.4667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
30	330	26.625	31	3	100	97.8	2.2	968204288	808,456,192	159,748,096	30	19.8	10.2	17.5667	MINIMUM	LIGHT	[(26.687, 23)]	NOT Adaptation	HIGH	0	0	O
1	331	26.625	1	1	100	79.3	20.7	968204288	808,611,840	159,592,448	30	19.77	10.23	23.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	O
2	332	26.625	2	1	100	98.5	1.5	968204288	808,611,840	159,592,448	30	19.74	10.26	17.4	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
3	333	26.625	3	1	100	98.7	1.3	968204288	808,591,360	159,612,928	30	19.71	10.29	17.3667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
4	334	26.625	4	1	100	97.5	2.5	968204288	808,591,360	159,612,928	30	19.68	10.32	17.8	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O
5	335	26.625	5	1	100	98	2	968204288	808,628,224	159,576,064	30	19.65	10.35	17.6667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	O

6	336	26.625	6	1	100	98.2	1.8	968204288	808,620,032	159,584,256	30	19.62	10.38	17.6333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
7	337	26.625	7	1	100	98.2	1.8	968204288	808,620,032	159,584,256	30	19.59	10.41	17.6667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
8	338	26.625	8	1	100	98	2	968204288	808,620,032	159,584,256	30	19.56	10.44	17.7667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
9	339	26.625	9	1	100	97.7	2.3	968204288	808,501,248	159,703,040	30	19.53	10.47	17.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
10	340	26.625	10	1	100	98	2	968204288	808,472,576	159,731,712	30	19.5	10.5	17.8333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
11	341	26.625	11	1	100	98.2	1.8	968204288	808,509,440	159,694,848	30	19.47	10.53	17.8	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
12	342	26.625	12	1	100	98	2	968204288	808,509,440	159,694,848	30	19.44	10.56	17.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
13	343	26.625	13	1	100	97.8	2.2	968204288	808,509,440	159,694,848	30	19.41	10.59	18	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
14	344	26.625	14	1	100	97.7	2.3	968204288	808,525,824	159,678,464	30	19.38	10.62	18.0667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
15	345	26.625	15	1	100	98.5	1.5	968204288	808,456,192	159,748,096	30	19.35	10.65	17.8333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
16	346	26.625	16	1	100	98.2	1.8	968204288	808,001,536	160,202,752	30	19.32	10.68	17.9667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
17	347	26.625	17	1	100	98	2	968204288	808,001,536	160,202,752	30	19.29	10.71	18.0667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
18	348	26.625	18	1	100	98	2	968204288	807,964,672	160,239,616	30	19.26	10.74	18.1333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
19	349	26.625	19	1	100	98.2	1.8	968204288	807,944,192	160,260,096	30	19.23	10.77	18.1	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
20	350	26.625	20	1	100	98	2	968204288	808,001,536	160,202,752	30	19.2	10.8	18.1667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
21	351	26.625	21	1	100	98	2	968204288	808,001,536	160,202,752	30	19.17	10.83	18.2	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
22	352	26.625	22	1	100	97.7	2.3	968204288	808,001,536	160,202,752	30	19.14	10.86	18.3333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
23	353	26.625	23	1	100	98.2	1.8	968204288	807,972,864	160,231,424	30	19.11	10.89	18.2	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
24	354	26.687	24	2	100	98.3	1.7	968204288	808,001,536	160,202,752	30	19.08	10.92	18.2	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
25	355	26.687	25	2	100	98	2	968204288	807,981,056	160,223,232	30	19.05	10.95	18.3333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
26	356	26.625	26	2	100	97.8	2.2	968204288	808,001,536	160,202,752	30	19.02	10.98	18.4333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
27	357	26.625	27	2	100	97.8	2.2	968204288	807,813,120	160,391,168	30	18.99	11.01	18.5	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
28	358	26.625	28	2	100	98.5	1.5	968204288	807,784,448	160,419,840	30	18.96	11.04	18.3	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
29	359	26.625	29	2	100	97.8	2.2	968204288	807,895,040	160,309,248	30	18.93	11.07	18.5667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
30	360	26.562	30	3	100	98.2	1.8	968204288	807,895,040	160,309,248	30	18.9	11.1	18.4667	MINIMUM	LIGHT	[(26.625, 27)]	NOT Adaptation	HIGH	0	0	0
1	361	26.562	1	1	100	67.6	32.4	968204288	807,907,328	160,296,960	30	18.84	11.16	28.7333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0
2	362	26.562	2	1	100	99.5	0.5	968204288	807,907,328	160,296,960	30	18.81	11.19	18.1333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
3	363	26.562	3	1	100	95.5	4.5	968204288	807,964,672	160,239,616	30	18.78	11.22	19.5	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
4	364	26.562	4	1	100	98	2	968204288	807,976,960	160,227,328	30	18.75	11.25	18.6667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
5	365	26.562	5	1	100	98.2	1.8	968204288	807,968,768	160,235,520	30	18.72	11.28	18.6333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
6	366	26.562	6	1	100	98.2	1.8	968204288	807,968,768	160,235,520	30	18.69	11.31	18.6667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
7	367	26.562	7	1	100	98	2	968204288	807,976,960	160,227,328	30	18.66	11.34	18.7667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
8	368	26.562	8	1	100	98	2	968204288	807,940,096	160,264,192	30	18.63	11.37	18.8333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
9	369	26.562	9	1	100	98.3	1.7	968204288	807,940,096	160,264,192	30	18.6	11.4	18.7667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
10	370	26.562	10	1	100	97.8	2.2	968204288	807,972,864	160,231,424	30	18.57	11.43	18.9333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
11	371	26.562	11	1	100	98	2	968204288	807,972,864	160,231,424	30	18.54	11.46	18.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
12	372	26.562	12	1	100	98	2	968204288	807,981,056	160,223,232	30	18.51	11.49	18.9333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
13	373	26.562	13	1	100	98.5	1.5	968204288	807,981,056	160,223,232	30	18.48	11.52	18.8	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
14	374	26.562	14	1	100	98	2	968204288	807,952,384	160,251,904	30	18.45	11.55	19.0333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
15	375	26.562	15	1	100	98	2	968204288	807,981,056	160,223,232	30	18.42	11.58	19.0333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
16	376	26.562	16	1	100	98.5	1.5	968204288	807,981,056	160,223,232	30	18.39	11.61	18.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
17	377	26.562	17	1	100	98	2	968204288	807,960,576	160,243,712	30	18.36	11.64	19.1333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
18	378	26.562	18	1	100	98	2	968204288	807,981,056	160,223,232	30	18.33	11.67	19.1333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
19	379	26.562	19	1	100	98	2	968204288	807,927,808	160,276,480	30	18.3	11.7	19.2	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
20	380	26.562	20	1	100	98	2	968204288	807,936,000	160,268,288	30	18.27	11.73	19.2333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
21	381	26.562	21	1	100	97.5	2.5	968204288	807,948,288	160,256,000	30	18.24	11.76	19.4333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
22	382	26.625	22	2	100	98	2	968204288	807,956,480	160,247,808	30	18.21	11.79	19.3	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
23	383	26.562	23	2	100	98	2	968204288	807,919,616	160,284,672	30	18.18	11.82	19.3333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
24	384	26.562	24	2	100	98	2	968204288	801,988,608	166,215,680	30	18.15	11.85	19.5667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
25	385	26.562	25	2	100	98.3	1.7	968204288	801,996,800	166,207,488	30	18.12	11.88	19.5	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
26	386	26.562	26	2	100	98.2	1.8	968204288	801,980,416	166,223,872	30	18.09	11.91	19.5667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
27	387	26.562	27	2	100	97.5	2.5	968204288	802,488,320	165,715,968	30	18.06	11.94	19.8	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
28	388	26.562	28	2	100	98	2	968204288	802,496,512	165,707,776	30	18.03	11.97	19.6667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
29	389	26.562	29	2	100	98.5	1.5	968204288	802,504,704	165,699,584	30	18	12	19.5333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0
30	390	26.562	30	2	100	98.5	1.5	968204288	804,900,864	163,303,424	30	17.97	12.03	19.5	MINIMUM	LIGHT	[(26.562, 29)]	NOT Adaptation	HIGH	0	0	0
1	391	26.562	1	1	100	63.1	36.9	968204288	808,398,848	159,805,440	30	17.94	12.06	31.2	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0

2	392	26.562	2	1	100	98.7	1.3	968204288	808,341,504	159,862,784	30	17.91	12.09	19.3667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0=
3	393	26.562	3	1	100	97.5	2.5	968204288	808,378,368	159,825,920	30	17.88	12.12	19.8	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0=
4	394	26.562	4	1	100	98.2	1.8	968204288	808,386,560	159,817,728	30	17.85	12.15	19.6	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0=
5	395	26.562	5	1	100	98.2	1.8	968204288	808,366,080	159,838,208	30	17.82	12.18	19.6333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0=
6	396	26.562	6	1	100	98	2	968204288	808,386,560	159,817,728	30	17.79	12.21	19.7333	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0=
7	397	26.562	7	1	100	97.7	2.3	968204288	808,357,888	159,846,400	30	17.76	12.24	19.8667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0=
8	398	26.562	8	1	100	97	3	968204288	808,357,888	159,846,400	30	17.73	12.27	20.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
9	399	26.562	9	1	100	98.2	1.8	968204288	808,345,600	159,858,688	30	17.7	12.3	19.7667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0=
10	400	26.562	10	1	100	97.7	2.3	968204288	808,353,792	159,850,496	30	17.67	12.33	19.9667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0=
11	401	26.5	11	2	100	98	2	968204288	808,333,312	159,870,976	30	17.64	12.36	19.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0=
12	402	26.5	12	2	100	98.2	1.8	968204288	808,353,792	159,850,496	30	17.61	12.39	19.8667	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0=
13	403	26.5	13	2	100	98.2	1.8	968204288	808,329,216	159,875,072	30	17.58	12.42	19.9	MINIMUM	LIGHT	-	NOT Adaptation	HIGH	0	0	0=
14	404	26.5	14	2	100	97.8	2.2	968204288	808,329,216	159,875,072	30	17.55	12.45	20.0667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
15	405	26.5	15	2	100	98	2	968204288	807,849,984	160,354,304	30	17.49	12.51	20.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
16	406	26.5	16	2	100	98.2	1.8	968204288	807,849,984	160,354,304	30	17.46	12.54	20.0667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
17	407	26.5	17	2	100	98	2	968204288	808,357,888	159,846,400	30	17.43	12.57	20.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
18	408	26.5	18	2	100	98.2	1.8	968204288	808,357,888	159,846,400	30	17.4	12.6	20.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
19	409	26.5	19	2	100	98	2	968204288	808,337,408	159,866,880	30	17.37	12.63	20.2	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
20	410	26.5	20	2	100	98	2	968204288	808,345,600	159,858,688	30	17.34	12.66	20.2333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
21	411	26.5	21	2	100	98	2	968204288	808,361,984	159,842,304	30	17.31	12.69	20.2667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
22	412	26.5	22	2	100	98	2	968204288	808,341,504	159,862,784	30	17.28	12.72	20.3	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
23	413	26.5	23	2	100	98.3	1.7	968204288	808,349,696	159,854,592	30	17.25	12.75	20.2333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
24	414	26.5	24	2	100	98	2	968204288	808,374,272	159,830,016	30	17.22	12.78	20.3667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
25	415	26.5	25	2	100	97.8	2.2	968204288	808,001,536	160,202,752	30	17.19	12.81	20.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
26	416	26.5	26	2	100	98.5	1.5	968204288	807,964,672	160,239,616	30	17.16	12.84	20.3	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
27	417	26.5	27	2	100	98.2	1.8	968204288	807,964,672	160,239,616	30	17.13	12.87	20.4333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
28	418	26.5	28	2	100	97.5	2.5	968204288	807,993,344	160,210,944	30	17.1	12.9	20.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
29	419	26.5	29	2	100	98	2	968204288	808,005,632	160,198,656	30	17.07	12.93	20.5333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
30	420	26.5	30	2	100	98.2	1.8	968204288	808,005,632	160,198,656	30	17.04	12.96	20.5	MINIMUM	LIGHT	[(26.5, 20)]	NOT Adaptation	MEDIUM	0	0	0=
1	421	26.5	1	1	100	88.6	11.4	968204288	808,058,880	160,145,408	30	17.01	12.99	23.7333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
2	422	26.5	2	1	100	98.7	1.3	968204288	808,067,072	160,137,216	30	16.98	13.02	20.4	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
3	423	26.5	3	1	100	97.3	2.7	968204288	808,005,632	160,198,656	30	16.95	13.05	20.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
4	424	26.5	4	1	100	98.2	1.8	968204288	808,034,304	160,169,984	30	16.92	13.08	20.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
5	425	26.5	5	1	100	98.2	1.8	968204288	808,034,304	160,169,984	30	16.89	13.11	20.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
6	426	26.5	6	1	100	98	2	968204288	808,034,304	160,169,984	30	16.86	13.14	20.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
7	427	26.5	7	1	100	98.2	1.8	968204288	808,013,824	160,190,464	30	16.83	13.17	20.7333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
8	428	26.5	8	1	100	98.2	1.8	968204288	808,067,072	160,137,216	30	16.8	13.2	20.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
9	429	26.5	9	1	100	98.2	1.8	968204288	808,038,400	160,165,888	30	16.77	13.23	20.8	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
10	430	26.5	10	1	100	97	3	968204288	808,075,264	160,129,024	30	16.74	13.26	21.2333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
11	431	26.5	11	1	100	98.2	1.8	968204288	808,046,592	160,157,696	30	16.71	13.29	20.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
12	432	26.5	12	1	100	98.2	1.8	968204288	808,083,456	160,120,832	30	16.68	13.32	20.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
13	433	26.5	13	1	100	98	2	968204288	808,075,264	160,129,024	30	16.65	13.35	21	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
14	434	26.5	14	1	100	98	2	968204288	808,042,496	160,161,792	30	16.62	13.38	21.0333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
15	435	26.5	15	1	100	98.2	1.8	968204288	808,042,496	160,161,792	30	16.59	13.41	21	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
16	436	26.5	16	1	100	98.5	1.5	968204288	808,050,688	160,153,600	30	16.56	13.44	20.9333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
17	437	26.5	17	1	100	98	2	968204288	808,022,016	160,182,272	30	16.53	13.47	21.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	0	0	0=
18	438	26.437	18	2	100	98	2	968204288	808,050,688	160,153,600	30	16.5	13.5	21.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1	0	0=
19	439	26.437	19	2	100	97.3	2.7	968204288	808,058,880	160,145,408	30	16.47	13.53	21.4333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.002	0	0=
20	440	26.437	20	2	100	98	2	968204288	807,919,616	160,284,672	30	16.44	13.56	21.2667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.005	0	0=
21	441	26.437	21	2	100	97.5	2.5	968204288	807,931,904	160,272,384	30	16.41	13.59	21.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.008	0	0=
22	442	26.437	22	2	100	98.2	1.8	968204288	807,903,232	160,301,056	30	16.38	13.62	21.2667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.01	0	0=
23	443	26.437	23	2	100	98.2	1.8	968204288	807,911,424	160,292,864	30	16.35	13.65	21.3	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.013	0	0=
24	444	26.437	24	2	100	97.8	2.2	968204288	807,919,616	160,284,672	30	16.32	13.68	21.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.016	0	0=
25	445	26.437	25	2	100	98.2	1.8	968204288	807,936,000	160,268,288	30	16.29	13.71	21.3667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.019	0	0=
26	446	26.375	26	3	100	97.8	2.2	968204288	807,907,328	160,296,960	30	16.26	13.74	21.5333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.021	0	0=
27	447	26.375	27	3	100	97.8	2.2	968204288	807,944,192	160,260,096	30	16.23	13.77	21.5667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.024	0	0=

28	448	26.437	28	3	100	98	2	968204288	807,907,328	160,296,960	30	16.2	13.8	21.5333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.027	0	0-
29	449	26.437	29	3	100	98	2	968204288	807,936,000	160,268,288	30	16.17	13.83	21.5667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.03	0	0-
30	450	26.375	30	3	100	97.5	2.5	968204288	807,944,192	160,260,096	30	16.14	13.86	21.7667	MINIMUM	LIGHT	[(26.5, 17)]	NOT Adaptation	MEDIUM	1.032	0	0-
1	451	26.375	1	1	100	85.1	14.9	968204288	807,968,768	160,235,520	30	16.11	13.89	25.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.035	0	0-
2	452	26.375	2	1	100	98.5	1.5	968204288	807,960,576	160,243,712	30	16.08	13.92	21.5	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.038	0	0-
3	453	26.437	3	2	100	97.8	2.2	968204288	807,960,576	160,243,712	30	16.05	13.95	21.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.04	0	0-
4	454	26.437	4	2	100	98	2	968204288	807,960,576	160,243,712	30	16.02	13.98	21.7333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.043	0	0-
5	455	26.437	5	2	100	98	2	968204288	807,931,904	160,272,384	30	15.99	14.01	21.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.046	0	0-
6	456	26.437	6	2	100	98	2	968204288	808,452,096	159,752,192	30	15.96	14.04	21.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.049	0	0-
7	457	26.437	7	2	100	97	3	968204288	808,460,288	159,744,000	30	15.93	14.07	22.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.051	0	0-
8	458	26.437	8	2	100	97.8	2.2	968204288	808,435,712	159,768,576	30	15.9	14.1	21.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.054	0	0-
9	459	26.437	9	2	100	97.7	2.3	968204288	808,435,712	159,768,576	30	15.87	14.13	21.9667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.057	0	0-
10	460	26.437	10	2	100	98	2	968204288	808,341,504	159,862,784	30	15.84	14.16	21.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.06	0	0-
11	461	26.437	11	2	100	97.7	2.3	968204288	808,345,600	159,858,688	30	15.81	14.19	22.0333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.062	0	0-
12	462	26.437	12	2	100	98.5	1.5	968204288	808,316,928	159,887,360	30	15.78	14.22	21.8	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.065	0	0-
13	463	26.437	13	2	100	97.7	2.3	968204288	808,325,120	159,879,168	30	15.75	14.25	22.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.068	0	0-
14	464	26.437	14	2	100	98.2	1.8	968204288	808,349,696	159,854,592	30	15.72	14.28	21.9667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.07	0	0-
15	465	26.437	15	2	100	98	2	968204288	808,349,696	159,854,592	30	15.69	14.31	22.0667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.073	0	0-
16	466	26.437	16	2	100	97.5	2.5	968204288	808,329,216	159,875,072	30	15.66	14.34	22.2667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.076	0	0-
17	467	26.437	17	2	100	98	2	968204288	808,357,888	159,846,400	30	15.63	14.37	22.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.079	0	0-
18	468	26.375	18	2	100	98.5	1.5	968204288	808,353,792	159,850,496	30	15.6	14.4	22	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.081	0	0-
19	469	26.375	19	2	100	98.2	1.8	968204288	808,366,080	159,838,208	30	15.57	14.43	22.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.084	0	0-
20	470	26.375	20	2	100	98	2	968204288	808,357,888	159,846,400	30	15.54	14.46	22.2333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.087	0	0-
21	471	26.375	21	2	100	97.3	2.7	968204288	807,821,312	160,382,976	30	15.51	14.49	22.5333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.09	0	0-
22	472	26.375	22	2	100	97.5	2.5	968204288	807,854,080	160,350,208	30	15.48	14.52	22.5	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.092	0	0-
23	473	26.375	23	2	100	98.2	1.8	968204288	807,854,080	160,350,208	30	15.45	14.55	22.3	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.095	0	0-
24	474	26.375	24	2	100	98.2	1.8	968204288	807,825,408	160,378,880	30	15.42	14.58	22.3333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.098	0	0-
25	475	26.375	25	2	100	98.2	1.8	968204288	807,825,408	160,378,880	30	15.39	14.61	22.3667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.1	0	0-
26	476	26.375	26	2	100	98	2	968204288	807,866,368	160,337,920	30	15.36	14.64	22.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.103	0	0-
27	477	26.375	27	2	100	98	2	968204288	807,837,696	160,366,592	30	15.33	14.67	22.5	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.106	0	0-
28	478	26.375	28	2	100	98	2	968204288	807,858,176	160,346,112	30	15.3	14.7	22.5333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.109	0	0-
29	479	26.375	29	2	100	98.2	1.8	968204288	807,862,272	160,342,016	30	15.27	14.73	22.5	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.111	0	0-
30	480	26.375	30	2	100	97.8	2.2	968204288	807,841,792	160,362,496	30	15.24	14.76	22.6667	MINIMUM	LIGHT	[(26.375, 15)]	NOT Adaptation	MEDIUM	1.114	0	0-
1	481	26.375	1	1	100	83.1	16.9	968204288	807,878,656	160,325,632	30	15.18	14.82	27.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.12	0	0-
2	482	26.375	2	1	100	98.2	1.8	968204288	807,878,656	160,325,632	30	15.15	14.85	22.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.122	0	0-
3	483	26.375	3	1	100	97.8	2.2	968204288	807,866,368	160,337,920	30	15.12	14.88	22.8	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.125	0	0-
4	484	26.375	4	1	100	98.2	1.8	968204288	807,890,944	160,313,344	30	15.09	14.91	22.7	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.128	0	0-
5	485	26.375	6	1	100	98.2	1.8	968204288	807,890,944	160,313,344	30	15.06	14.94	22.7333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.13	0	0-
6	486	26.375	7	1	100	98	2	968204288	807,837,696	160,366,592	30	15.03	14.97	22.8333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.133	0	0-
7	487	26.375	8	1	100	98	2	968204288	807,845,888	160,358,400	30	15	15	22.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.136	0	0-
8	488	26.375	9	1	100	97.7	2.3	968204288	807,858,176	160,346,112	30	14.97	15.03	23	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.139	0	0-
9	489	26.375	10	1	100	98	2	968204288	807,862,272	160,342,016	30	14.94	15.06	22.9333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.141	0	0-
10	490	26.375	11	1	100	98.2	1.8	968204288	807,862,272	160,342,016	30	14.91	15.09	22.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.144	0	0-
11	491	26.375	12	1	100	98	2	968204288	807,862,272	160,342,016	30	14.88	15.12	23	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.147	0	0-
12	492	26.375	13	1	100	98	2	968204288	807,841,792	160,362,496	30	14.85	15.15	23.0333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.15	0	0-
13	493	26.375	14	1	100	97.7	2.3	968204288	807,849,984	160,354,304	30	14.82	15.18	23.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.152	0	0-
14	494	26.375	15	1	100	98	2	968204288	807,878,656	160,325,632	30	14.79	15.21	23.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.155	0	0-
15	495	26.375	16	1	100	98	2	968204288	807,878,656	160,325,632	30	14.76	15.24	23.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.158	0	0-
16	496	26.375	17	1	100	98.5	1.5	968204288	807,849,984	160,354,304	30	14.73	15.27	23	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.16	0	0-
17	497	26.375	18	1	100	98	2	968204288	807,878,656	160,325,632	30	14.7	15.3	23.2	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.163	0	0-
18	498	26.375	19	1	100	98	2	968204288	807,878,656	160,325,632	30	14.67	15.33	23.2333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.166	0	0-
19	499	26.375	20	1	100	98.2	1.8	968204288	807,907,328	160,296,960	30	14.64	15.36	23.2	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.169	0	0-
20	500	26.375	21	1	100	98	2	968204288	807,915,520	160,288,768	30	14.61	15.39	23.3	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.171	0	0-
21	501	26.375	22	1	100	99	1	968204288	807,915,520	160,288,768	30	14.58	15.42	23	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.174	0	0-
22	502	26.375	23	1	100	97.2	2.8	968204288	807,915,520	160,288,768	30	14.55	15.45	23.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.177	0	0-
23	503	26.375	24	1	100	98.2	1.8	968204288	807,886,848	160,317,440	30	14.52	15.48	23.3333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.18	0	0-

24	504	26.375	25	1	100	98	2	968204288	807,915,520	160,288,768	30	14.49	15.51	23.4333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.182	0	0
25	505	26.375	26	1	100	98	2	968204288	807,915,520	160,288,768	30	14.46	15.54	23.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.185	0	0
26	506	26.375	27	1	100	98	2	968204288	807,886,848	160,317,440	30	14.43	15.57	23.5	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.188	0	0
27	507	26.375	28	1	100	98.2	1.8	968204288	807,886,848	160,317,440	30	14.4	15.6	23.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.19	0	0
28	508	26.375	29	1	100	98.5	1.5	968204288	807,923,712	160,280,576	30	14.37	15.63	23.4	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.193	0	0
29	509	26.375	30	1	100	98.2	1.8	968204288	807,931,904	160,272,384	30	14.34	15.66	23.5333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.196	0	0
30	510	26.375	31	1	100	98.2	1.8	968204288	807,911,424	160,292,864	30	14.31	15.69	23.5667	MINIMUM	LIGHT	[(26.375, 31)]	NOT Adaptation	MEDIUM	1.199	0	0
1	511	26.375	1	1	100	90.7	9.3	968204288	807,936,000	160,268,288	30	14.28	15.72	26.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.201	0	0
2	512	26.375	2	1	100	98.5	1.5	968204288	807,915,520	160,288,768	30	14.25	15.75	23.5333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.204	0	0
3	513	26.375	3	1	100	98.5	1.5	968204288	807,936,000	160,268,288	30	14.22	15.78	23.5667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.207	0	0
4	514	26.375	4	1	100	98	2	968204288	807,936,000	160,268,288	30	14.19	15.81	23.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.21	0	0
5	515	26.375	5	1	100	98	2	968204288	807,776,256	160,428,032	30	14.16	15.84	23.8	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.212	0	0
6	516	26.375	6	1	100	97.7	2.3	968204288	807,776,256	160,428,032	30	14.13	15.87	23.9333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.215	0	0
7	517	26.375	7	1	100	98	2	968204288	807,768,064	160,436,224	30	14.1	15.9	23.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.218	0	0
8	518	26.375	8	1	100	98	2	968204288	807,776,256	160,428,032	30	14.07	15.93	23.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.22	0	0
9	519	26.375	9	1	100	98.2	1.8	968204288	807,784,448	160,419,840	30	14.04	15.96	23.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.223	0	0
10	520	26.375	10	1	100	98.2	1.8	968204288	807,776,256	160,428,032	30	14.01	15.99	23.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.226	0	0
11	521	26.375	11	1	100	98	2	968204288	807,776,256	160,428,032	30	13.98	16.02	24	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.229	0	0
12	522	26.375	12	1	100	97.8	2.2	968204288	807,776,256	160,428,032	30	13.95	16.05	24.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.231	0	0
13	523	26.375	13	1	100	97.8	2.2	968204288	807,776,256	160,428,032	30	13.92	16.08	24.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.234	0	0
14	524	26.375	14	1	100	98.2	1.8	968204288	807,784,448	160,419,840	30	13.89	16.11	24.0333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.237	0	0
15	525	26.375	15	1	100	98	2	968204288	807,747,584	160,456,704	30	13.86	16.14	24.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.24	0	0
16	526	26.437	16	2	100	98	2	968204288	807,776,256	160,428,032	30	13.83	16.17	24.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.242	0	0
17	527	26.437	17	2	100	97.7	2.3	968204288	807,776,256	160,428,032	30	13.8	16.2	24.3	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.245	0	0
18	528	26.437	18	2	100	98.2	1.8	968204288	807,776,256	160,428,032	30	13.77	16.23	24.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.248	0	0
19	529	26.437	19	2	100	98	2	968204288	807,743,488	160,460,800	30	13.74	16.26	24.2667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.25	0	0
20	530	26.437	20	2	100	97.8	2.2	968204288	807,743,488	160,460,800	30	13.71	16.29	24.3667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.253	0	0
21	531	26.437	21	2	100	97.7	2.3	968204288	807,796,736	160,407,552	30	13.68	16.32	24.4333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.256	0	0
22	532	26.437	22	2	100	98	2	968204288	807,768,064	160,436,224	30	13.65	16.35	24.3667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.259	0	0
23	533	26.437	23	2	100	98.2	1.8	968204288	807,804,928	160,399,360	30	13.62	16.38	24.3333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.261	0	0
24	534	26.437	24	2	100	98.2	1.8	968204288	807,796,736	160,407,552	30	13.59	16.41	24.3667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.264	0	0
25	535	26.437	25	2	100	97.5	2.5	968204288	807,796,736	160,407,552	30	13.56	16.44	24.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.267	0	0
26	536	26.437	26	2	100	98	2	968204288	807,804,928	160,399,360	30	13.53	16.47	24.5	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.27	0	0
27	537	26.437	28	2	100	99.7	0.3	968204288	807,804,928	160,399,360	30	13.47	16.53	24	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.275	0	0
28	538	26.437	29	2	100	98	2	968204288	807,686,144	160,518,144	30	13.44	16.56	24.6	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.278	0	0
29	539	26.437	30	2	100	98	2	968204288	807,649,280	160,555,008	30	13.41	16.59	24.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.28	0	0
30	540	26.437	31	2	100	97.7	2.3	968204288	807,821,312	160,382,976	30	13.38	16.62	24.7667	MINIMUM	LIGHT	[(26.437, 16)]	NOT Adaptation	MEDIUM	1.283	0	0
1	541	26.437	1	1	100	69.8	30.2	968204288	808,288,256	159,916,032	30	13.32	16.68	34.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.289	0	0
2	542	26.437	2	1	100	98.5	1.5	968204288	808,472,576	159,731,712	30	13.29	16.71	24.5667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.291	0	0
3	543	26.437	3	1	100	98	2	968204288	808,480,768	159,723,520	30	13.26	16.74	24.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.294	0	0
4	544	26.437	4	1	100	98.2	1.8	968204288	808,488,960	159,715,328	30	13.23	16.77	24.7333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.297	0	0
5	545	26.437	5	1	100	98.2	1.8	968204288	808,497,152	159,707,136	30	13.2	16.8	24.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.3	0	0
6	546	26.437	6	1	100	98	2	968204288	808,517,632	159,686,656	30	13.17	16.83	24.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.302	0	0
7	547	26.5	7	2	100	98	2	968204288	808,521,728	159,682,560	30	13.14	16.86	24.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.305	0	0
8	548	26.5	8	2	100	98	2	968204288	808,468,480	159,735,808	30	13.11	16.89	24.9333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.308	0	0
9	549	26.5	9	2	100	98.2	1.8	968204288	808,525,824	159,678,464	30	13.08	16.92	24.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.31	0	0
10	550	26.5	10	2	100	97.8	2.2	968204288	808,534,016	159,670,272	30	13.05	16.95	25.0667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.313	0	0
11	551	26.5	11	2	100	97.7	2.3	968204288	808,525,824	159,678,464	30	13.02	16.98	25.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.316	0	0
12	552	26.5	12	2	100	98.2	1.8	968204288	808,525,824	159,678,464	30	12.99	17.01	25	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.319	0	0
13	553	26.437	13	2	100	98	2	968204288	808,525,824	159,678,464	30	12.96	17.04	25.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.321	0	0
14	554	26.437	14	2	100	98	2	968204288	808,525,824	159,678,464	30	12.93	17.07	25.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.324	0	0
15	555	26.437	15	2	100	98	2	968204288	808,525,824	159,678,464	30	12.9	17.1	25.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.327	0	0
16	556	26.437	16	2	100	98.5	1.5	968204288	808,493,056	159,711,232	30	12.87	17.13	25.0333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.33	0	0
17	557	26.437	17	2	100	97.7	2.3	968204288	808,493,056	159,711,232	30	12.84	17.16	25.3333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.332	0	0
18	558	26.437	18	2	100	98.5	1.5	968204288	808,472,576	159,731,712	30	12.81	17.19	25.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.335	0	0
19	559	26.437	19	2	100	97.7	2.3	968204288	808,493,056	159,711,232	30	12.78	17.22	25.4	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.338	0	0

20	560	26.5	20	2	100	98.2	1.8	968204288	808,472,576	159,731,712	30	12.75	17.25	25.2667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.34	0	0
21	561	26.5	21	2	100	98	2	968204288	808,480,768	159,723,520	30	12.72	17.28	25.3667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.343	0	0
22	562	26.437	22	2	100	98.2	1.8	968204288	808,501,248	159,703,040	30	12.69	17.31	25.3333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.346	0	0
23	563	26.437	23	2	100	98	2	968204288	808,353,792	159,850,496	30	12.66	17.34	25.4333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.349	0	0
24	564	26.437	24	2	100	98.2	1.8	968204288	808.378.368	159.825.920	30	12.63	17.37	25.4	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.351	0	0
25	565	26.437	25	2	100	98	2	968204288	808,378,368	159,825,920	30	12.6	17.4	25.5	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.354	0	0
26	566	26.375	26	3	100	98.2	1.8	968204288	808,357,888	159,846,400	30	12.57	17.43	25.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.357	0	0
27	567	26.375	27	3	100	97.7	2.3	968204288	808,378,368	159,825,920	30	12.54	17.46	25.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.36	0	0
28	568	26.437	28	3	100	100	0	968204288	808,415,232	159,789,056	30	12.51	17.49	24.9333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.362	0	0
29	569	26.437	29	3	100	98	2	968204288	808.255.488	159.948.800	30	12.48	17.52	25.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.365	0	0
30	570	26.375	30	3	100	98.2	1.8	968204288	808,271,872	159,932,416	30	12.45	17.55	25.6	MINIMUM	LIGHT	[(26.437, 19)]	NOT Adaptation	MEDIUM	1.368	0	0
1	571	26.375	1	1	100	86.7	13.3	968204288	808,312,832	159,891,456	30	12.42	17.58	29.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.37	0	0
2	572	26.437	2	2	100	98	2	968204288	808,284,160	159,920,128	30	12.39	17.61	25.7333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.373	0	0
3	573	26.437	3	2	100	97.7	2.3	968204288	808,181,760	160,022,528	30	12.36	17.64	25.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.376	0	0
4	574	26.437	4	2	100	97.3	2.7	968204288	808.165.376	160.038.912	30	12.33	17.67	26.0333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.379	0	0
5	575	26.437	5	2	100	98.2	1.8	968204288	808,173,568	160,030,720	30	12.3	17.7	25.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.381	0	0
6	576	26.437	6	2	100	98.5	1.5	968204288	808,181,760	160,022,528	30	12.27	17.73	25.7	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.384	0	0
7	577	26.437	7	2	100	98	2	968204288	808,181,760	160,022,528	30	12.24	17.76	25.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.387	0	0
8	578	26.437	8	2	100	98.5	1.5	968204288	808.153.088	160.051.200	30	12.21	17.79	25.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.39	0	0
9	579	26.437	9	2	100	97.5	2.5	968204288	808.181.760	160.022.528	30	12.18	17.82	26.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.392	0	0
10	580	26.437	10	2	100	98	2	968204288	808,194,048	160,010,240	30	12.15	17.85	26	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.395	0	0
11	581	26.437	11	2	100	98	2	968204288	808,198,144	160,006,144	30	12.12	17.88	26.0333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.398	0	0
12	582	26.375	12	2	100	98.2	1.8	968204288	808,198,144	160,006,144	30	12.09	17.91	26	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.4	0	0
13	583	26.437	13	2	100	97.5	2.5	968204288	808.198.144	160.006.144	30	12.06	17.94	26.2667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.403	0	0
14	584	26.437	14	2	100	97.7	2.3	968204288	808.198.144	160.006.144	30	12.03	17.97	26.2333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.406	0	0
15	585	26.375	15	2	100	98.2	1.8	968204288	808,169,472	160,034,816	30	12	18	26.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.409	0	0
16	586	26.375	16	2	100	98.2	1.8	968204288	808,198,144	160,006,144	30	11.97	18.03	26.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.411	0	0
17	587	26.437	17	2	100	98.5	1.5	968204288	808,198,144	160,006,144	30	11.94	18.06	26.0667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.414	0	0
18	588	26.437	18	2	100	98	2	968204288	808.689.664	159.514.624	30	11.91	18.09	26.2667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.417	0	0
19	589	26.437	19	2	100	98	2	968204288	808,677,376	159,526,912	30	11.88	18.12	26.3	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.42	0	0
20	590	26.437	20	2	100	98.5	1.5	968204288	808,738,816	159,465,472	30	11.85	18.15	26.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.422	0	0
21	591	26.437	21	2	100	98	2	968204288	808,738,816	159,465,472	30	11.82	18.18	26.3667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.425	0	0
22	592	26.437	22	2	100	98.2	1.8	968204288	808,710,144	159,494,144	30	11.79	18.21	26.3333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.428	0	0
23	593	26.437	23	2	100	97.3	2.7	968204288	808,747,008	159,457,280	30	11.76	18.24	26.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.43	0	0
24	594	26.437	24	2	100	98.2	1.8	968204288	808,755,200	159,449,088	30	11.73	18.27	26.4	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.433	0	0
25	595	26.437	25	2	100	97.8	2.2	968204288	808,738,816	159,465,472	30	11.7	18.3	26.5667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.436	0	0
26	596	26.437	26	2	100	98.2	1.8	968204288	808,738,816	159,465,472	30	11.67	18.33	26.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.439	0	0
27	597	26.437	27	2	100	97.8	2.2	968204288	808,710,144	159,494,144	30	11.64	18.36	26.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.441	0	0
28	598	26.437	28	2	100	98	2	968204288	808.615.936	159.588.352	30	11.61	18.39	26.6	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.444	0	0
29	599	26.437	29	2	100	98	2	968204288	808,615,936	159,588,352	30	11.58	18.42	26.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.447	0	0
30	600	26.437	30	2	100	98.2	1.8	968204288	808,587,264	159,617,024	30	11.55	18.45	26.6	MINIMUM	LIGHT	[(26.437, 26)]	NOT Adaptation	MEDIUM	1.45	0	0
1	601	26.437	1	1	100	77.7	22.3	968204288	808,763,392	159,440,896	30	11.49	18.51	33.5	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.455	0	0
2	602	26.437	2	1	100	98.2	1.8	968204288	808,783,872	159,420,416	30	11.46	18.54	26.7	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.458	0	0
3	603	26.437	3	1	100	97.8	2.2	968204288	808.783.872	159.420.416	30	11.43	18.57	26.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.46	0	0
4	604	26.437	4	1	100	98.5	1.5	968204288	808,792,064	159,412,224	30	11.4	18.6	26.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.463	0	0
5	605	26.437	5	1	100	98	2	968204288	808,792,064	159,412,224	30	11.37	18.63	26.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.466	0	0
6	606	26.437	6	1	100	97.8	2.2	968204288	808,816,640	159,387,648	30	11.34	18.66	26.9667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.469	0	0
7	607	26.437	7	1	100	98.2	1.8	968204288	808,824,832	159,379,456	30	11.31	18.69	26.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.471	0	0
8	608	26.437	9	1	100	98	2	968204288	808.783.872	159.420.416	30	11.28	18.72	26.9667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.474	0	0
9	609	26.437	10	1	100	97.8	2.2	968204288	808,284,160	159,920,128	30	11.25	18.75	27.0667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.477	0	0
10	610	26.437	11	1	100	97.7	2.3	968204288	808,292,352	159,911,936	30	11.22	18.78	27.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.48	0	0
11	611	26.437	12	1	100	98	2	968204288	808,292,352	159,911,936	30	11.19	18.81	27.0667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.482	0	0
12	612	26.437	13	1	100	98	2	968204288	807,915,520	160,288,768	30	11.16	18.84	27.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.485	0	0
13	613	26.437	14	1	100	97.5	2.5	968204288	807,923,712	160,280,576	30	11.13	18.87	27.3333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.488	0	0
14	614	26.437	15	1	100	98	2	968204288	807,923,712	160,280,576	30	11.1	18.9	27.2	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.49	0	0
15	615	26.437	16	1	100	98.2	1.8	968204288	807,923,712	160,280,576	30	11.07	18.93	27.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.493	0	0

16	616	26.437	17	1	100	97.5	2.5	968204288	807,923,712	160,280,576	30	11.04	18.96	27.4333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.496	0	0-
17	617	26.437	18	1	100	97.5	2.5	968204288	807,903,232	160,301,056	30	11.01	18.99	27.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.499	0	0-
18	618	26.437	19	1	100	98.5	1.5	968204288	807,927,808	160,276,480	30	10.98	19.02	27.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.501	0	0-
19	619	26.375	20	2	100	98.2	1.8	968204288	807,931,904	160,272,384	30	10.95	19.05	27.3	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.504	0	0-
20	620	26.375	21	2	100	99	1	968204288	807,895,040	160,309,248	30	10.92	19.08	27.0667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.507	0	0-
21	621	26.375	22	2	100	99	1	968204288	807,944,192	160,260,096	30	10.89	19.11	27.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.51	0	0-
22	622	26.375	23	2	100	99	1	968204288	807,923,712	160,280,576	30	10.86	19.14	27.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.512	0	0-
23	623	26.375	24	2	100	99	1	968204288	807,907,328	160,296,960	30	10.83	19.17	27.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.515	0	0-
24	624	26.375	25	2	100	99.1	0.9	968204288	807,919,616	160,284,672	30	10.8	19.2	27.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.518	0	0-
25	625	26.375	26	2	100	98.6	1.4	968204288	807,964,672	160,239,616	30	10.77	19.23	27.3667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.52	0	0-
26	626	26.375	27	2	100	98.5	1.5	968204288	807,964,672	160,239,616	30	10.74	19.26	27.4333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.523	0	0-
27	627	26.375	28	2	100	99	1	968204288	807,956,480	160,247,808	30	10.71	19.29	27.3	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.526	0	0-
28	628	26.375	29	2	100	99	1	968204288	807,944,192	160,260,096	30	10.68	19.32	27.3333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.529	0	0-
29	629	26.312	30	3	100	98.8	1.2	968204288	807,944,192	160,260,096	30	10.65	19.35	27.4333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.531	0	0-
30	630	26.312	31	3	100	98.7	1.3	968204288	807,964,672	160,239,616	30	10.62	19.38	27.5	MINIMUM	LIGHT	[(26.437, 19)]	NOT Adaptation	MEDIUM	1.534	0	0-
1	631	26.312	1	1	100	92.8	7.2	968204288	802,099,200	166,105,088	30	10.59	19.41	29.7	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.537	0	0-
2	632	26.312	2	1	100	97.1	2.9	968204288	804,683,776	163,520,512	30	10.56	19.44	28.2	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.54	0	0-
3	633	26.312	3	1	100	99	1	968204288	806,563,840	161,640,448	30	10.53	19.47	27.5333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.542	0	0-
4	634	26.375	4	2	100	99	1	968204288	807,825,408	160,378,880	30	10.5	19.5	27.5333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.545	0	0-
5	635	26.375	5	2	100	98.8	1.2	968204288	807,956,480	160,247,808	30	10.47	19.53	27.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.548	0	0-
6	636	26.375	6	2	100	98.9	1.1	968204288	807,956,480	160,247,808	30	10.44	19.56	27.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.55	0	0-
7	637	26.375	7	2	100	99.1	0.9	968204288	807,837,696	160,366,592	30	10.41	19.59	27.6	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.553	0	0-
8	638	26.375	8	2	100	99	1	968204288	807,837,696	160,366,592	30	10.38	19.62	27.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.556	0	0-
9	639	26.375	9	2	100	99	1	968204288	807,837,696	160,366,592	30	10.35	19.65	27.7	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.559	0	0-
10	640	26.375	10	2	100	98.9	1.1	968204288	807,845,888	160,358,400	30	10.32	19.68	27.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.561	0	0-
11	641	26.375	11	2	100	99.1	0.9	968204288	807,849,984	160,354,304	30	10.29	19.71	27.7333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.564	0	0-
12	642	26.375	12	2	100	99.1	0.9	968204288	807,858,176	160,346,112	30	10.26	19.74	27.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.567	0	0-
13	643	26.375	13	2	100	98.9	1.1	968204288	807,862,272	160,342,016	30	10.23	19.77	27.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.57	0	0-
14	644	26.375	14	2	100	98.9	1.1	968204288	807,862,272	160,342,016	30	10.2	19.8	27.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.572	0	0-
15	645	26.312	15	2	100	99	1	968204288	807,874,560	160,329,728	30	10.17	19.83	27.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.575	0	0-
16	646	26.312	16	2	100	99.1	0.9	968204288	807,874,560	160,329,728	30	10.14	19.86	27.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.578	0	0-
17	647	26.312	17	2	100	98.9	1.1	968204288	807,874,560	160,329,728	30	10.11	19.89	28	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.58	0	0-
18	648	26.312	18	2	100	99	1	968204288	807,882,752	160,321,536	30	10.08	19.92	28	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.583	0	0-
19	649	26.312	19	2	100	98.9	1.1	968204288	807,882,752	160,321,536	30	10.05	19.95	28.0667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.586	0	0-
20	650	26.312	20	2	100	98.9	1.1	968204288	807,882,752	160,321,536	30	10.02	19.98	28.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.589	0	0-
21	651	26.312	21	2	100	98.8	1.2	968204288	807,882,752	160,321,536	30	9.99	20.01	28.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.591	0	0-
22	652	26.312	22	2	100	99.1	0.9	968204288	807,882,752	160,321,536	30	9.96	20.04	28.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.594	0	0-
23	653	26.312	23	2	100	99.1	0.9	968204288	807,886,848	160,317,440	30	9.93	20.07	28.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.597	0	0-
24	654	26.312	24	2	100	98.9	1.1	968204288	807,899,136	160,305,152	30	9.9	20.1	28.2333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.6	0	0-
25	655	26.312	25	2	100	98.6	1.4	968204288	807,899,136	160,305,152	30	9.87	20.13	28.3667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.602	0	0-
26	656	26.312	26	2	100	99	1	968204288	807,899,136	160,305,152	30	9.84	20.16	28.2667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.605	0	0-
27	657	26.312	27	2	100	99.2	0.8	968204288	807,903,232	160,301,056	30	9.81	20.19	28.2333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.608	0	0-
28	658	26.312	28	2	100	98.8	1.2	968204288	807,911,424	160,292,864	30	9.78	20.22	28.4	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.61	0	0-
29	659	26.312	29	2	100	99.1	0.9	968204288	807,915,520	160,288,768	30	9.75	20.25	28.3333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.613	0	0-
30	660	26.312	30	2	100	98.9	1.1	968204288	807,923,712	160,280,576	30	9.72	20.28	28.4333	MINIMUM	LIGHT	[(26.312, 19)]	NOT Adaptation	MEDIUM	1.616	0	0-
1	661	26.312	1	1	100	84.9	15.1	968204288	807,948,288	160,256,000	30	9.66	20.34	33.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.621	0	0-
2	662	26.312	2	1	100	99.1	0.9	968204288	807,956,480	160,247,808	30	9.63	20.37	28.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.624	0	0-
3	663	26.312	3	1	100	98.9	1.1	968204288	807,952,384	160,251,904	30	9.6	20.4	28.5667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.627	0	0-
4	664	26.312	4	1	100	99	1	968204288	807,919,616	160,284,672	30	9.57	20.43	28.5667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.63	0	0-
5	665	26.312	5	1	100	98.6	1.4	968204288	807,919,616	160,284,672	30	9.54	20.46	28.7333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.632	0	0-
6	666	26.312	6	1	100	98.6	1.4	968204288	807,919,616	160,284,672	30	9.51	20.49	28.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.635	0	0-
7	667	26.312	7	1	100	99.1	0.9	968204288	807,919,616	160,284,672	30	9.48	20.52	28.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.638	0	0-
8	668	26.312	8	1	100	99.1	0.9	968204288	807,927,808	160,276,480	30	9.45	20.55	28.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.64	0	0-
9	669	26.312	9	1	100	98.9	1.1	968204288	807,927,808	160,276,480	30	9.42	20.58	28.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.643	0	0-
10	670	26.312	10	1	100	98.7	1.3	968204288	807,927,808	160,276,480	30	9.39	20.61	28.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.646	0	0-
11	671	26.312	11	1	100	99.1	0.9	968204288	807,936,000	160,268,288	30	9.36	20.64	28.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.649	0	0-

12	672	26.312	12	1	100	99	1	968204288	807,899,136	160,305,152	30	9.33	20.67	28.8333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.651	0	0
13	673	26.312	13	1	100	99.1	0.9	968204288	807,944,192	160,260,096	30	9.3	20.7	28.8333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.654	0	0
14	674	26.312	14	1	100	98.7	1.3	968204288	807,944,192	160,260,096	30	9.27	20.73	29	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.657	0	0
15	675	26.312	16	1	100	99	1	968204288	807,952,384	160,251,904	30	9.24	20.76	28.9333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.66	0	0
16	676	26.312	17	1	100	98.9	1.1	968204288	807,944,192	160,260,096	30	9.21	20.79	29	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.662	0	0
17	677	26.312	18	1	100	98.9	1.1	968204288	807,952,384	160,251,904	30	9.18	20.82	29.0333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.665	0	0
18	678	26.312	19	1	100	99	1	968204288	807,960,576	160,243,712	30	9.15	20.85	29.0333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.668	0	0
19	679	26.312	20	1	100	98.9	1.1	968204288	807,960,576	160,243,712	30	9.12	20.88	29.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.67	0	0
20	680	26.312	21	1	100	99	1	968204288	807,997,440	160,206,848	30	9.09	20.91	29.0667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.673	0	0
21	681	26.312	22	1	100	98.6	1.4	968204288	807,997,440	160,206,848	30	9.06	20.94	29.2333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.676	0	0
22	682	26.312	23	1	100	99	1	968204288	807,997,440	160,206,848	30	9.03	20.97	29.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.679	0	0
23	683	26.312	24	1	100	99.1	0.9	968204288	807,997,440	160,206,848	30	9	21	29.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.681	0	0
24	684	26.312	25	1	100	98.9	1.1	968204288	807,997,440	160,206,848	30	8.97	21.03	29.2333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.684	0	0
25	685	26.312	26	1	100	98.5	1.5	968204288	807,997,440	160,206,848	30	8.94	21.06	29.4	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.687	0	0
26	686	26.312	27	1	100	98.7	1.3	968204288	807,997,440	160,206,848	30	8.91	21.09	29.3667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.69	0	0
27	687	26.312	28	1	100	99	1	968204288	807,997,440	160,206,848	30	8.88	21.12	29.3	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.692	0	0
28	688	26.312	29	1	100	99.1	0.9	968204288	807,997,440	160,206,848	30	8.85	21.15	29.3	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.695	0	0
29	689	26.312	30	1	100	99.2	0.8	968204288	807,874,560	160,329,728	30	8.82	21.18	29.3333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.698	0	0
30	690	26.312	31	1	100	98.5	1.5	968204288	807,874,560	160,329,728	30	8.79	21.21	29.6	MINIMUM	LIGHT	[(26.312, 31)]	NOT Adaptation	MEDIUM	1.7	0	0
1	691	26.312	1	1	100	89.3	10.7	968204288	808,513,536	159,690,752	30	8.76	21.24	32.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.703	0	0
2	692	26.312	2	1	100	99.1	0.9	968204288	808,521,728	159,682,560	30	8.73	21.27	29.4333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.706	0	0
3	693	26.312	3	1	100	99.1	0.9	968204288	808,562,688	159,641,600	30	8.7	21.3	29.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.709	0	0
4	694	26.312	4	1	100	99.1	0.9	968204288	808,562,688	159,641,600	30	8.67	21.33	29.5	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.711	0	0
5	695	26.312	5	1	100	99	1	968204288	808,542,208	159,662,080	30	8.64	21.36	29.5667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.714	0	0
6	696	26.312	6	1	100	98.7	1.3	968204288	808,562,688	159,641,600	30	8.61	21.39	29.7	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.717	0	0
7	697	26.312	7	1	100	98.9	1.1	968204288	808,509,440	159,694,848	30	8.58	21.42	29.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.72	0	0
8	698	26.312	8	1	100	98.9	1.1	968204288	808,529,920	159,674,368	30	8.55	21.45	29.7	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.722	0	0
9	699	26.312	9	1	100	99.1	0.9	968204288	808,534,016	159,670,272	30	8.52	21.48	29.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.725	0	0
10	700	26.312	10	1	100	99.1	0.9	968204288	808,546,304	159,657,984	30	8.49	21.51	29.7	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.728	0	0
11	701	26.312	11	1	100	98.9	1.1	968204288	808,525,824	159,678,464	30	8.46	21.54	29.8	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.73	0	0
12	702	26.312	12	1	100	98.7	1.3	968204288	808,423,424	159,780,864	30	8.43	21.57	29.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.733	0	0
13	703	26.312	13	1	100	99	1	968204288	808,427,520	159,776,768	30	8.4	21.6	29.8333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.736	0	0
14	704	26.312	14	1	100	99.1	0.9	968204288	808,435,712	159,768,576	30	8.37	21.63	29.8333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.739	0	0
15	705	26.312	15	1	100	98.9	1.1	968204288	808,439,808	159,764,480	30	8.34	21.66	29.9333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.741	0	0
16	706	26.312	16	1	100	98.9	1.1	968204288	808,439,808	159,764,480	30	8.31	21.69	29.9667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.744	0	0
17	707	26.312	17	1	100	99	1	968204288	807,776,256	160,428,032	30	8.28	21.72	30	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.747	0	0
18	708	26.312	18	1	100	99.4	0.6	968204288	807,825,408	160,378,880	30	8.25	21.75	29.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.75	0	0
19	709	26.375	19	2	100	99.1	0.9	968204288	807,825,408	160,378,880	30	8.22	21.78	30.0333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.752	0	0
20	710	26.375	20	2	100	99.1	0.9	968204288	807,796,736	160,407,552	30	8.19	21.81	30.0667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.755	0	0
21	711	26.375	21	2	100	98.9	1.1	968204288	807,768,064	160,436,224	30	8.16	21.84	30.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.758	0	0
22	712	26.375	22	2	100	99	1	968204288	807,845,888	160,358,400	30	8.13	21.87	30.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.76	0	0
23	713	26.375	23	2	100	99.1	0.9	968204288	807,845,888	160,358,400	30	8.1	21.9	30.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.763	0	0
24	714	26.375	24	2	100	98.7	1.3	968204288	807,845,888	160,358,400	30	8.07	21.93	30.3333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.766	0	0
25	715	26.375	25	2	100	98.7	1.3	968204288	807,825,408	160,378,880	30	8.04	21.96	30.3667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.769	0	0
26	716	26.375	26	2	100	99	1	968204288	807,972,864	160,231,424	30	8.01	21.99	30.2667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.771	0	0
27	717	26.375	27	2	100	99	1	968204288	807,972,864	160,231,424	30	7.98	22.02	30.3	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.774	0	0
28	718	26.375	28	2	100	99	1	968204288	807,952,384	160,251,904	30	7.95	22.05	30.3667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.777	0	0
29	719	26.312	29	2	100	99.1	0.9	968204288	807,981,056	160,223,232	30	7.92	22.08	30.3333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.78	0	0
30	720	26.312	30	2	100	99	1	968204288	807,858,176	160,346,112	30	7.89	22.11	30.4333	MINIMUM	LIGHT	[(26.312, 20)]	NOT Adaptation	MEDIUM	1.782	0	0
1	721	26.312	1	1	100	85.9	14.1	968204288	807,911,424	160,292,864	30	7.86	22.14	34.8333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.785	0	0
2	722	26.312	2	1	100	98.9	1.1	968204288	807,890,944	160,313,344	30	7.83	22.17	30.5333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.788	0	0
3	723	26.312	3	1	100	99	1	968204288	807,919,616	160,284,672	30	7.8	22.2	30.5333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.79	0	0
4	724	26.312	4	1	100	98.9	1.1	968204288	807,899,136	160,305,152	30	7.77	22.23	30.6	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.793	0	0
5	725	26.375	5	2	100	99.1	0.9	968204288	807,886,848	160,317,440	30	7.74	22.26	30.5667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.796	0	0
6	726	26.375	6	2	100	99	1	968204288	807,866,368	160,337,920	30	7.71	22.29	30.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.799	0	0
7	727	26.375	7	2	100	98.9	1.1	968204288	807,870,464	160,333,824	30	7.68	22.32	30.7	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.801	0	0

8	728	26.375	8	2	100	99.2	0.8	968204288	807,890,944	160,313,344	30	7.65	22.35	30.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.804	0	0
9	729	26.375	9	2	100	99.2	0.8	968204288	807,743,488	160,460,800	30	7.62	22.38	30.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.807	0	0
10	730	26.312	10	2	100	98.9	1.1	968204288	807,763,968	160,440,320	30	7.59	22.41	30.8	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.81	0	0
11	731	26.312	11	2	100	99.1	0.9	968204288	807,743,488	160,460,800	30	7.56	22.44	30.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.812	0	0
12	732	26.312	12	2	100	98.9	1.1	968204288	807,747,584	160,456,704	30	7.53	22.47	30.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.815	0	0
13	733	26.312	13	2	100	99	1	968204288	807,784,448	160,419,840	30	7.5	22.5	30.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.818	0	0
14	734	26.312	14	2	100	99.1	0.9	968204288	807,747,584	160,456,704	30	7.47	22.53	30.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.82	0	0
15	735	26.312	15	2	100	98	2	968204288	807,849,984	160,354,304	30	7.44	22.56	31.2667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.823	0	0
16	736	26.312	16	2	100	96.8	3.2	968204288	807,944,192	160,260,096	30	7.41	22.59	31.7	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.826	0	0
17	737	26.312	17	2	100	98.9	1.1	968204288	807,972,864	160,231,424	30	7.38	22.62	31	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.829	0	0
18	738	26.312	18	2	100	99	1	968204288	807,972,864	160,231,424	30	7.35	22.65	31	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.831	0	0
19	739	26.312	19	2	100	98.7	1.3	968204288	807,944,192	160,260,096	30	7.32	22.68	31.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.834	0	0
20	740	26.312	20	2	100	99.1	0.9	968204288	807,944,192	160,260,096	30	7.29	22.71	31.0667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.837	0	0
21	741	26.312	21	2	100	98.4	1.6	968204288	807,981,056	160,223,232	30	7.26	22.74	31.3	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.84	0	0
22	742	26.312	22	2	100	94.9	5.1	968204288	807,833,600	160,370,688	30	7.23	22.77	32.5333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.842	0	0
23	743	26.312	23	2	100	98.9	1.1	968204288	807,870,464	160,333,824	30	7.2	22.8	31.2333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.845	0	0
24	744	26.312	24	2	100	98.9	1.1	968204288	807,989,248	160,215,040	30	7.17	22.83	31.2333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.848	0	0
25	745	26.312	25	2	100	98.9	1.1	968204288	807,968,768	160,235,520	30	7.14	22.86	31.2667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.85	0	0
26	746	26.312	26	2	100	99.1	0.9	968204288	808,005,632	160,198,656	30	7.11	22.89	31.2333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.853	0	0
27	747	26.312	27	2	100	98.7	1.3	968204288	807,976,960	160,227,328	30	7.08	22.92	31.4	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.856	0	0
28	748	26.312	28	2	100	98.7	1.3	968204288	808,001,536	160,202,752	30	7.05	22.95	31.4333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.859	0	0
29	749	26.312	29	2	100	99.1	0.9	968204288	807,993,344	160,210,944	30	7.02	22.98	31.3333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.861	0	0
30	750	26.312	30	2	100	98.9	1.1	968204288	807,972,864	160,231,424	30	6.99	23.01	31.4333	MINIMUM	LIGHT	[(26.312, 25)]	NOT Adaptation	MEDIUM	1.864	0	0
1	751	26.312	1	1	100	88.8	11.2	968204288	807,997,440	160,206,848	30	6.96	23.04	34.8333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.867	0	0
2	752	26.312	2	1	100	98.9	1.1	968204288	807,960,576	160,243,712	30	6.93	23.07	31.5333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.87	0	0
3	753	26.375	3	2	100	99.1	0.9	968204288	807,976,960	160,227,328	30	6.9	23.1	31.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.872	0	0
4	754	26.312	4	2	100	98.8	1.2	968204288	807,997,440	160,206,848	30	6.87	23.13	31.6	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.875	0	0
5	755	26.312	5	2	100	99	1	968204288	807,976,960	160,227,328	30	6.84	23.16	31.5667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.878	0	0
6	756	26.312	6	2	100	98.6	1.4	968204288	807,997,440	160,206,848	30	6.81	23.19	31.7333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.88	0	0
7	757	26.312	7	2	100	99	1	968204288	807,944,192	160,260,096	30	6.78	23.22	31.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.883	0	0
8	758	26.25	8	3	100	98.9	1.1	968204288	807,964,672	160,239,616	30	6.75	23.25	31.7333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.886	0	0
9	759	26.25	9	3	100	99.1	0.9	968204288	807,944,192	160,260,096	30	6.72	23.28	31.7	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.889	0	0
10	760	26.312	10	3	100	99.1	0.9	968204288	807,960,576	160,243,712	30	6.69	23.31	31.7333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.891	0	0
11	761	26.25	11	3	100	99.1	0.9	968204288	807,976,960	160,227,328	30	6.66	23.34	31.7333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.894	0	0
12	762	26.25	12	3	100	98.9	1.1	968204288	807,845,888	160,358,400	30	6.63	23.37	31.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.897	0	0
13	763	26.25	13	3	100	98.8	1.2	968204288	807,849,984	160,354,304	30	6.6	23.4	31.9333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.9	0	0
14	764	26.25	14	3	100	99.1	0.9	968204288	807,854,080	160,350,208	30	6.57	23.43	31.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.902	0	0
15	765	26.25	15	3	100	98.9	1.1	968204288	807,849,984	160,354,304	30	6.54	23.46	31.9667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.905	0	0
16	766	26.25	16	3	100	98.9	1.1	968204288	807,854,080	160,350,208	30	6.51	23.49	32	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.908	0	0
17	767	26.25	17	3	100	99	1	968204288	807,858,176	160,346,112	30	6.48	23.52	32	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.91	0	0
18	768	26.25	18	3	100	98.9	1.1	968204288	807,895,040	160,309,248	30	6.45	23.55	32.0667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.913	0	0
19	769	26.25	19	3	100	98.9	1.1	968204288	807,907,328	160,296,960	30	6.42	23.58	32.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.916	0	0
20	770	26.25	20	3	100	99.2	0.8	968204288	807,903,232	160,301,056	30	6.39	23.61	32.0333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.919	0	0
21	771	26.25	21	3	100	99.1	0.9	968204288	807,915,520	160,288,768	30	6.36	23.64	32.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.921	0	0
22	772	26.25	22	3	100	99.1	0.9	968204288	807,911,424	160,292,864	30	6.33	23.67	32.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.924	0	0
23	773	26.25	23	3	100	98.7	1.3	968204288	807,907,328	160,296,960	30	6.3	23.7	32.3	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.927	0	0
24	774	26.25	24	3	100	99	1	968204288	807,911,424	160,292,864	30	6.27	23.73	32.2333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.93	0	0
25	775	26.25	25	3	100	98.6	1.4	968204288	807,784,448	160,419,840	30	6.24	23.76	32.4	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.932	0	0
26	776	26.25	26	3	100	99	1	968204288	807,800,832	160,403,456	30	6.21	23.79	32.3	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.935	0	0
27	777	26.25	27	3	100	99	1	968204288	807,772,160	160,432,128	30	6.18	23.82	32.3333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.938	0	0
28	778	26.187	28	4	100	98.9	1.1	968204288	807,821,312	160,382,976	30	6.15	23.85	32.4	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.94	0	0
29	779	26.25	29	4	100	99.1	0.9	968204288	807,784,448	160,419,840	30	6.12	23.88	32.3667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.943	0	0
30	780	26.25	30	4	100	98.7	1.3	968204288	807,796,736	160,407,552	30	6.09	23.91	32.5333	MINIMUM	LIGHT	[(26.25, 21), (26.312, 7)]	NOT Adaptation	MEDIUM	1.946	0	0
1	781	26.25	1	1	100	94.4	5.6	968204288	807,821,312	160,382,976	30	6.06	23.94	34	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.949	0	0
2	782	26.25	2	1	100	96.4	3.6	968204288	807,829,504	160,374,784	30	6.03	23.97	33.3667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.951	0	0
3	783	26.25	3	1	100	98.9	1.1	968204288	807,874,560	160,329,728	30	6	24	32.5667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	1.954	0	0

4	784	26.187	4	2	100	99	1	968204288	807,874,560	160,329,728	30	5.97	24.03	32.5667	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	1.957	0	0-
5	785	26.187	5	2	100	98.6	1.4	968204288	807,874,560	160,329,728	30	5.94	24.06	32.7333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	1.96	0	0-
6	786	26.187	6	2	100	99	1	968204288	807,845,888	160,358,400	30	5.91	24.09	32.6333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	1.962	0	0-
7	787	26.187	7	2	100	98.6	1.4	968204288	807,845,888	160,358,400	30	5.88	24.12	32.8	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	1.965	0	0-
8	788	26.187	8	2	100	99	1	968204288	807,845,888	160,358,400	30	5.85	24.15	32.7	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	1.968	0	0-
9	789	26.187	9	2	100	99	1	968204288	807,845,888	160,358,400	30	5.82	24.18	32.7333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	1.97	0	0-
10	790	26.187	10	2	100	99.1	0.9	968204288	807,845,888	160,358,400	30	5.79	24.21	32.7333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	1.973	0	0-
11	791	26.25	11	2	100	98.7	1.3	968204288	807,845,888	160,358,400	30	5.76	24.24	32.9	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	1.976	0	0-
12	792	26.187	12	2	100	99	1	968204288	807,870,464	160,333,824	30	5.73	24.27	32.8333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	1.979	0	0-
13	793	26.187	13	2	100	99	1	968204288	807,870,464	160,333,824	30	5.7	24.3	32.8667	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	1.981	0	0-
14	794	26.187	14	2	100	99	1	968204288	807,870,464	160,333,824	30	5.67	24.33	32.9	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	1.984	0	0-
15	795	26.187	15	2	100	98.8	1.2	968204288	807,886,848	160,317,440	30	5.64	24.36	33	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	1.987	0	0-
16	796	26.187	16	2	100	99.2	0.8	968204288	807,886,848	160,317,440	30	5.61	24.39	32.9	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	1.99	0	0-
17	797	26.187	17	2	100	98.4	1.6	968204288	807,899,136	160,305,152	30	5.58	24.42	33.2	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	1.992	0	0-
18	798	26.25	18	2	100	99	1	968204288	807,899,136	160,305,152	30	5.55	24.45	33.0333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	1.995	0	0-
19	799	26.25	19	2	100	99	1	968204288	807,899,136	160,305,152	30	5.52	24.48	33.0667	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	1.998	0	0-
20	800	26.25	20	2	100	99	1	968204288	807,895,040	160,309,248	30	5.49	24.51	33.1	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2	0	0-
21	801	26.25	21	2	100	99	1	968204288	807,915,520	160,288,768	30	5.46	24.54	33.1333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.003	0	0-
22	802	26.25	22	2	100	99	1	968204288	807,878,656	160,325,632	30	5.43	24.57	33.1667	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.006	0	0-
23	803	26.25	23	2	100	98.9	1.1	968204288	807,911,424	160,292,864	30	5.4	24.6	33.2333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.009	0	0-
24	804	26.25	24	2	100	98.5	1.5	968204288	807,915,520	160,288,768	30	5.37	24.63	33.4	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.011	0	0-
25	805	26.25	25	2	100	99.1	0.9	968204288	807,915,520	160,288,768	30	5.34	24.66	33.2333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.014	0	0-
26	806	26.25	26	2	100	98.6	1.4	968204288	807,886,848	160,317,440	30	5.31	24.69	33.4333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.017	0	0-
27	807	26.25	27	2	100	99	1	968204288	807,915,520	160,288,768	30	5.28	24.72	33.3333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.02	0	0-
28	808	26.25	28	2	100	99.1	0.9	968204288	807,915,520	160,288,768	30	5.25	24.75	33.3333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.022	0	0-
29	809	26.25	29	2	100	98.9	1.1	968204288	807,886,848	160,317,440	30	5.22	24.78	33.4333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.025	0	0-
30	810	26.25	30	2	100	99.1	0.9	968204288	807,890,944	160,313,344	30	5.19	24.81	33.4	MINIMUM	LIGHT	[(26.25, 17)]		NOT Adaptation	MEDIUM	2.028	0	0-
1	811	26.25	1	1	100	90.2	9.8	968204288	807,915,520	160,288,768	30	5.13	24.87	36.4333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.033	0	0-
2	812	26.25	2	1	100	98.9	1.1	968204288	807,927,808	160,276,480	30	5.1	24.9	33.5667	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.036	0	0-
3	813	26.187	3	2	100	99	1	968204288	807,948,288	160,256,000	30	5.07	24.93	33.5667	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.039	0	0-
4	814	26.25	4	2	100	99.1	0.9	968204288	807,927,808	160,276,480	30	5.04	24.96	33.5667	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.041	0	0-
5	815	26.25	5	2	100	99	1	968204288	807,956,480	160,247,808	30	5.01	24.99	33.6333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.044	0	0-
6	816	26.25	6	2	100	99.1	0.9	968204288	807,956,480	160,247,808	30	4.98	25.02	33.6333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.047	0	0-
7	817	26.25	7	2	100	98.9	1.1	968204288	807,964,672	160,239,616	30	4.95	25.05	33.7333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.05	0	0-
8	818	26.25	8	2	100	98.6	1.4	968204288	807,989,248	160,215,040	30	4.92	25.08	33.8333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.052	0	0-
9	819	26.25	9	2	100	99.1	0.9	968204288	807,956,480	160,247,808	30	4.89	25.11	33.7333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.055	0	0-
10	820	26.25	10	2	100	98.7	1.3	968204288	807,964,672	160,239,616	30	4.86	25.14	33.9	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.058	0	0-
11	821	26.25	11	2	100	99	1	968204288	807,964,672	160,239,616	30	4.83	25.17	33.8333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.06	0	0-
12	822	26.25	12	2	100	98.9	1.1	968204288	807,964,672	160,239,616	30	4.8	25.2	33.9	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.063	0	0-
13	823	26.25	13	2	100	98.9	1.1	968204288	807,964,672	160,239,616	30	4.77	25.23	33.9333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.066	0	0-
14	824	26.312	14	3	100	98.9	1.1	968204288	807,964,672	160,239,616	30	4.74	25.26	33.9667	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.069	0	0-
15	825	26.312	15	3	100	98.9	1.1	968204288	807,964,672	160,239,616	30	4.71	25.29	34	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.071	0	0-
16	826	26.25	16	3	100	99	1	968204288	807,964,672	160,239,616	30	4.68	25.32	34	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.074	0	0-
17	827	26.25	17	3	100	99.1	0.9	968204288	807,964,672	160,239,616	30	4.65	25.35	34	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.077	0	0-
18	828	26.25	18	3	100	98.8	1.2	968204288	807,993,344	160,210,944	30	4.62	25.38	34.1	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.08	0	0-
19	829	26.25	19	3	100	99.1	0.9	968204288	807,993,344	160,210,944	30	4.59	25.41	34.0333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.082	0	0-
20	830	26.25	20	3	100	99	1	968204288	807,993,344	160,210,944	30	4.56	25.44	34.1	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.085	0	0-
21	831	26.25	21	3	100	99.1	0.9	968204288	807,993,344	160,210,944	30	4.53	25.47	34.1	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.088	0	0-
22	832	26.25	22	3	100	98.9	1.1	968204288	807,993,344	160,210,944	30	4.5	25.5	34.2	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.09	0	0-
23	833	26.25	23	3	100	98.7	1.3	968204288	807,993,344	160,210,944	30	4.47	25.53	34.3	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.093	0	0-
24	834	26.25	24	3	100	98.5	1.5	968204288	807,866,368	160,337,920	30	4.44	25.56	34.4333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.096	0	0-
25	835	26.25	25	3	100	99	1	968204288	807,890,944	160,313,344	30	4.41	25.59	34.3	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.099	0	0-
26	836	26.25	26	3	100	98.7	1.3	968204288	807,862,272	160,342,016	30	4.38	25.62	34.4333	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.101	0	0-
27	837	26.25	27	3	100	98.9	1.1	968204288	807,768,064	160,436,224	30	4.35	25.65	34.4	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.104	0	0-
28	838	26.25	28	3	100	99	1	968204288	807,768,064	160,436,224	30	4.32	25.68	34.4	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.107	0	0-
29	839	26.312	29	3	100	98.5	1.5	968204288	807,903,232	160,301,056	30	4.29	25.71	34.6	MINIMUM	LIGHT	-		NOT Adaptation	MEDIUM	2.11	0	0-

30	840	26.312	30	3	100	99	1	968204288	807,911,424	160,292,864	30	4.26	25.74	34.4667	MINIMUM	LIGHT	[(26.25, 25)]	NOT Adaptation	MEDIUM	2.112	0	0
1	841	26.25	1	1	100	91.3	8.7	968204288	807,899,136	160,305,152	30	4.23	25.77	37.0667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.115	0	0
2	842	26.312	2	2	100	99.2	0.8	968204288	807,940,096	160,264,192	30	4.2	25.8	34.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.118	0	0
3	843	26.312	3	2	100	98.9	1.1	968204288	807,981,056	160,223,232	30	4.17	25.83	34.5667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.12	0	0
4	844	26.312	4	2	100	99.1	0.9	968204288	807,952,384	160,251,904	30	4.14	25.86	34.5667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.123	0	0
5	845	26.312	5	2	100	99.1	0.9	968204288	807,854,080	160,350,208	30	4.11	25.89	34.6	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.126	0	0
6	846	26.312	6	2	100	99	1	968204288	807,854,080	160,350,208	30	4.08	25.92	34.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.129	0	0
7	847	26.312	7	2	100	99.1	0.9	968204288	807,796,736	160,407,552	30	4.05	25.95	34.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.131	0	0
8	848	26.312	8	2	100	98.7	1.3	968204288	807,825,408	160,378,880	30	4.02	25.98	34.8333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.134	0	0
9	849	26.312	9	2	100	99.1	0.9	968204288	807,829,504	160,374,784	30	3.99	26.01	34.7333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.137	0	0
10	850	26.312	10	2	100	98.9	1.1	968204288	807,825,408	160,378,880	30	3.96	26.04	34.8333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.14	0	0
11	851	26.312	11	2	100	98.4	1.6	968204288	807,849,984	160,354,304	30	3.93	26.07	35.0333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.142	0	0
12	852	26.312	12	2	100	99.1	0.9	968204288	807,854,080	160,350,208	30	3.9	26.1	34.8333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.145	0	0
13	853	26.375	13	3	100	99	1	968204288	807,849,984	160,354,304	30	3.87	26.13	34.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.148	0	0
14	854	26.375	14	3	100	98.6	1.4	968204288	807,854,080	160,350,208	30	3.84	26.16	35.0667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.15	0	0
15	855	26.375	15	3	100	99	1	968204288	807,858,176	160,346,112	30	3.81	26.19	34.9667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.153	0	0
16	856	26.375	16	3	100	99	1	968204288	807,858,176	160,346,112	30	3.78	26.22	35	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.156	0	0
17	857	26.375	17	3	100	98.9	1.1	968204288	807,858,176	160,346,112	30	3.75	26.25	35.0667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.159	0	0
18	858	26.375	18	3	100	98.9	1.1	968204288	807,862,272	160,342,016	30	3.72	26.28	35.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.161	0	0
19	859	26.375	19	3	100	99	1	968204288	807,866,368	160,337,920	30	3.69	26.31	35.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.164	0	0
20	860	26.375	20	3	100	98.7	1.3	968204288	807,866,368	160,337,920	30	3.66	26.34	35.2333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.167	0	0
21	861	26.375	21	3	100	99	1	968204288	807,837,696	160,366,592	30	3.63	26.37	35.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.17	0	0
22	862	26.375	22	3	100	99	1	968204288	807,874,560	160,329,728	30	3.6	26.4	35.2	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.172	0	0
23	863	26.375	23	3	100	99	1	968204288	807,878,656	160,325,632	30	3.57	26.43	35.2333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.175	0	0
24	864	26.375	24	3	100	98.5	1.5	968204288	807,833,600	160,370,688	30	3.54	26.46	35.4333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.178	0	0
25	865	26.375	25	3	100	99.1	0.9	968204288	807,882,752	160,321,536	30	3.51	26.49	35.2667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.18	0	0
26	866	26.375	26	3	100	98.8	1.2	968204288	807,882,752	160,321,536	30	3.48	26.52	35.4	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.183	0	0
27	867	26.375	27	3	100	99	1	968204288	807,763,968	160,440,320	30	3.45	26.55	35.3667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.186	0	0
28	868	26.375	28	3	100	98.9	1.1	968204288	807,759,872	160,444,416	30	3.42	26.58	35.4333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.189	0	0
29	869	26.375	29	3	100	98.7	1.3	968204288	807,768,064	160,436,224	30	3.39	26.61	35.5333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.191	0	0
30	870	26.375	30	3	100	99.1	0.9	968204288	807,776,256	160,428,032	30	3.36	26.64	35.4333	MINIMUM	LIGHT	[(26.375, 18)]	NOT Adaptation	MEDIUM	2.194	0	0
1	871	26.375	1	1	100	89.5	10.5	968204288	807,919,616	160,284,672	30	3.33	26.67	38.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.197	0	0
2	872	26.375	2	1	100	99.2	0.8	968204288	807,858,176	160,346,112	30	3.3	26.7	35.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.2	0	0
3	873	26.375	3	1	100	99.2	0.8	968204288	807,755,776	160,448,512	30	3.27	26.73	35.5	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.202	0	0
4	874	26.375	4	1	100	98.9	1.1	968204288	807,792,640	160,411,648	30	3.24	26.76	35.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.205	0	0
5	875	26.375	5	1	100	99	1	968204288	807,755,776	160,448,512	30	3.21	26.79	35.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.208	0	0
6	876	26.375	6	1	100	99	1	968204288	807,776,256	160,428,032	30	3.18	26.82	35.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.21	0	0
7	877	26.375	7	1	100	99.1	0.9	968204288	807,784,448	160,419,840	30	3.15	26.85	35.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.213	0	0
8	878	26.375	8	1	100	98.6	1.4	968204288	807,780,352	160,423,936	30	3.12	26.88	35.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.216	0	0
9	879	26.375	9	1	100	98.9	1.1	968204288	807,780,352	160,423,936	30	3.09	26.91	35.8	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.219	0	0
10	880	26.375	10	1	100	99	1	968204288	807,784,448	160,419,840	30	3.06	26.94	35.8	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.221	0	0
11	881	26.375	11	1	100	98.9	1.1	968204288	807,788,544	160,415,744	30	3.03	26.97	35.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.224	0	0
12	882	26.375	12	1	100	99.1	0.9	968204288	807,792,640	160,411,648	30	3	27	35.8333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.227	0	0
13	883	26.375	13	1	100	99	1	968204288	807,792,640	160,411,648	30	2.97	27.03	35.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.23	0	0
14	884	26.437	14	2	100	99	1	968204288	807,792,640	160,411,648	30	2.94	27.06	35.9333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.232	0	0
15	885	26.437	15	2	100	98.8	1.2	968204288	807,792,640	160,411,648	30	2.91	27.09	36.0333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.235	0	0
16	886	26.437	16	2	100	99.1	0.9	968204288	807,796,736	160,407,552	30	2.88	27.12	35.9667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.238	0	0
17	887	26.437	17	2	100	99	1	968204288	807,809,024	160,395,264	30	2.85	27.15	36.0333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.24	0	0
18	888	26.437	18	2	100	99.2	0.8	968204288	807,821,312	160,382,976	30	2.82	27.18	36	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.243	0	0
19	889	26.437	19	2	100	98.9	1.1	968204288	807,825,408	160,378,880	30	2.79	27.21	36.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.246	0	0
20	890	26.437	20	2	100	99	1	968204288	807,825,408	160,378,880	30	2.76	27.24	36.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.249	0	0
21	891	26.437	21	2	100	99.1	0.9	968204288	807,829,504	160,374,784	30	2.73	27.27	36.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.251	0	0
22	892	26.375	22	2	100	98.7	1.3	968204288	807,837,696	160,366,592	30	2.7	27.3	36.3	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.254	0	0
23	893	26.375	23	2	100	98.9	1.1	968204288	807,817,216	160,387,072	30	2.67	27.33	36.2667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.257	0	0
24	894	26.375	24	2	100	98.4	1.6	968204288	807,849,984	160,354,304	30	2.64	27.36	36.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.26	0	0
25	895	26.375	25	2	100	99.1	0.9	968204288	807,841,792	160,362,496	30	2.61	27.39	36.2667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.262	0	0

26	896	26.375	26	2	100	98.6	1.4	968204288	807,849,984	160,354,304	30	2.58	27.42	36.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.265	0	0
27	897	26.375	27	2	100	99.1	0.9	968204288	807,813,120	160,391,168	30	2.55	27.45	36.3333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.268	0	0
28	898	26.375	28	2	100	99	1	968204288	807,849,984	160,354,304	30	2.52	27.48	36.4	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.27	0	0
29	899	26.375	29	2	100	98.6	1.4	968204288	807,813,120	160,391,168	30	2.49	27.51	36.5667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.273	0	0
30	900	26.375	30	2	100	99	1	968204288	807,841,792	160,362,496	30	2.46	27.54	36.4667	MINIMUM	LIGHT	[(26.375, 22)]	NOT Adaptation	MEDIUM	2.276	0	0
1	901	26.375	1	1	100	89.3	10.7	968204288	807,804,928	160,399,360	30	2.43	27.57	39.7333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.279	0	0
2	902	26.375	2	1	100	99	1	968204288	807,890,944	160,313,344	30	2.4	27.6	36.5333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.281	0	0
3	903	26.375	3	1	100	99.2	0.8	968204288	807,882,752	160,321,536	30	2.37	27.63	36.5	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.284	0	0
4	904	26.375	4	1	100	98.7	1.3	968204288	807,821,312	160,382,976	30	2.34	27.66	36.7	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.287	0	0
5	905	26.375	5	1	100	99	1	968204288	807,849,984	160,354,304	30	2.31	27.69	36.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.29	0	0
6	906	26.375	6	1	100	98.9	1.1	968204288	807,829,504	160,374,784	30	2.28	27.72	36.7	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.292	0	0
7	907	26.437	7	2	100	99.1	0.9	968204288	807,874,560	160,329,728	30	2.25	27.75	36.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.295	0	0
8	908	26.437	8	2	100	98.6	1.4	968204288	807,874,560	160,329,728	30	2.22	27.78	36.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.298	0	0
9	909	26.437	9	2	100	99.1	0.9	968204288	807,878,656	160,325,632	30	2.19	27.81	36.7333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.3	0	0
10	910	26.437	10	2	100	99.1	0.9	968204288	807,878,656	160,325,632	30	2.16	27.84	36.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.303	0	0
11	911	26.437	11	2	100	98.6	1.4	968204288	807,858,176	160,346,112	30	2.13	27.87	36.9667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.306	0	0
12	912	26.437	12	2	100	99.1	0.9	968204288	807,886,848	160,317,440	30	2.1	27.9	36.8333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.309	0	0
13	913	26.437	13	2	100	99	1	968204288	807,886,848	160,317,440	30	2.07	27.93	36.9	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.311	0	0
14	914	26.437	14	2	100	98.9	1.1	968204288	807,890,944	160,313,344	30	2.04	27.96	36.9667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.314	0	0
15	915	26.437	15	2	100	98.9	1.1	968204288	807,890,944	160,313,344	30	2.01	27.99	37	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.317	0	0
16	916	26.375	16	2	100	98.9	1.1	968204288	807,870,464	160,333,824	30	1.98	28.02	37.0333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.32	0	0
17	917	26.375	17	2	100	99	1	968204288	807,899,136	160,305,152	30	1.95	28.05	37.0333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.322	0	0
18	918	26.437	18	2	100	98.7	1.3	968204288	807,870,464	160,333,824	30	1.92	28.08	37.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.325	0	0
19	919	26.437	19	2	100	99	1	968204288	807,866,368	160,337,920	30	1.89	28.11	37.1	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.328	0	0
20	920	26.437	20	2	100	98.9	1.1	968204288	807,886,848	160,317,440	30	1.86	28.14	37.1667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.33	0	0
21	921	26.437	21	2	100	99.1	0.9	968204288	807,890,944	160,313,344	30	1.83	28.17	37.1333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.333	0	0
22	922	26.437	22	2	100	98.9	1.1	968204288	807,874,560	160,329,728	30	1.8	28.2	37.2333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.336	0	0
23	923	26.437	23	2	100	99.1	0.9	968204288	807,895,040	160,309,248	30	1.77	28.23	37.2	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.339	0	0
24	924	26.437	24	2	100	98.6	1.4	968204288	807,731,200	160,473,088	30	1.74	28.26	37.4	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.341	0	0
25	925	26.437	25	2	100	98.7	1.3	968204288	807,780,352	160,423,936	30	1.71	28.29	37.4	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.344	0	0
26	926	26.437	26	2	100	98.7	1.3	968204288	807,780,352	160,423,936	30	1.68	28.32	37.4333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.347	0	0
27	927	26.437	27	2	100	99	1	968204288	807,788,544	160,415,744	30	1.65	28.35	37.3667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.35	0	0
28	928	26.437	28	2	100	99	1	968204288	807,788,544	160,415,744	30	1.62	28.38	37.4	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.352	0	0
29	929	26.437	29	2	100	98.9	1.1	968204288	807,796,736	160,407,552	30	1.59	28.41	37.4667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.355	0	0
30	930	26.5	30	3	100	99	1	968204288	807,792,640	160,411,648	30	1.56	28.44	37.4667	MINIMUM	LIGHT	[(26.437, 21)]	NOT Adaptation	MEDIUM	2.358	0	0
1	931	26.5	1	1	100	90.3	9.7	968204288	807,813,120	160,391,168	30	1.53	28.47	40.4	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.36	0	0
2	932	26.437	2	2	100	99.1	0.9	968204288	807,792,640	160,411,648	30	1.5	28.5	37.5	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.363	0	0
3	933	26.437	3	2	100	99.1	0.9	968204288	807,829,504	160,374,784	30	1.47	28.53	37.5333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.366	0	0
4	934	26.437	4	2	100	99.1	0.9	968204288	807,800,832	160,403,456	30	1.44	28.56	37.5667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.369	0	0
5	935	26.437	5	2	100	98.6	1.4	968204288	807,821,312	160,382,976	30	1.41	28.59	37.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.371	0	0
6	936	26.437	6	2	100	99.1	0.9	968204288	807,792,640	160,411,648	30	1.38	28.62	37.6333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.374	0	0
7	937	26.437	7	2	100	99.1	0.9	968204288	807,821,312	160,382,976	30	1.35	28.65	37.6667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.377	0	0
8	938	26.437	8	2	100	98.9	1.1	968204288	807,800,832	160,403,456	30	1.32	28.68	37.7667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.38	0	0
9	939	26.437	9	2	100	99.1	0.9	968204288	807,821,312	160,382,976	30	1.29	28.71	37.7333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.382	0	0
10	940	26.437	10	2	100	99	1	968204288	807,800,832	160,403,456	30	1.26	28.74	37.8	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.385	0	0
11	941	26.437	11	2	100	99	1	968204288	807,800,832	160,403,456	30	1.23	28.77	37.8333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.388	0	0
12	942	26.437	12	2	100	99	1	968204288	807,858,176	160,346,112	30	1.2	28.8	37.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.39	0	0
13	943	26.437	13	2	100	99.1	0.9	968204288	807,862,272	160,342,016	30	1.17	28.83	37.8667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.393	0	0
14	944	26.437	14	2	100	98.6	1.4	968204288	807,862,272	160,342,016	30	1.14	28.86	38.0667	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.396	0	0
15	945	26.437	15	2	100	98.9	1.1	968204288	807,841,792	160,362,496	30	1.11	28.89	38	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.399	0	0
16	946	26.437	16	2	100	99	1	968204288	807,870,464	160,333,824	30	1.08	28.92	38	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.401	0	0
17	947	26.437	17	2	100	99.1	0.9	968204288	807,837,696	160,366,592	30	1.05	28.95	38	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.404	0	0
18	948	26.437	18	2	100	99.1	0.9	968204288	807,809,024	160,395,264	30	1.02	28.98	38.0333	MINIMUM	LIGHT	-	NOT Adaptation	MEDIUM	2.407	0	0

Appendix F. Log File Stress Test 30 mAh and 30s release data to server

timer_rilis	timer	temp_capt	total_item	total_varia	cpu_total	cpu_free	cpu_usage	mem_total	mem_free	mem_usage	batt_total	batt_free	bat_usage	avg_res	res_condit	work_cond	rilis_data_	res_adapt	secu_updt	si	rf	rt
1	1	26.437	1	1	100	98	2	968,204,288	808,951,808	159,252,480	30	29.91	0.09	6.233333	MINIMUM	LIGHT	-	NOT Adapt	HIGH	0	0	0
2	2	26.437	2	1	100	88	12	968,204,288	807,817,216	160,387,072	30	29.88	0.12	9.666667	MINIMUM	LIGHT	-	NOT Adapt	HIGH	0	0	0
3	3	26.437	3	1	100	86.7	13.3	968,204,288	805,052,416	163,151,872	30	29.85	0.15	10.23333	MINIMUM	LIGHT	-	NOT Adapt	HIGH	0	0	0
4	4	26.437	4	1	100	93.4	6.6	968,204,288	799,571,968	168,632,320	30	29.82	0.18	8.2	MINIMUM	LIGHT	-	NOT Adapt	HIGH	0	0	0
5	5	26.437	5	1	100	91.6	8.4	968,204,288	797,908,992	170,295,296	30	29.79	0.21	8.9	MINIMUM	LIGHT	-	NOT Adapt	HIGH	0	0	0
6	6	26.437	6	1	100	85.1	14.9	968,204,288	793,935,872	174,268,416	30	29.76	0.24	11.23333	MINIMUM	LIGHT	-	NOT Adapt	HIGH	0	0	0
7	7	26.437	7	1	100	80.9	19.1	968,204,288	790,028,288	178,176,000	30	29.73	0.27	12.8	MINIMUM	LIGHT	-	NOT Adapt	HIGH	0	0	0
8	8	26.437	8	1	100	83.3	16.7	968,204,288	787,681,280	180,523,008	30	29.7	0.3	12.1	MINIMUM	LIGHT	-	NOT Adapt	HIGH	0	0	0
9	9	26.437	9	1	100	83	17	968,204,288	777,277,440	190,926,848	30	29.67	0.33	12.6	MINIMUM	LIGHT	-	NOT Adapt	HIGH	0	0	0
10	10	26.437	10	1	100	95.5	4.5	968,204,288	777,269,248	190,935,040	30	29.64	0.36	8.466667	MINIMUM	LIGHT	-	NOT Adapt	HIGH	0	0	0
11	11	26.437	11	1	100	97.3	2.7	968,204,288	777,261,056	190,943,232	30	29.61	0.39	7.9	MINIMUM	LIGHT	-	NOT Adapt	HIGH	0	0	0
12	12	26.437	12	1	100	78.6	21.4	968,204,288	765,960,192	202,244,096	30	29.58	0.42	14.56667	MINIMUM	LIGHT	-	NOT Adapt	HIGH	0	0	0
13	13	26.437	13	1	100	79.5	20.5	968,204,288	763,256,832	204,947,456	30	29.55	0.45	14.4	MINIMUM	LIGHT	-	NOT Adapt	HIGH	0	0	0
14	14	26.437	14	1	100	47.6	52.4	968,204,288	753,115,136	215,089,152	30	29.52	0.48	25.4	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	0
15	15	26.437	15	1	100	48.7	51.3	968,204,288	736,100,352	232,103,936	30	29.49	0.51	25.66667	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	0
16	16	26.437	16	1	100	61.2	38.8	968,204,288	739,717,120	228,487,168	30	29.46	0.54	21.4	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	0
17	17	26.5	17	2	100	51.6	48.4	968,204,288	713,478,144	254,726,144	30	29.43	0.57	25.53333	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	0
18	18	26.5	18	2	100	6.6	93.4	968,204,288	709,066,752	259,137,536	30	29.4	0.6	40.73333	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	14.66667	0
19	19	26.5	17	2	100	3.3	96.7	968,204,288	671,014,912	297,189,376	30	29.32	0.68	43.22222	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	7.333333	0
20	20	26.5	17	2	100	0.5	99.5	968,204,288	643,469,312	324,734,976	30	29.24	0.76	45.17778	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	1.111111	0
21	21	26.437	17	1	100	0.5	99.5	968,204,288	637,108,224	331,096,064	30	29.16	0.84	45.5	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	1.111111	0
22	22	26.437	18	1	100	0	100	968,204,288	644,292,608	323,911,680	30	29.08	0.92	45.52222	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	0
23	23	26.5	19	2	100	0	100	968,204,288	621,740,032	346,464,256	30	29.05	0.95	46.32222	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	0
24	24	26.5	20	2	100	0	100	968,204,288	600,064,000	368,140,288	30	29.02	0.98	47.08889	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	0
25	25	26.5	21	2	100	0.3	99.7	968,204,288	603,627,520	364,576,768	30	28.99	1.01	46.92222	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0.666667	0
26	26	26.5	19	2	100	0	100	968,204,288	595,169,280	373,035,008	30	28.91	1.09	47.37778	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	0
27	27	26.5	20	2	100	0.3	99.7	968,204,288	608,587,776	359,616,512	30	28.88	1.12	46.84444	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0.666667	0
28	28	26.437	19	1	100	2.2	97.8	968,204,288	605,507,584	362,696,704	30	28.8	1.2	46.43333	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	4.888889	0
29	29	26.437	20	1	100	10.6	89.4	968,204,288	604,991,488	363,212,800	30	28.72	1.28	43.72222	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	23.55556	0
30	30	26.437	22	1	100	42.9	57.1	968,204,288	591,802,368	376,401,920	30	28.56	1.44	33.6	MINIMUM	LIGHT	[(26.437, 2	NOT Adapt	MEDIUM	0	95.33333	0
1	31	26.437	1	1	100	0.3	99.7	968,204,288	562,552,832	405,651,456	30	28.4	1.6	48.97778	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0.666667	0
2	32	26.437	2	1	100	0	100	968,204,288	561,225,728	406,978,560	30	28.32	1.68	49.2	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	0
3	33	26.437	5	1	100	0.5	99.5	968,204,288	495,255,552	472,948,736	30	28.23	1.77	51.4	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	1.111111	0
4	34	26.437	6	1	100	0	100	968,204,288	530,358,272	437,846,016	30	28.15	1.85	50.45556	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	0
5	35	26.437	7	1	100	0.2	99.8	968,204,288	528,576,512	439,627,776	30	28.12	1.88	50.48889	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0.444444	0
6	36	26.437	8	1	100	1	99	968,204,288	532,549,632	435,654,656	30	28.04	1.96	50.17778	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	2.222222	0
7	37	26.437	9	1	100	0	100	968,204,288	537,841,664	430,362,624	30	27.96	2.04	50.4	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	0
8	38	26.437	10	1	100	0	100	968,204,288	526,032,896	442,171,392	30	27.93	2.07	50.86667	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	0
9	39	26.437	11	1	100	0.5	99.5	968,204,288	529,743,872	438,460,416	30	27.9	2.1	50.6	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	1.111111	0
10	40	26.437	12	1	100	1.3	98.7	968,204,288	526,606,336	441,597,952	30	27.82	2.18	50.52222	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	2.888889	0
11	41	26.437	13	1	100	0.2	99.8	968,204,288	526,196,736	442,007,552	30	27.74	2.26	51.01111	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0.444444	0
12	42	26.437	14	1	100	2.3	97.7	968,204,288	530,636,800	437,567,488	30	27.66	2.34	50.23333	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	5.111111	0
13	43	26.375	15	2	100	14.8	85.2	968,204,288	521,728,000	446,476,288	30	27.5	2.5	46.54444	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	32.88889	0
14	44	26.375	15	2	100	11.7	88.3	968,204,288	516,136,960	452,067,328	30	27.42	2.58	47.86667	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	26	0
15	45	26.375	15	2	100	11.8	88.2	968,204,288	515,420,160	452,784,128	30	27.34	2.66	47.95556	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	26.22222	0
16	46	26.375	15	2	100	7.3	92.7	968,204,288	512,913,408	455,290,880	30	27.26	2.74	49.61111	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	16.22222	0
17	47	26.437	15	1	100	6.6	93.4	968,204,288	504,164,352	464,039,936	30	27.18	2.82	50.23333	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	14.66667	0
18	48	26.437	16	1	100	6.1	93.9	968,204,288	510,193,664	458,010,624	30	27.1	2.9	50.28889	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	13.55556	0
19	49	26.437	17	1	100	10.9	89.1	968,204,288	509,394,944	458,809,344	30	27.02	2.98	48.81111	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	24.22222	0
20	50	26.437	18	1	100	2.3	97.7	968,204,288	507,043,840	461,160,448	30	26.94	3.06	51.83333	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	5.111111	0
21	51	26.437	29	1	100	5.8	94.2	968,204,288	472,256,512	495,947,776	30	26.06	3.94	52.84444	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	12.88889	50
22	52	26.437	30	1	100	0.2	99.8	968,204,288	455,524,352	512,679,936	30	25.98	4.02	55.4	MAXIMUM	HEAVY	-	Adaptation	LOW	0	0.444444	50
23	53	26.437	39	1	100	47.6	52.4	968,204,288	456,765,440	511,438,848	30	25.26	4.74	40.33333	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	50
24	54	26.437	40	1	100	25.7	74.3	968,204,288	454,860,800	513,343,488	30	25.18	4.82	47.78889	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	57.11111	50
25	55	26.437	41	1	100	12.2	87.8	968,204,288	452,362,240	515,842,048	30	25.1	4.9	52.47778	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	27.11111	50

26	56	26.437	42	1	100	15	85	968,204,288	450,158,592	518,045,696	30	25.02	4.98	51.7	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	33.33333	50
27	57	26.437	43	1	100	25	75	968,204,288	446,132,224	522,072,064	30	24.94	5.06	48.58889	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	55.55556	50
28	58	26.437	44	1	100	21.6	78.4	968,204,288	446,205,952	521,998,336	30	24.86	5.14	49.81111	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	48	50
29	59	26.437	45	1	100	33.9	66.1	968,204,288	445,050,880	523,153,408	30	24.78	5.22	45.83333	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	75.33333	50
30	60	26.437	46	1	100	50.7	49.3	968,204,288	445,046,784	523,157,504	30	24.7	5.3	40.32222	MINIMUM	LIGHT	[(26.437, 4	NOT Adapt	MEDIUM	0	0	50
1	61	26.5	1	1	100	59.2	40.8	968,204,288	443,805,696	524,398,592	30	24.3	5.7	38	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	50
2	62	26.5	7	1	100	41	59	968,204,288	438,841,344	529,362,944	30	23.74	6.26	44.85556	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	91.11111	50
3	63	26.5	8	1	100	22.1	77.9	968,204,288	437,411,840	530,792,448	30	23.66	6.34	51.27778	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	49.11111	50
4	64	28.25	13	2	100	53.4	46.6	968,204,288	439,848,960	528,355,328	30	23.1	6.9	41.4	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	50
5	65	28.75	13	2	100	45.1	54.9	968,204,288	441,229,312	526,974,976	30	23.02	6.98	44.18889	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	50
6	66	29.062	13	2	100	57	43	968,204,288	437,915,648	530,288,640	30	22.78	7.22	40.62222	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	50
7	67	29.062	13	2	100	35.2	64.8	968,204,288	433,446,912	534,757,376	30	22.7	7.3	48.11111	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	78.22222	44.8
8	68	29.687	13	2	100	52.7	47.3	968,204,288	430,215,168	537,989,120	30	22.54	7.46	42.58889	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	44.4
9	69	29.937	13	2	100	47.7	52.3	968,204,288	429,846,528	538,357,760	30	22.46	7.54	44.34444	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	44.4
10	70	29.937	13	2	100	50.6	49.4	968,204,288	430,411,776	537,792,512	30	22.38	7.62	43.43333	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	44.5
11	71	30.125	13	2	100	62.6	37.4	968,204,288	430,039,040	538,165,248	30	22.3	7.7	39.55556	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	44.4
12	72	30.125	13	2	100	65.6	34.4	968,204,288	429,764,608	538,439,680	30	22.22	7.78	38.64444	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	0	44.4
13	73	30.25	13	2	100	19.9	80.1	968,204,288	420,397,056	547,807,232	30	22.14	7.86	54.3	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	44.22222	43.4
14	74	30.25	13	2	100	1	99	968,204,288	419,004,416	549,199,872	30	22.06	7.94	60.72222	MAXIMUM	HEAVY	-	Adaptation	LOW	0	2.222222	43.3
15	75	30.25	13	2	100	0	100	968,204,288	421,613,568	546,590,720	30	21.98	8.02	61.07778	MAXIMUM	HEAVY	-	Adaptation	LOW	0	0	43.5
16	76	30.187	13	2	100	1.3	98.7	968,204,288	422,273,024	545,931,264	30	21.74	8.26	60.87778	MAXIMUM	HEAVY	-	Adaptation	LOW	0	2.888889	43.6
17	77	30.187	13	2	100	0	100	968,204,288	421,261,312	546,942,976	30	21.66	8.34	61.43333	MAXIMUM	HEAVY	-	Adaptation	LOW	0	0	43.5
18	78	30.25	13	2	100	0.5	99.5	968,204,288	419,921,920	548,282,368	30	21.58	8.42	61.38889	MAXIMUM	HEAVY	-	Adaptation	LOW	0	1.111111	43.4
19	79	30.25	13	2	100	2.2	97.8	968,204,288	419,651,584	548,552,704	30	21.5	8.5	60.94444	MAXIMUM	HEAVY	-	Adaptation	LOW	0	4.888889	43.3
20	80	30.312	13	2	100	4.5	95.5	968,204,288	421,617,664	546,586,624	30	21.34	8.66	60.28889	MAXIMUM	HEAVY	-	Adaptation	LOW	0	10	43.5
21	81	30.312	13	2	100	3.3	96.7	968,204,288	422,297,600	545,906,688	30	21.26	8.74	60.74444	MAXIMUM	HEAVY	-	Adaptation	LOW	0	7.333333	43.6
22	82	30.25	13	2	100	3.5	96.5	968,204,288	421,232,640	546,971,648	30	21.18	8.82	60.8	MAXIMUM	HEAVY	-	Adaptation	LOW	0	7.777778	43.5
23	83	30.25	13	2	100	5.1	94.9	968,204,288	415,571,968	552,632,320	30	21.1	8.9	60.55556	MAXIMUM	HEAVY	-	Adaptation	LOW	0	11.33333	42.9
24	84	30.25	13	2	100	18.6	81.4	968,204,288	417,554,432	550,649,856	30	21.02	8.98	56.07778	MAXIMUM	HEAVY	-	Adaptation	LOW	0	41.33333	43.1
25	85	30.312	13	2	100	26.9	73.1	968,204,288	417,173,504	551,030,784	30	20.94	9.06	53.4	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	59.77778	43.1
26	86	30.312	13	2	100	13.1	86.9	968,204,288	413,982,720	554,221,568	30	20.86	9.14	58.18889	MAXIMUM	HEAVY	-	Adaptation	LOW	0	29.11111	42.8
27	87	30.312	13	2	100	17.5	82.5	968,204,288	414,695,424	553,508,864	30	20.78	9.22	56.81111	MAXIMUM	HEAVY	-	Adaptation	LOW	0	38.88889	42.8
28	88	30.312	13	2	100	20.8	79.2	968,204,288	414,494,720	553,709,568	30	20.7	9.3	55.8	MAXIMUM	HEAVY	-	Adaptation	LOW	0	46.22222	42.8
29	89	30.312	13	2	100	29.3	70.7	968,204,288	416,530,432	551,673,856	30	20.62	9.38	52.98889	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	65.11111	43
30	90	30.312	13	2	100	28.7	71.3	968,204,288	415,268,864	552,935,424	30	20.54	9.46	53.31111	MINIMUM	LIGHT	[(26.5, 12)]	NOT Adapt	MEDIUM	0	63.77778	42.9
1	91	29.875	1	1	100	4.8	95.2	968,204,288	414,158,848	554,045,440	30	20.14	9.86	61.75556	MAXIMUM	HEAVY	-	Adaptation	LOW	0	10.66667	42.8
2	92	29.875	2	1	100	8.1	91.9	968,204,288	409,059,328	559,144,960	30	20.06	9.94	60.94444	MAXIMUM	HEAVY	-	Adaptation	LOW	0	18	42.2
3	93	29.562	3	2	100	30.4	69.6	968,204,288	410,488,832	557,715,456	30	19.98	10.02	53.53333	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	0	67.55556	42.4
4	94	29.562	3	2	100	11.4	88.6	968,204,288	408,760,320	559,443,968	30	19.9	10.1	60.02222	MAXIMUM	HEAVY	-	Adaptation	LOW	0	25.33333	42.2
5	95	29.25	3	2	100	13.5	86.5	968,204,288	406,700,032	561,504,256	30	19.82	10.18	59.47778	MAXIMUM	HEAVY	-	Adaptation	LOW	0	30	42
6	96	29.25	3	2	100	7.7	92.3	968,204,288	405,110,784	563,093,504	30	19.74	10.26	61.56667	MAXIMUM	HEAVY	-	Adaptation	LOW	0	17.11111	41.8
7	97	28.812	3	2	100	11.7	88.3	968,204,288	401,162,240	567,042,048	30	19.58	10.42	60.54444	MAXIMUM	HEAVY	-	Adaptation	LOW	0	26	41.4
8	98	28.812	3	2	100	16.8	83.2	968,204,288	402,530,304	565,673,984	30	19.5	10.5	58.86667	MAXIMUM	HEAVY	-	Adaptation	LOW	0	37.33333	41.6
9	99	28.687	3	2	100	9.5	90.5	968,204,288	402,362,368	565,841,920	30	19.42	10.58	61.38889	MAXIMUM	HEAVY	-	Adaptation	LOW	0	21.11111	41.6
10	100	28.687	3	2	100	3.7	96.3	968,204,288	400,060,416	568,143,872	30	19.34	10.66	63.51111	MAXIMUM	HEAVY	-	Adaptation	LOW	0	8.222222	41.3
11	101	28.5	3	2	100	11.6	88.4	968,204,288	396,443,648	571,760,640	30	19.1	10.9	61.27778	MAXIMUM	HEAVY	-	Adaptation	LOW	0	25.77778	40.9
12	102	28.5	3	2	100	23.2	76.8	968,204,288	395,960,320	572,243,968	30	19.02	10.98	57.5	MAXIMUM	HEAVY	-	Adaptation	LOW	0	51.55556	40.9
13	103	28.375	3	2	100	18.5	81.5	968,204,288	395,649,024	572,555,264	30	18.94	11.06	59.15556	MAXIMUM	HEAVY	-	Adaptation	LOW	0	41.11111	40.9
14	104	28.375	3	2	100	23.3	76.7	968,204,288	394,375,168	573,829,120	30	18.86	11.14	57.71111	MAXIMUM	HEAVY	-	Adaptation	LOW	0	51.77778	40.7
15	105	28.312	3	2	100	17.8	82.2	968,204,288	391,725,056	576,479,232	30	18.78	11.22	59.7	MAXIMUM	HEAVY	-	Adaptation	LOW	0	39.55556	40.5
16	106	28.312	3	2	100	31.3	68.7	968,204,288	392,679,424	575,524,864	30	18.7	11.3	55.25556	MAXIMUM	HEAVY	-	Adaptation	LOW	0	69.55556	40.6
17	107	28.25	3	2	100	11.7	88.3	968,204,288	397,103,104	571,101,184	30	18.62	11.38	61.74444	MAXIMUM	HEAVY	-	Adaptation	LOW	0	26	41
18	108	28.25	3	2	100	6.8	93.2	968,204,288	395,218,944	572,985,344	30	18.54	11.46	63.53333	MAXIMUM	HEAVY	-	Adaptation	LOW	0	15.11111	40.8
19	109	28.25	3	2	100	16.1	83.9	968,204,288	393,441,280	574,763,008	30	18.46	11.54	60.58889	MAXIMUM	HEAVY	-	Adaptation	LOW	0	35.77778	40.6
20	110	28.125	3	2	100	6	94	968,204,288	387,551,232	580,653,056	30	18.38	11.62	64.24444	MAXIMUM	HEAVY	-	Adaptation	LOW	0	13.33333	40
21	111	28.125	3	2	100	4.8	95.2	968,204,288	389,918,720	578,285,568	30	18.3	11.7	64.63333	MAXIMUM	HEAVY	-	Adaptation	LOW	0	10.66667	40.3

22	112	28.062	3	2	100	9.7	90.3	968,204,288	389,083,136	579,121,152	30	18.22	11.78	63.12222	MAXIMUM	HEAVY	-	Adaptation	LOW	0	21.55556	40.2
23	113	28.062	3	2	100	10.7	89.3	968,204,288	385,110,016	583,094,272	30	18.14	11.86	63.01111	MAXIMUM	HEAVY	-	Adaptation	LOW	0	23.77778	39.8
24	114	28	3	2	100	11.5	88.5	968,204,288	386,392,064	581,812,224	30	18.06	11.94	62.8	MAXIMUM	HEAVY	-	Adaptation	LOW	0	25.55556	39.9
25	115	28	3	2	100	14.5	85.5	968,204,288	390,037,504	578,166,784	30	17.98	12.02	61.75556	MAXIMUM	HEAVY	-	Adaptation	LOW	0	32.22222	40.3
26	116	27.937	3	2	100	15.7	84.3	968,204,288	393,695,232	574,509,056	30	17.9	12.1	61.31111	MAXIMUM	HEAVY	-	Adaptation	LOW	0	34.88889	40.7
27	117	27.937	3	2	100	17.3	82.7	968,204,288	388,505,600	579,698,688	30	17.82	12.18	61.06667	MAXIMUM	HEAVY	-	Adaptation	LOW	0	38.44444	40.1
28	118	27.875	3	2	100	8.4	91.6	968,204,288	388,898,816	579,305,472	30	17.74	12.26	64.08889	MAXIMUM	HEAVY	-	Adaptation	LOW	0	18.66667	40.2
29	119	27.875	3	2	100	15.9	84.1	968,204,288	391,467,008	576,737,280	30	17.66	12.34	61.61111	MAXIMUM	HEAVY	-	Adaptation	LOW	0	35.33333	40.4
30	120	27.812	3	2	100	19.3	80.7	968,204,288	390,311,936	577,892,352	30	17.58	12.42	60.6	MAXIMUM	HEAVY	[(29.875, 2	Adaptation	LOW	0	42.88889	40.3
1	121	27.812	1	1	100	9.7	90.3	968,204,288	385,384,448	582,819,840	30	17.5	12.5	64.05556	MAXIMUM	HEAVY	-	Adaptation	LOW	0	21.55556	39.8
2	122	27.75	2	2	100	24.2	75.8	968,204,288	384,106,496	584,097,792	30	17.42	12.58	59.34444	MAXIMUM	HEAVY	-	Adaptation	LOW	0	53.77778	39.7
3	123	27.75	4	1	100	27.1	72.9	968,204,288	386,273,280	581,931,008	30	17.18	12.82	58.57778	MAXIMUM	HEAVY	-	Adaptation	LOW	0	60.22222	39.9
4	124	27.687	5	2	100	20.7	79.3	968,204,288	379,334,656	588,869,632	30	17.1	12.9	61.03333	MAXIMUM	HEAVY	-	Adaptation	LOW	0	46	39.2
5	125	27.687	5	2	100	17.6	82.4	968,204,288	377,528,320	590,675,968	30	17.02	12.98	62.22222	MAXIMUM	HEAVY	-	Adaptation	LOW	0	39.11111	39
6	126	27.625	5	2	100	14.5	85.5	968,204,288	380,477,440	587,726,848	30	16.94	13.06	63.24444	MAXIMUM	HEAVY	-	Adaptation	LOW	0	32.22222	39.3
7	127	27.625	5	2	100	16.6	83.4	968,204,288	380,395,520	587,808,768	30	16.86	13.14	62.63333	MAXIMUM	HEAVY	-	Adaptation	LOW	0	36.88889	39.3
8	128	27.625	5	2	100	29.2	70.8	968,204,288	376,307,712	591,896,576	30	16.78	13.22	58.65556	MAXIMUM	HEAVY	-	Adaptation	LOW	0	64.88889	38.9
9	129	27.625	5	2	100	28.5	71.5	968,204,288	376,213,504	591,990,784	30	16.7	13.3	58.97778	MAXIMUM	HEAVY	-	Adaptation	LOW	0	63.33333	38.9
10	130	27.562	5	2	100	22	78	968,204,288	377,831,424	590,372,864	30	16.62	13.38	61.2	MAXIMUM	HEAVY	-	Adaptation	LOW	0	48.88889	39
11	131	27.562	5	2	100	22	78	968,204,288	381,718,528	586,485,760	30	16.54	13.46	61.15556	MAXIMUM	HEAVY	-	Adaptation	LOW	0	48.88889	39.4
12	132	27.562	5	2	100	32.9	67.1	968,204,288	381,005,824	587,198,464	30	16.46	13.54	57.61111	MAXIMUM	HEAVY	-	Adaptation	LOW	1.003	73.11111	39.4
13	133	27.562	5	2	100	26.9	73.1	968,204,288	376,180,736	592,023,552	30	16.38	13.62	59.86667	MAXIMUM	HEAVY	-	Adaptation	LOW	1.01	59.77778	38.9
14	134	27.5	5	2	100	16.8	83.2	968,204,288	379,969,536	588,234,752	30	16.3	13.7	63.22222	MAXIMUM	HEAVY	-	Adaptation	LOW	1.018	37.33333	39.2
15	135	27.5	5	2	100	9.8	90.2	968,204,288	380,698,624	587,505,664	30	16.22	13.78	65.61111	MAXIMUM	HEAVY	-	Adaptation	LOW	1.025	21.77778	39.3
16	136	27.5	5	2	100	14.6	85.4	968,204,288	375,640,064	592,564,224	30	16.14	13.86	64.26667	MAXIMUM	HEAVY	-	Adaptation	LOW	1.032	32.44444	38.8
17	137	27.437	5	2	100	28.5	71.5	968,204,288	379,985,920	588,218,368	30	16.06	13.94	59.58889	MAXIMUM	HEAVY	-	Adaptation	LOW	1.039	63.33333	39.2
18	138	27.437	5	2	100	14.1	85.9	968,204,288	378,580,992	589,623,296	30	15.98	14.02	64.51111	MAXIMUM	HEAVY	-	Adaptation	LOW	1.047	31.33333	39.1
19	139	27.437	5	2	100	27.1	72.9	968,204,288	379,015,168	589,189,120	30	15.9	14.1	60.26667	MAXIMUM	HEAVY	-	Adaptation	LOW	1.054	60.22222	39.1
20	140	27.437	5	2	100	17.8	82.2	968,204,288	381,579,264	586,625,024	30	15.82	14.18	63.35556	MAXIMUM	HEAVY	-	Adaptation	LOW	1.061	39.55556	39.4
21	141	27.375	5	2	100	38.5	61.5	968,204,288	380,915,712	587,288,576	30	15.74	14.26	56.57778	MAXIMUM	HEAVY	-	Adaptation	LOW	1.069	85.55556	39.3
22	142	27.375	5	2	100	39.6	60.4	968,204,288	378,900,480	589,303,808	30	15.58	14.42	56.45556	MAXIMUM	HEAVY	-	Adaptation	LOW	1.083	88	39.1
23	143	27.375	5	2	100	54.5	45.5	968,204,288	378,023,936	590,180,352	30	15.5	14.5	51.61111	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	1.09	0	39
24	144	27.312	5	2	100	54.3	45.7	968,204,288	377,774,080	590,430,208	30	15.42	14.58	51.76667	MINIMUM	LIGHT	-	NOT Adapt	MEDIUM	1.098	0	39
25	145	27.312	5	2	100	29.2	70.8	968,204,288	376,950,784	591,253,504	30	15.34	14.66	60.25556	MAXIMUM	HEAVY	-	Adaptation	LOW	1.105	64.88889	38.9
26	146	27.312	5	2	100	24.6	75.4	968,204,288	373,542,912	594,661,376	30	15.1	14.9	62.15556	MAXIMUM	HEAVY	-	Adaptation	LOW	1.127	54.66667	38.6
27	147	27.312	5	2	100	15.5	84.5	968,204,288	371,658,752	596,545,536	30	15.02	14.98	65.34444	MAXIMUM	HEAVY	-	Adaptation	LOW	1.134	34.44444	38.4
28	148	27.25	5	2	100	15	85	968,204,288	364,535,808	603,668,480	30	14.94	15.06	65.83333	MAXIMUM	HEAVY	-	Adaptation	LOW	1.141	33.33333	37.7
29	149	27.187	5	2	100	0	100	968,204,288	341,536,768	626,667,520	30	14.14	15.86	72.52222	MAXIMUM	HEAVY	-	Adaptation	LOW	1.214	0	35.3
30	150	27.187	5	2	100	0	100	968,204,288	342,040,576	626,163,712	30	14.06	15.94	72.61111	MAXIMUM	HEAVY	[(27.75, 4)]	Adaptation	LOW	1.221	0	35.3
1	151	27.187	1	1	100	0.7	99.3	968,204,288	341,708,800	626,495,488	30	13.9	16.1	72.55556	MAXIMUM	HEAVY	-	Adaptation	LOW	1.236	1.555556	35.3
2	152	27.125	2	2	100	0	100	968,204,288	336,912,384	631,291,904	30	13.82	16.18	73.04444	MAXIMUM	HEAVY	-	Adaptation	LOW	1.243	0	34.8
3	153	27.125	2	1	100	0.2	99.8	968,204,288	345,509,888	622,694,400	30	13.74	16.26	72.76667	MAXIMUM	HEAVY	-	Adaptation	LOW	1.25	0.444444	35.7
4	154	27.125	3	1	100	0.2	99.8	968,204,288	339,517,440	628,686,848	30	13.66	16.34	73.05556	MAXIMUM	HEAVY	-	Adaptation	LOW	1.258	0.444444	35.1
5	155	27.125	4	1	100	0.2	99.8	968,204,288	336,764,928	631,439,360	30	13.58	16.42	73.24444	MAXIMUM	HEAVY	-	Adaptation	LOW	1.265	0.444444	34.8
6	156	27.125	5	1	100	1	99	968,204,288	333,860,864	634,343,424	30	13.5	16.5	73.16667	MAXIMUM	HEAVY	-	Adaptation	LOW	1.272	2.222222	34.5
7	157	27.125	6	1	100	0.5	99.5	968,204,288	323,567,616	644,636,672	30	13.42	16.58	73.78889	MAXIMUM	HEAVY	-	Adaptation	LOW	1.279	1.111111	33.4
8	158	27.062	7	2	100	1.7	98.3	968,204,288	317,128,704	651,075,584	30	13.34	16.66	73.67778	MAXIMUM	HEAVY	-	Adaptation	LOW	1.287	3.777778	32.8
9	159	26.875	7	2	100	10.6	89.4	968,204,288	329,498,624	638,705,664	30	12.14	17.86	71.64444	MAXIMUM	HEAVY	-	Adaptation	LOW	1.396	23.55556	34
10	160	26.937	7	2	100	22.8	77.2	968,204,288	328,863,744	639,340,544	30	12.06	17.94	67.66667	MAXIMUM	HEAVY	-	Adaptation	LOW	1.403	50.66667	34
11	161	26.937	7	2	100	15	85	968,204,288	328,237,056	639,967,232	30	11.98	18.02	70.38889	MAXIMUM	HEAVY	-	Adaptation	LOW	1.41	33.33333	33.9
12	162	26.937	7	2	100	14.9	85.1	968,204,288	329,109,504	639,094,784	30	11.9	18.1	70.47778	MAXIMUM	HEAVY	-	Adaptation	LOW	1.418	33.11111	34
13	163	26.937	7	2	100	20.2	79.8	968,204,288	328,724,480	639,479,808	30	11.82	18.18	68.8	MAXIMUM	HEAVY	-	Adaptation	LOW	1.425	44.88889	34
14	164	26.875	7	2	100	25.1	74.9	968,204,288	328,798,208	639,406,080	30	11.42	18.58	67.61111	MAXIMUM	HEAVY	-	Adaptation	LOW	1.461	55.77778	34
15	165	26.812	7	2	100	7.6	92.4	968,204,288	328,192,000	640,012,288	30	11.34	18.66	73.56667	MAXIMUM	HEAVY	-	Adaptation	LOW	1.469	16.88889	33.9
16	166	26.812	7	2	100	4.6	95.4	968,204,288	327,405,568	640,798,720	30	11.26	18.74	74.68889	MAXIMUM	HEAVY	-	Adaptation	LOW	1.476	10.22222	33.8
17	167	26.75	7	2	100	5.2	94.8	968,204,288	324,411,392	643,792,896	30	10.7	19.3	75.21111	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.527	11.55556	33.5

18	168	26.75	7	2	100	20.6	79.4	968,204,288	325,369,856	642,834,432	30	10.62	19.38	70.13333	MAXIMUM	HEAVY	-	Adaptation	LOW	1.534	45.77778	33.6
19	169	26.75	7	2	100	31	69	968,204,288	326,021,120	642,183,168	30	10.54	19.46	66.72222	MAXIMUM	HEAVY	-	Adaptation	LOW	1.541	68.88889	33.7
20	170	26.687	7	2	100	18	82	968,204,288	324,366,336	643,837,952	30	10.46	19.54	71.21111	MAXIMUM	HEAVY	-	Adaptation	LOW	1.549	40	33.5
21	171	26.687	7	2	100	31.7	68.3	968,204,288	330,317,824	637,886,464	30	10.38	19.62	66.53333	MAXIMUM	HEAVY	-	Adaptation	LOW	1.556	70.44444	34.1
22	172	26.625	7	2	100	24.9	75.1	968,204,288	327,368,704	640,835,584	30	10.22	19.78	69.07778	MAXIMUM	HEAVY	-	Adaptation	LOW	1.57	55.33333	33.8
23	173	26.625	7	2	100	26.4	73.6	968,204,288	328,359,936	639,844,352	30	10.14	19.86	68.63333	MAXIMUM	HEAVY	-	Adaptation	LOW	1.578	58.66667	33.9
24	174	26.625	7	2	100	35.1	64.9	968,204,288	327,520,256	640,684,032	30	10.06	19.94	65.85556	MAXIMUM	HEAVY	-	Adaptation	LOW	1.585	78	33.8
25	175	26.625	7	2	100	20.3	79.7	968,204,288	324,325,376	643,878,912	30	9.98	20.02	70.97778	MAXIMUM	HEAVY	-	Adaptation	LOW	1.592	45.11111	33.5
26	176	26.625	7	2	100	25.5	74.5	968,204,288	319,787,008	648,417,280	30	9.9	20.1	69.5	MAXIMUM	HEAVY	-	Adaptation	LOW	1.599	56.66667	33
27	177	26.625	7	2	100	24.1	75.9	968,204,288	321,150,976	647,053,312	30	9.82	20.18	69.98889	MAXIMUM	HEAVY	-	Adaptation	LOW	1.607	53.55556	33.2
28	178	26.562	7	2	100	7.9	92.1	968,204,288	303,009,792	665,194,496	30	9.74	20.26	76.11111	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.614	17.55556	31.3
29	179	26.562	7	2	100	3.5	96.5	968,204,288	305,860,608	662,343,680	30	9.66	20.34	77.56667	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.621	7.777778	31.6
30	180	26.625	7	2	100	21.5	78.5	968,204,288	307,519,488	660,684,800	30	9.42	20.58	71.76667	MAXIMUM	HEAVY	[(27.125, 6	Adaptation	LOW	1.643	47.77778	31.8
1	181	26.625	1	1	100	19.2	80.8	968,204,288	305,053,696	663,150,592	30	9.34	20.66	72.72222	MAXIMUM	HEAVY	-	Adaptation	LOW	1.65	42.66667	31.5
2	182	26.625	2	1	100	18.5	81.5	968,204,288	306,360,320	661,843,968	30	9.26	20.74	73.01111	MAXIMUM	HEAVY	-	Adaptation	LOW	1.658	41.11111	31.6
3	183	26.625	3	1	100	20.8	79.2	968,204,288	308,002,816	660,201,472	30	9.18	20.82	72.26667	MAXIMUM	HEAVY	-	Adaptation	LOW	1.665	46.22222	31.8
4	184	26.625	4	1	100	14.5	85.5	968,204,288	307,879,936	660,324,352	30	9.1	20.9	74.45556	MAXIMUM	HEAVY	-	Adaptation	LOW	1.672	32.22222	31.8
5	185	26.562	5	2	100	39.4	60.6	968,204,288	307,167,232	661,037,056	30	9.02	20.98	66.27778	MAXIMUM	HEAVY	-	Adaptation	LOW	1.679	87.55556	31.7
6	186	26.562	5	2	100	31.2	68.8	968,204,288	305,467,392	662,736,896	30	8.86	21.14	69.25556	MAXIMUM	HEAVY	-	Adaptation	LOW	1.694	69.33333	31.5
7	187	26.562	5	2	100	11.7	88.3	968,204,288	302,415,872	665,788,416	30	8.78	21.22	75.94444	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.701	26	31.2
8	188	26.562	5	2	100	11.3	88.7	968,204,288	302,321,664	665,882,624	30	8.7	21.3	76.16667	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.709	25.11111	31.2
9	189	26.562	5	2	100	17.5	82.5	968,204,288	299,847,680	668,356,608	30	8.62	21.38	74.25556	MAXIMUM	HEAVY	-	Adaptation	LOW	1.716	38.88889	31
10	190	26.5	5	2	100	36.1	63.9	968,204,288	299,560,960	668,643,328	30	8.54	21.46	68.17778	MAXIMUM	HEAVY	-	Adaptation	LOW	1.723	80.22222	30.9
11	191	26.5	5	2	100	30.7	69.3	968,204,288	299,134,976	669,069,312	30	8.46	21.54	70.06667	MAXIMUM	HEAVY	-	Adaptation	LOW	1.73	68.22222	30.9
12	192	26.5	5	2	100	38	62	968,204,288	307,191,808	661,012,480	30	8.38	21.62	67.45556	MAXIMUM	HEAVY	-	Adaptation	LOW	1.738	84.44444	31.7
13	193	26.437	5	2	100	38.4	61.6	968,204,288	305,307,648	662,896,640	30	8.14	21.86	67.65556	MAXIMUM	HEAVY	-	Adaptation	LOW	1.759	85.33333	31.5
14	194	26.437	5	2	100	30.2	69.8	968,204,288	303,869,952	664,334,336	30	8.06	21.94	70.51111	MAXIMUM	HEAVY	-	Adaptation	LOW	1.767	67.11111	31.4
15	195	26.437	5	2	100	36.1	63.9	968,204,288	306,536,448	661,667,840	30	7.98	22.02	68.53333	MAXIMUM	HEAVY	-	Adaptation	LOW	1.774	80.22222	31.7
16	196	26.437	5	2	100	18.1	81.9	968,204,288	304,852,992	663,351,296	30	7.9	22.1	74.68889	MAXIMUM	HEAVY	-	Adaptation	LOW	1.781	40.22222	31.5
17	197	26.5	5	2	100	13.9	86.1	968,204,288	301,617,152	666,587,136	30	7.5	22.5	76.63333	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.818	30.88889	31.2
18	198	26.5	5	2	100	29	71	968,204,288	301,862,912	666,341,376	30	7.26	22.74	71.86667	MAXIMUM	HEAVY	-	Adaptation	LOW	1.839	64.44444	31.2
19	199	26.5	5	2	100	22.3	77.7	968,204,288	301,076,480	667,127,808	30	7.18	22.82	74.22222	MAXIMUM	HEAVY	-	Adaptation	LOW	1.847	49.55556	31.1
20	200	26.437	5	2	100	24.9	75.1	968,204,288	299,446,272	668,758,016	30	7.1	22.9	73.51111	MAXIMUM	HEAVY	-	Adaptation	LOW	1.854	55.33333	30.9
21	201	26.437	5	2	100	5.2	94.8	968,204,288	293,941,248	674,263,040	30	7.02	22.98	80.33333	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.861	11.55556	30.4
22	202	26.437	5	2	100	3	97	968,204,288	296,316,928	671,887,360	30	6.86	23.14	81.17778	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.876	6.666667	30.6
23	203	26.437	5	2	100	3.4	96.6	968,204,288	284,667,904	683,536,384	30	6.7	23.3	81.62222	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.89	7.555556	29.4
24	204	26.437	5	2	100	4.7	95.3	968,204,288	286,773,248	681,431,040	30	6.54	23.46	81.3	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.905	10.44444	29.6
25	205	26.437	5	2	100	0.9	99.1	968,204,288	284,131,328	684,072,960	30	6.46	23.54	82.75556	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.912	2	29.3
26	206	26.437	5	2	100	0.9	99.1	968,204,288	281,137,152	687,067,136	30	6.38	23.62	82.94444	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.919	2	29
27	207	26.437	5	2	100	2.5	97.5	968,204,288	284,422,144	683,782,144	30	6.3	23.7	82.36667	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.927	5.555556	29.4
28	208	26.437	5	2	100	1.1	98.9	968,204,288	272,785,408	695,418,880	30	6.14	23.86	83.41111	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.941	2.444444	28.2
29	209	26.437	5	2	100	5.8	94.2	968,204,288	271,622,144	696,582,144	30	6.06	23.94	81.96667	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.949	12.88889	28.1
30	210	26.437	5	2	100	3.6	96.4	968,204,288	262,934,528	705,269,760	30	5.98	24.02	83.08889	MAXIMUM	HEAVY	[(26.625, 4	Adaptation	VERY LOW	1.956	8	27.2
1	211	26.437	1	1	100	0.7	99.3	968,204,288	266,305,536	701,898,752	30	5.82	24.18	84.13333	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.97	1.555556	27.5
2	212	26.437	2	1	100	0.7	99.3	968,204,288	264,523,776	703,680,512	30	5.74	24.26	84.28889	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.978	1.555556	27.3
3	213	26.437	3	1	100	0.7	99.3	968,204,288	261,738,496	706,465,792	30	5.66	24.34	84.47778	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.985	1.555556	27
4	214	26.437	4	1	100	4.5	95.5	968,204,288	259,211,264	708,993,024	30	5.58	24.42	83.36667	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.992	10	26.8
5	215	26.437	5	1	100	7.2	92.8	968,204,288	255,729,664	712,474,624	30	5.5	24.5	82.68889	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	1.999	16	26.4
6	216	26.437	8	1	100	4.6	95.4	968,204,288	247,390,208	720,814,080	30	5.18	24.82	84.17778	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.029	10.22222	25.6
7	217	26.375	9	2	100	6.3	93.7	968,204,288	247,382,016	720,822,272	30	5.1	24.9	83.7	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.036	14	25.6
8	218	26.375	9	2	100	0.8	99.2	968,204,288	243,924,992	724,279,296	30	5.02	24.98	85.75556	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.043	1.777778	25.2
9	219	26.375	9	2	100	2.6	97.4	968,204,288	241,979,392	726,224,896	30	4.94	25.06	85.31111	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.05	5.777778	25
10	220	26.375	9	2	100	10.2	89.8	968,204,288	239,984,640	728,219,648	30	4.86	25.14	82.93333	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.058	22.66667	24.8
11	221	26.437	9	1	100	13.2	86.8	968,204,288	238,968,832	729,235,456	30	4.78	25.22	82.05556	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.065	29.33333	24.7
12	222	26.375	10	2	100	3.9	96.1	968,204,288	235,634,688	732,569,600	30	4.7	25.3	85.37778	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.072	8.666667	24.3
13	223	26.437	11	1	100	9.9	90.1	968,204,288	236,380,160	731,824,128	30	4.54	25.46	83.52222	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.087	22	24.4

14	224	26.375	13	2	100	7.6	92.4	968,204,288	234,786,816	733,417,472	30	4.22	25.78	84.71111	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.116	16.88889	24.2
15	225	26.375	13	2	100	13.8	86.2	968,204,288	234,684,416	733,519,872	30	4.14	25.86	82.73333	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.123	30.66667	24.2
16	226	26.375	13	2	100	8.9	91.1	968,204,288	236,376,064	731,828,224	30	4.06	25.94	84.38889	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.13	19.77778	24.4
17	227	26.375	13	2	100	10	90	968,204,288	235,487,232	732,717,056	30	3.98	26.02	84.14444	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.138	22.22222	24.3
18	228	26.375	13	2	100	9.8	90.2	968,204,288	234,422,272	733,782,016	30	3.9	26.1	84.33333	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.145	21.77778	24.2
19	229	26.375	13	2	100	11.6	88.4	968,204,288	229,773,312	738,430,976	30	3.5	26.5	84.34444	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.181	25.77778	23.7
20	230	26.375	13	2	100	7.8	92.2	968,204,288	229,810,176	738,394,112	30	3.42	26.58	85.7	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.189	17.33333	23.7
21	231	26.375	13	2	100	2.4	97.6	968,204,288	229,888,000	738,316,288	30	3.34	26.66	87.58889	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.196	5.333333	23.7
22	232	26.375	13	2	100	1	99	968,204,288	227,160,064	741,044,224	30	3.26	26.74	88.21111	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.203	2.222222	23.5
23	233	26.312	13	2	100	0.9	99.1	968,204,288	230,182,912	738,021,376	30	3.18	26.82	88.23333	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.21	2	23.8
24	234	26.375	13	2	100	2.3	97.7	968,204,288	227,737,600	740,466,688	30	3.1	26.9	87.95556	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.218	5.111111	23.5
25	235	26.375	13	2	100	26.8	73.2	968,204,288	230,670,336	737,533,952	30	3.02	26.98	79.77778	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.225	59.55556	23.8
26	236	26.375	13	2	100	12.8	87.2	968,204,288	227,250,176	740,954,112	30	2.94	27.06	84.63333	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.232	28.44444	23.5
27	237	26.312	13	2	100	2.1	97.9	968,204,288	228,233,216	739,971,072	30	2.86	27.14	88.25556	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.239	4.666667	23.6
28	238	26.312	13	2	100	2.9	97.1	968,204,288	226,406,400	741,797,888	30	2.78	27.22	88.14444	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.247	6.444444	23.4
29	239	26.375	13	2	100	1.5	98.5	968,204,288	226,193,408	742,010,880	30	2.7	27.3	88.7	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.254	3.333333	23.4
30	240	26.375	13	2	100	1	99	968,204,288	224,665,600	743,538,688	30	2.62	27.38	89.02222	MAXIMUM	HEAVY	[(26.437, 1	Adaptation	VERY LOW	2.261	2.222222	23.2
1	241	26.312	1	1	100	9.8	90.2	968,204,288	221,683,712	746,520,576	30	1.82	28.18	87.07778	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.334	21.77778	22.9
2	242	26.312	2	1	100	0.6	99.4	968,204,288	219,455,488	748,748,800	30	1.74	28.26	90.3	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.341	1.333333	22.7
3	243	26.312	3	1	100	2.7	97.3	968,204,288	216,629,248	751,575,040	30	1.66	28.34	89.78889	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.349	6	22.4
4	244	26.312	4	1	100	2.9	97.1	968,204,288	217,247,744	750,956,544	30	1.58	28.42	89.81111	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.356	6.444444	22.4
5	245	26.312	5	1	100	0.9	99.1	968,204,288	213,950,464	754,253,824	30	1.5	28.5	90.66667	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.363	2	22.1
6	246	26.312	6	1	100	1.3	98.7	968,204,288	212,639,744	755,564,544	30	1.42	28.58	90.65556	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.37	2.888889	22
7	247	26.25	7	2	100	6.5	93.5	968,204,288	210,309,120	757,895,168	30	1.26	28.74	89.2	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.385	14.44444	21.7
8	248	26.25	7	2	100	4.9	95.1	968,204,288	216,887,296	751,316,992	30	1.18	28.82	89.58889	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.392	10.88889	22.4
9	249	26.25	7	2	100	3	97	968,204,288	215,179,264	753,025,024	30	1.1	28.9	90.37778	MAXIMUM	HEAVY	-	Adaptation	VERY LOW	2.399	6.666667	22.2