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INFORMATION TECHNOLOGY PAPER I

Grade 11

June Examination 2018

Marks: 120
Time: 2 hours
Reading Time: 10 minutes

Examiner: J Nocton-Smith
Moderator: D Love

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 22 pages (including the extra pages and front cover). Please check that your question paper is complete.
2. Read the questions carefully and make sure that you answer all parts of each question.
3. Answer ALL questions in the space provided. TWO blank pages have been included at the end of the paper. Number each question clearly on these pages, should you use the space.
4. Show all working where applicable.
5. A non-programmable calculator may be used.
6. It is in your own interest to write legibly and to present your work neatly.

	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Total
Possible Marks	10	10	26	12	30	32	120
Actual Marks							

Question 1**Terminology****10 Marks**

Define the following terms. Do NOT expand the acronym. You may use an example to support your answer once you have provided a definition. Please note that examples on their own will not be given any credit. Please do not use brand names.

1.1 Machine Cycle (2)

The processing sequence followed by the CPU
FETCH a programming instruction from memory
DECODE the instructions
EXECUTE the instruction using data if necessary
STORE the result back in memory or send to an output device.

1.2. CSMA/CD Access method (2)

This is the access method used with ethernet technology to handle collisions on a line
CS Carrier sense - the sending devices checks for carrier signal before sending a message
MA Multiple devices have access to the same line
CD if two devices transmit simultaneously a collision will be detected. Each device will wait a random time before resending

1.3 Process (2)

A process is a running program that is in the computers memory. A process includes data.

1.4 Clock Multiplication (2)

The frequency at which certain devices operate is determined by applying a clock multiplier to the FSB speed in some cases. Eg by applying a clock multiplication factor of 8 to the CPU the CPU will be set to run 8 times the speed of the FSB

1.5 Virtual memory (2)

An area of disk reserved by the operating system that can be used as an extension of RAM thus enlarging the address space or places in memory where a program and its data can be stored. Pages are swapped between the hard drive and RAM.

Question 2**Matching Columns****10 Marks**

Column A		Column B	Column C	
2.0	Computer Term	V	A.	A network security system that monitors and controls incoming and outgoing network traffic based on predetermined security rules.
2.1	Hotspot	D	B.	A computer hardware component that allows a computer to connect to a network
2.2	Biometric Input	F	C.	A unique identifier assigned to a network interface controller for communications at the data link layer of a network segment.
2.3	Device Driver	J	D.	Zone for accessing wifi.
2.4	Mac address	C	E.	A memory chip that permanently stores instructions and data.
2.5	NIC	B	F.	A technique for identification/authorisation that uses characteristics of a person for identity verification.
2.6	Proxy Server	I	G.	A standard for connecting peripheral devices to a computer.
2.7	Interpreter	M	H.	A unique string of numbers separated by full stops that identifies each computer using the Internet Protocol to communicate over a network.
2.8	Register	L	I.	A server that acts as an intermediary for requests from clients seeking resources from other servers.
2.9	ROM	E	J.	A piece of software that controls a peripheral on a computer.
2.10	USB	G	K.	Memory that stores programs and data currently in use by the CPU.
			L.	A temporary storage area built into the processor.
			M.	Converts and executes high-level language code one line at a time.
			N.	Device used only with ADSL connections.
			O.	Circuitry responsible for managing a specific hardware part of the computer system.

Scenario

Consider the scenario below when answering the rest of the examination paper:

Ebrahim & Fatima Moosa have purchased a large house in Auckland Park that they intend to set up as a private student residence. The house can accommodate 10 students. They plan to have a manager on site to attend to the needs of the students and handle the administration.

Question 3

System Technologies

26 Marks

Ebrahim and Fatima have received a quote for a server for the technological needs of the business. They need some help to understand the specifications.

Examine the table below.

Processor	Intel® Xeon® processor E3-1225 v5 • 8 MB Cache • 4 Cores • 4 Threads • 3.30 GHz Clock Speed
Memory	16GB DDR4 RAM installed (Maximum RAM 64GB DDR4)
Chipset	Intel C236
Slots	1 PCIe x16 3.0 1 PCIe x4 3.0 1 PCI
Ports	10 x USB, PS2, HDMI, RJ45,
Storage	Up to 6 total SATA HDDs (4 x 3.5" SATA HDD + 2 additional 2.5" SATA HDD)
OS	Microsoft® Windows Server® 2012 OR Red Hat® Enterprise Linux®
Network Controller	Intel I219-LM Gigabit Ethernet LAN 10/100/1000 1-port

3.1 The CPU has a clock speed of 3.30GHz.

3.1.1 What does GHz mean? (2)

1000 000 cycles per second.

3.2 In one of the reviews on the server you found the following comment.

There's a heap of USB 2 and USB 3 ports for conveniently adding external devices; these can be disabled from the BIOS if security is a concern.

3.2.1 Give an example of any device that would connect to a USB 2.0 port. (1)

Keyboard or mice – slower devices

3.2.2 Give an example of any device that would connect to a USB 3.0 port. (1)

External hard drive – anything transferring large amounts of data

3.2.3 Explain what BIOS is. (2)

BIOS is the basic input output system stored in ROM and is used to start up the computer, run POST and load the OS

3.2.4 Explain how it would be possible to use the BIOS to disable the ports. (2)

At start up time – enter the BIOS and navigate the menu system to the option to disable the ports. This setting will be saved to CMOS with the other BIOS settings.

3.3 The maximum amount of RAM that can be installed in this computer is specified as being 64 GB.

3.3.1 Briefly explain the purpose of RAM. (1)

It is a temporary workspace used by the CPU where instructions to be executed and data to be processed are stored so they can be easily accessed by the CPU.

- 3.3.2 What factor is most likely to limit the amount of RAM to 64 GB on this server? (1)

The number of slots on the motherboard and the size of the memory chips (DIMMS)

- 3.4 The Processor has an 8MB cache.

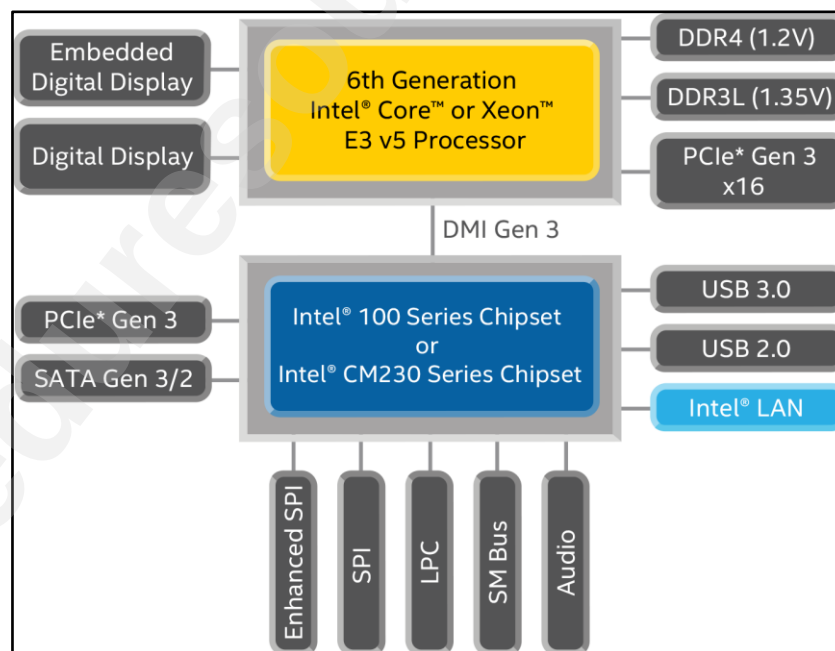
- 3.4.1 Briefly explain the purpose of cache memory. (2)

Cache stores copies of data and instructions from frequently used memory locations in a bid to improve processing speed and efficiency.

- 3.4.2 What type of RAM is usually used in processor caches? (1)

SRAM – static RAM

- 3.5 The system features the Intel C236 Chipset, which is represented in the diagram below.



- 3.5.1 Name the two components of a traditional chipset (2)

Northbridge, southbridge

- 3.5.2. In the new design shown above the features of the northbridge has been built into the Xeon Processor. Name the two **components** connected to the processor. (2)

South bridge, Graphics card, RAM ANY TWO

- 3.5.3. Describe the main advantage of the new design. (2)

Reduces bottlenecks/latency between the CPU and the rest of the motherboard.

- 3.5.4 The Intel C236 chipset does not support overclocking. (2)

3.5.4.1 Explain the term overclocking.

Overclocking involves increasing the clock speed of a component past the rate at which it was originally designed to run by adjusting the clock multiplier or by manipulating the system clock. The latter will affect all components on the system.

- 3.5.4.2 Would the absence of overclocking be an important factor to consider? Explain your answer. (2)

No – overclocking can cause overheating and damage to the components. You need to be very tech-savvy to start overclocking and Ebrahim does not have the necessary skills.

OR Yes – server carry heavy load to provide services to those on the network

- 3.6 The server can support 6 HDDs.

- 3.6.1 Name an alternate storage device that could be used. (1)

SSD – solid state disk

- 3.6.2 Name one advantage and one disadvantage to having an HDD. (2)

Advantage : large capacity – good cost per megabyte ratio

Disadvantage : Not as fast as SDD, less reliable – more susceptible to physical damage.

Question 4

Software

12 Marks

4.1 The operating system is responsible for process management.

4.1.1 Describe TWO process management functions that must occur. (2)

Each process must get enough CPU time to carry out its task properly

CPU is being used efficiently to carry out a many tasks as possible

Each process gets other resources it needs eg memory, IO data
ANY TWO

4.2 The server can be supplied with Windows or Linux as the Operating System.

4.2.1 Which operating system do you think would be most suitable? (2)
Justify your choice.

Windows – easy to support – easier to manage

Linux – good for server – uses less resources - free

4.2.2 Compare the two operating systems in terms of licensing and user support (4)

	Linux	Windows
Licensing	Open source, some versions free, others paid for. Accept copyleft ; GNU	Propriety licence purchased, licence key, 1 per PC. Accept copyright
User support	Mostly via online community. Purchased versions come with some support. No official support, no vendor support	Support via Microsoft either online or phone

4.3 The processor specifications list includes the following two features

- 4 Cores
- 4 Threads

Explain how these two specifications work together with the operating system functions to achieve multiprocessing and multithreading?

(4)

Another name for 4 Cores: **Multiprocessing**

Another name for 4 Threads: **Hyperthreading**

Explain how these two work together to effectively utilise the CPU:

An application can produce multiple threads, each thread can be processed by a logical/virtual core (or loaded on the extra set of registers).

Question 5

Networks

28 Marks

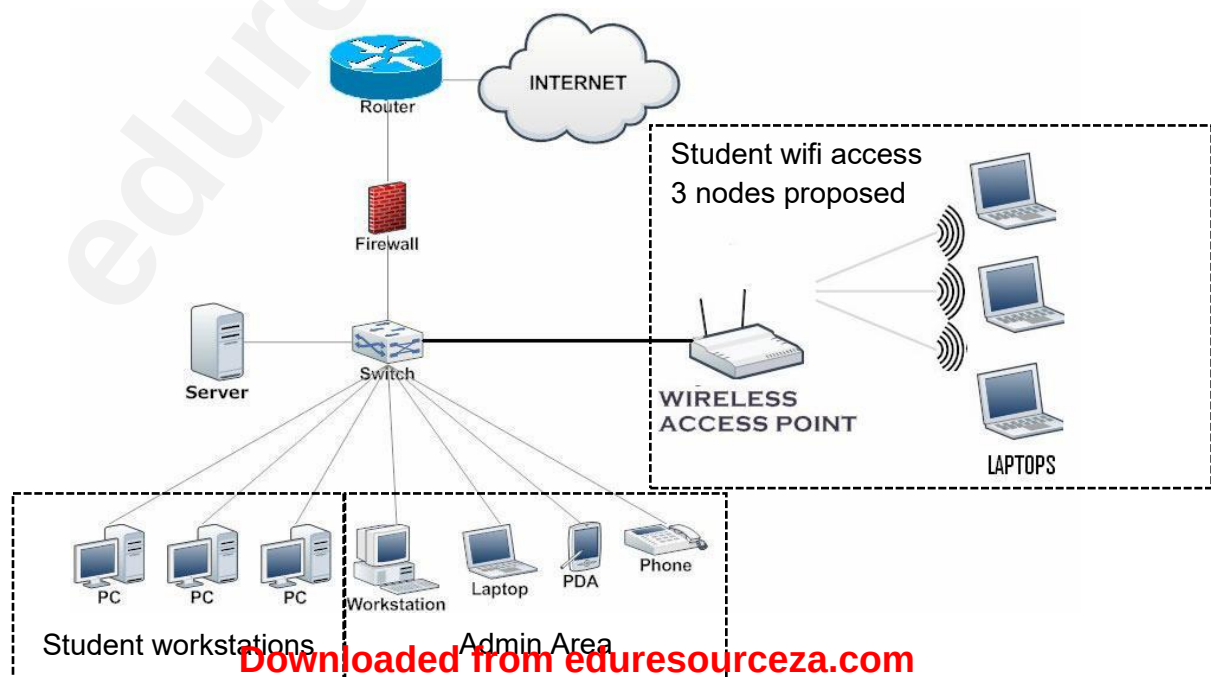
Ebrahim and Fatima have a lot of factors to take into consideration when setting up the network at the residence.

The manager will need to have a workstation that will need to be able to access the server and the internet. They will need a printer for daily printing requirements.

The students will need access to the internet for their own devices.

They will provide 2 workstations for students who do not have their own devices to use.

The proposed network has features of a LAN and a WLAN.



5.1 The network in the diagram above represents a star topology.

5.1.1 Give one advantage and one disadvantage of a star topology. (2)

Easy to setup /install

Flexible to add new devices

A problem with one computer won't affect the others pg 41

5.1.2 Name another network topology. (1)

Ring / bus

5.2 Wired and wireless LANs are being proposed for the network at the residence.

5.2.1 Describe ONE negative aspect of using a WLAN. (1)

Slower the wired

Security can be a problem

5.2.2 What networking device would be used to add wireless functionality to the LAN? (1)

Wireless access point **NOT router!!!!!!**

5.3 The LAN will be making use of Ethernet technology.

Name two features of Ethernet technology. (2)

Star topology, UTP or fibre cables, CSMA/CD access method

- 5.4 Why is it advisable to have a firewall installed at the residence? (2)

Briefly describe TWO reasons.

Yes, students will be accessing internet, downloading, sharing – very vulnerable to

Viruses, cyber threats

- 5.5 For each of the statements below, match the appropriate device/term from the following list.

Repeater, modem, bridge, router

- 5.5.1 The device that connects network segments and reduces traffic. (1)

Bridge

- 5.5.2 This device merely boosts the signal (1)

repeater

- 5.5.3 A device that connects nodes in a star network. (1)

switch

- 5.5.4 A device that connects a local area network (LAN) to another local area network that uses the same protocol. (1)

router

- 5.6 When the students are accessing the internet, they may make use of number of protocols in the TCP/IP suite. For each of the protocols listed below describe what they may be doing. The first one has been completed for you as an example: (3)

FTP	Transferring files between a client and a server on a network
HTTP	Using a browser to access the internet

SMTP	Sending email
VOIP	Using an application such as skype to have a conversation using the IP as the transmission technology

5.7 As well as using the WiFi to access the internet the students will at times set up a PAN.

5.7.1 What technology would be used to create a PAN? (1)

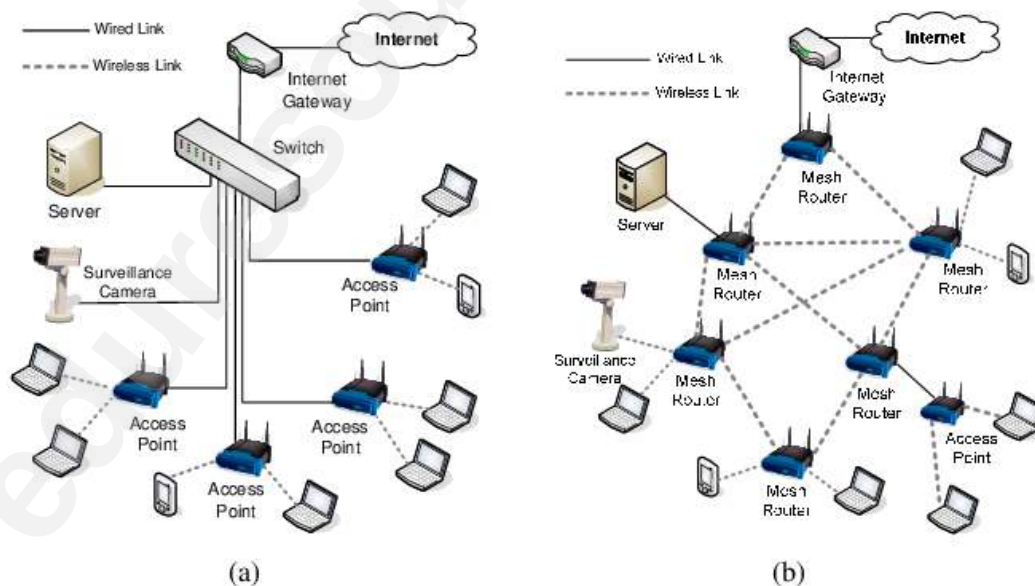
Bluetooth

Consider other options eg airdrop

5.7.2 Explain how they would achieve this. (2)

Devices must be in close proximity – Bluetooth enabled devices can then be paired. Can only make one connection at a time

5.8 Ebrahim and Fatima have been advised that they should consider a Wireless Mesh Network in place of the WLAN. Consider the diagram below that compares a Wireless Mesh Network to a WLAN.



5.8.1 Describe two features of a wireless mesh network? (2)

NW made of a large number of mesh nodes that talk to each other.

Info travels wirelessly from one node to the next choosing the best route

Only one node needs to be physically wired to a NW connection

Marked incorrect if router was mentioned

- 5.8.2 Would you advise that they install a WLAN or Wireless Mesh Network? (1)

WLAN or Wireless Mesh

- 5.8.3 Justify your choice. (2)

Easy to install – covering a relatively small area – cost implications
OR no cabling for WMN

Answer must justify 5.8.2

- 5.9 Ebrahim and Fatima would like to buy the house across the road to expand their business. They would like to extend the network to the new residence.

- 5.9.1 Give TWO possible ways that they could extend the network. (2)

Wireless bridge

Run fibre

- 5.9.2 Give one advantage for each method you have chosen given the scenario. (2)

Bridge: easy way to link if line of sight – no need to dig up road

Fibre: fast reliable connection

- 5.10 IPv6 is a newer version of the original IP addressing system, IPv4.

- 5.11 Why did IPv6 need to be introduced? (1)

IPv4 addresses have 32 bits and allows for 2^{32} separate addresses. (approx. 4 billion addresses) There are now more than 4 billion devices accessing the internet so need to increase the pool of

- 5.1.2 How many bits are used for IPv6 addresses? (1)
- 128.

Question 6

Software development

32 Marks

Ebrahim has asked one of the students to create an application to help with the administration. The student has chosen to use Java. One of the classes he has designed is a **Student** class.

Consider the UML diagram of the Student class below.

Student
- fullName : String - age : int - gender : char - IDNumber : int
+ Student (infullName: String, inAge :int, inGender :char, inIDNumber : int) + setAge (inAge:int) + getIDNumber () : int + toString (): String

- 6.1 There are four different method types in the **Student** class. Constructors, mutators, accessors and toString. (8)

Explain the purpose of the method types in the table below and give an example taken from the **Student** class. Complete the table below.

Method Type	Purpose	Example
Constructor	Used to instantiate an object – assign values to private instance fields when object is created.	+ Student
Mutator	Used to make changes to a private instance field using the value passed as a parameter	+ setAge
Accessor	Used to return value of a private field	+ getIDNumber
toString	Method that returns the values of the instance fields formatted in a string	toString

- 6.2 Below is the Java code of the **selection sort** to sort an array of integers. The code produces an exception.

```
public void selectionSort()
{
    for (int i = 0; i < size; i++)
    {
        for (int j = i + 1; j < size + 1; j++)
        {
            if (arr[i] < arr[j])
            {
                int temp = ipArr[i];
                ipArr[i] = ipArr[j];
                ipArr[j] = temp;
            }
        }
    }
}
```

- 6.2.1 What is an exception? (2)

Error or disruption in program flow

- 6.2.2 Is an exception a syntax / run time or logical error? Circle the correct answer. (1)

Run time

- 6.2.3 Name the construct that Java provide to deal with exceptions? (1)

Try Catch/Exception Handling

- 6.2.4 Complete the trace table below to show why the code will produce an exception. The value of size and the values of the array are given in the trace table. (7)

```
public void selectionSort()
{
    for (int i = 0; i < size; i++)
    {
        for (int j = i + 1; j < size + 1; j++)
        {
            if (arr[i] < arr[j])
            {
                int temp = ipArr[i];
                ipArr[i] = ipArr[j];
                ipArr[j] = temp;
            }
        }
    }
}
```

i	i < size?	j	j < size+1?	arr[i] < arr[j]	size	arr[0]	arr[1]	arr[2]	arr[3]
0	T				4	7	5	10	3
		1	T	F					
		2	T	T		10		7	
		3	T	F					
		4	T	Exception					

6.2.5 Why is it necessary to have a nested loop in a selection sort? (2)

Need to check first element against the rest of the array, then the 2nd el against the rest of the array etc.

6.2.6 What is the name of the sort that improves the efficiency of the selection sort? (1)

Improved selection sort

6.2.7 Explain how this sort is an improvement over a selection sort. (2)

The inner loop finds the position of the highest/lowest and only swap once after the inner loop

6.3 The validation rules for an e-mail address are as follows: (8)

- Email address cannot be a null string
- Email must contain an @
- Domain name must end in ".co.za"

Code a Java method called **validateEmail** to check if the email address is correct. The method must accept a String email address and return a boolean value of true if it is valid and false if it is invalid. Your method should return as soon as it finds an error.

The method is called by:

```
boolean checkEmail = validateEmail (String email);
```

Solution is an algorithm here – but answer MUST be in Java

Begin

Error ← ""

if email IS null

error ← "email cannot be null"

else

if email does not contain @

error ← "email must contain @"

endif

if email does not end in .co.za

error ← "domain must end in .co.za"

Downloaded from eduresourceza.com

```
endif  
endif  
return error  
end
```

1 marks correct method header
2 marks check for null
2 marks check for @
2 marks check for .co.za
1 to return as soon as errors is found

6.5 The validation rules for the e-mail address are as follows: (8)

- Email address cannot be a null string
- Email must contain an @
- Doman name must end in “.co.za”

Create an algorithm / pseudocode for the **validateEmail** method.
NB: Do not write the code out in rough.

Solution MUST be an algorithm

Algorithm:

```
Begin  
  Error ← ""  
  if email IS null  
    error ← "email cannot be null"  
  else  
    if email does not contain @  
      error ← "email must contain @"  
    endif  
    if email does not end in .co.za  
      error ← error + "domain must end in .co.za"  
    endif  
  endif  
  return error  
end
```