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**INFORMATION TECHNOLOGY: PAPER I
MATRIC
PRELIM EXAMINATIONS 2020**

MARKS: 180
TIME: 3 HOURS
READING TIME: 10 MINUTES

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MODERATOR: IT CLUSTER

NAME:

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of **28** pages and 2 Inserts, Appendix A and Appendix B. 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 on the question paper. Please make sure that you write your examination number in the space above.
4. Answer ALL questions – there are no options in this paper.
5. Show all working where applicable.
6. A non-programmable calculator may be used.
7. It is in your own interest to write legibly and to present your work neatly.

There are two blank pages at the end of this paper. In case you run out of space when answering a question, use these pages. Clearly indicate the number of the question you are working on.

SECTION A SHORT QUESTIONS**QUESTION 1 DEFINITIONS****10 MARKS**

Give the most appropriate term for each of the following expressions:

1.1 The physical layout of a network. (1)

1.2 An extension of a private network across a public network to allow remote access. (1)

1.3 A feature that allows a class to have more than one method having the same name. (1)

1.4 A network device that selects the best possible path. (1)

1.5 A cryptographic key that can be obtained and used by anyone to encrypt messages intended for a particular recipient. (1)

1.6 A small electronic circuit embedded into labels, material etc for the purpose of tracking and stock control. (1)

1.7 Software that converts source code into object code. (1)

1.8 A zone for accessing Wi-Fi. (1)

1.9 The amount of data that can be transmitted through any medium in a fixed period of time. (1)

1.10 Data input using human characteristics. (1)

QUESTION 2 MATCHING COLUMNS**10 MARKS**

For each of the items shown in column A below, select the most appropriate definition from column C. Write your answer in column B. Your answer should match the item from column A. The first item in column A has been matched with the letter V and has been done for you as an example.

Column A	Column B	Column C
2.0 Computer term	V	A. A small piece of data sent from a website and stored on a user's computer
2.1 Phishing		B. An email protocol that downloads messages to the mail client when the user connects to the mail server.
2.2 Checksum		C. Permanent software programmed into a hardware chip.
2.3 Hot swapping		D. Used to help detect errors in manually entered data such as check accounts
2.4 Data redundancy		E. A scam in which a perpetrator sends an official looking e-mail that attempts to obtain your personal and financial information.
2.5 SMTP		F. The process of replacing or adding devices in a computer system without stopping or shutting down the system.
2.6 Firmware		G. A value used to verify the integrity of a file or data transfer.
2.7 Denial of Service		H. Malicious code.
2.8 Device driver		I. A part of the network that connects parts of the same network together.
2.9 Cookie		J. A piece of software that controls a peripheral on a computer.
2.10 Botnet		K. A type of cyber-attack which renders a computer unavailable by flooding it with requests until normal traffic is unable to be processed.
		L. Protocol for sending email.
		M. A feature of a computer system by which peripherals are automatically detected and configured by the operating system
		N. Unnecessarily storing data more than once in a single database.
		O. A scamming practice in which malicious code misdirects users to fraudulent Web sites without their knowledge or consent.
		P. A method of software delivery and licensing in which software is accessed online via a subscription.
		Q. A number of computers infected with a type of malware capable of being controlled remotely.

SECTION B SYSTEM TECHNOLOGIES

Consider the following scenario when answering the rest of the examination paper, unless the questions are of a general nature or you are otherwise instructed.

Essential-Offices is an office provider that offer fully furnished, IT-enabled workspaces to entrepreneurs and small businesses. The services they offer include free Wi-Fi, private or co-working spaces, meeting rooms and conference facilities. They also offer on-site technical assistance.

QUESTION 3**42 MARKS**

Callum is a recently qualified Interior Designer and is planning to make use of Essential Offices. He needs to purchase a new laptop that he will be using for administrative and design purposes. His jobs requires him to visit clients and be able to demonstrate design information on his laptop.

The laptop he is considering purchasing has the following specifications:

- 2.3GHz 8-core 9th Gen Intel Core i9 processor (up to 4.8GHz) with 16MB shared L3 cache.
- 16GB of 2666MHz DDR4
- AMD Radeon Pro 5500M with 4GB of GDDR6 memory
- 1TB PCIe-based onboard SSD
- 16.0-inch Retina display, 3072 x 1920, 226ppi
- 100 watt-hour battery, rated to 11 hours of “wireless web”
- 96W USB-C charger
- USB 3.0 ports x 2
- 802.11ac Wi-Fi
- Bluetooth 5.0

Configurable options

- Up to 64GB RAM
- Up to 8TB storage
- AMD Radeon Pro 5500M with 8GB of GDDR6 memory

3.1 Intel is a manufacturer of CPUs and graphics cards. Name the manufacturer of the graphics card in the above specification. (1)

3.2 This laptop has 16GB of DDR4 RAM and the Graphics card has 4GB of GDDR6 RAM

3.2.1 What is the purpose of RAM in a laptop? (1)

3.2.2 Explain ONE difference between onboard graphics and a discrete graphics card. (1)

3.2.3 Explain ONE benefit of GDDR6 RAM over DDR4 RAM. (1)

3.2.4 Give one reason why there is more DDR4 RAM required than GDDR6 RAM. (1)

3.3 The processor includes 16MB of shared L3 cache.

3.3.1 Define processor cache. (2)

3.3.2 Where would the L3 cache be housed? (1)

- 3.3.3 Give ONE reason why the amount of SRAM (cache) is much smaller compared to SDRAM ? (1)

- 3.4 Callum has researched the processor and found the following explanation: 2.3 GHz is the base frequency which your processors run at when in idle state and 4.8 GHz frequency is the maximum frequency which your processor hits when under load. The clock speed automatically drops if CPU overheats.

- 3.4.1 Explain the difference between overclocking the system bus speed vs a CPU with variable speeds. (2)

- 3.4.2 Describe TWO problems that can occur with overclocking the system bus. (2)

Problem 1:

Problem 2:

- 3.5 The interface type for the SSD is PCIe.

- 3.5.1 Describe TWO characteristics of PCIe that are improvements of the older PCI type interface. (2)

Characteristic 1:

Characteristic 2:

- 3.5.2 Describe TWO characteristics of an SSD that are improvements over the older HDDs (2)

Characteristic 1:

Characteristic 2:

- 3.6 The specifications refer to an HDMI port:

- 3.6.1 What is the purpose of a HDMI? (2)

- 3.6.2 What is the difference between a port and a slot? (2)

- 3.7 This laptop comes with a **proprietary** operating system – MacOS Catalina.

- 3.7.1 Give TWO facts about proprietary SW. (2)

Fact 1:

Fact 2:

3.7.2 What are the THREE main functions of any operating system?

(3)

Function 1:

Function 2:

Function 3:

3.8 The battery can provide up to 11 hours of usage.

3.8.1 Explain why this is an important feature to consider. (Relate this to the scenario.)

(1)

3.8.2 Describe TWO methods that Callum can employ to limit power consumption when he is relying on the battery for power for either his smartphone or laptop.

(2)

Method 1:

Method 2:

3.9 Modern processors make use of several techniques to ensure that they operate as efficiently as possible.

3.9.1 Explain the difference between **multithreading** and **hyper-threading**.

(2)

- 3.9.2 If there is a graphics card with RAM is virtual memory still necessary? Motivate your answer. (2)

- 3.9.3 Does the availability of virtual memory mean that adding more RAM to the computer system to improve the performance is no longer necessary? Motivate your answer. (2)

- 3.10 *Essential-Offices* have recommended that for security purposes all clients -

- Keep their antivirus software up to date
- Apply regular updates to the operating system.

- 3.10.1 Name and describe one security risk anti-virus software can protect your system against. (2)

Risk :

Description:

- 3.10.2 Name and describe one security risk that updating the operating system can protect your system from. (2)

Risk :

Description :

3.11 A flash disk is normally plugged into a USB port.

3.11.1 How will a flash disk communicate that it requires the attention of the operating system? (1)

3.11.2 Name TWO resources the OS allocates to the flash drive when it is plugged into the USB port. (2)

SECTION C INTERNET AND COMMUNICATION TECHNOLOGIES

QUESTION 4

49 MARKS

Essential-Offices have a standard network setup that they can replicate at all their facilities.

Refer to **Appendix A** for the network diagram.

4.1 Consider the network diagram.
Describe the purpose of each of the following devices in the network.

4.1.1 Switch (2)

4.1.2 Wireless Access Point (2)

4.2 The network uses a star topology.

4.2.1 Describe TWO advantages of a star topology. (2)

Advantage 1:

Advantage 2:

4.2.2 As with most star topologies the network uses UTP cabling. List ONE advantage and ONE disadvantage of UTP as a connection medium. Your answers may not be opposites of each other. (2)

Advantage:

Disadvantage:

4.3 The link to the ISP is shown at point A in the diagram is a 100 mbps link over fibre. It is important for **Essential-Offices** to have a second, backup connection from the firewall to ensure seamless connectivity for their clients.

4.3.1 Give ONE reason why a fibre connection, which is usually very reliable, might fail causing lost connectivity? (1)

4.3.2 Recommend to **Essential-Offices** TWO other possible internet connection technologies they could use, which will allow them to have a connection of a similar speed. (2)

- 4.4 Most of the clients will be connected to the network via Wi-Fi with the 802.11n standard.

4.4.1 Explain what a **protocol** is. (2)

4.4.2 HTTP and WEBDAV are two protocols used for communication. Describe the role of each protocol. (2)

HTTP : Role

WEBDAV : Role

4.4.3 Name ONE other technology for connecting devices wirelessly over short distances. (1)

4.4.4 Consider the area labelled B in the diagram. Only one of the wireless access points is connected to the switch via a cable. Explain how the other wireless access points will be connected to the network. (2)

- 4.5 Each device connected to the network has two unique identifiers that aid in the routing of traffic an IP address and a MAC address.

4.5.1 Describe each address and state which networking device will make use of that address: (4)

IP Address:

Networking Device:

Mac Address:

Networking Device:

4.5.2. Name the protocol that translates IP addresses to MAC addresses. (1)

- 4.6 **Essential-Offices** need to protect the privacy of the clients by employing high encryption standards for the Wi-Fi. The Wi-Fi protocol makes use of 256 bit encryption.

4.6.1 Explain what is meant by 256 bit encryption. (2)

4.6.2 Do you believe that 256 bit encryption is secure enough for the information being transferred by the clients over the Wi-Fi network? Justify your answer with ONE reason. (2)

4.7 **Essential-Offices** block the **BitTorrent** protocol on their firewall.

4.7.1 Explain what the BitTorrent protocol is used for. (2)

4.7.2 Give TWO reasons why **Essential-Offices** would want to block the use of BitTorrents. (2)

Reason 1:

Reason 2:

4.8 **Essential-Offices** advise their clients to make use of cloud computing and need your help to compile a terminology list.

For each of the following terms you need to:

- Give a brief definition of each
- Describe one advantage of the service provided

4.8.1 Cloud Computing (2)

Definition:

Advantage:

4.8.2 SaaS (2)

Definition:

Advantage:

4.8.3 Server Virtualisation (2)

Definition:

Advantage:

- 4.9 The meeting rooms at **Essential-Offices** provide facilities for video and voice conferencing.

4.9.1 Describe what VOIP is used for. (Do not expand the acronym) (1)

4.9.2 Why would they rather make use of UDP than TCP for video conferencing? (1)

- 4.10 **Essential-Services** have a website to promote the available facilities and to allow clients to book the facilities.

4.10.1 Explain why it is important to encrypt the data of clients booking facilities. (2)

4.10.2 A digital certificate is accessible to the browser to verify the website when the clients are making bookings. List TWO pieces of information that can be found on a digital certificate. (2)

4.11 The technical manager at **Essential-Services** wants to make use of Search-Engine-Optimisation(SEO) on their website.

4.11.1 Explain what Search-Engine-Optimisation is? (2)

4.11.2 One of the criteria for a successful SEO strategy is to manage the key words on the site.

Suggest two possible key words that could be chosen for the **Essential-Services** website. (2)

4.11.3 The **Essential-Services** website is viewed by users with desktop and mobile browsers. Explain why it is necessary for the two versions of the website to have different keyword lists. (2)

SECTION D SOCIAL IMPLICATIONS

QUESTION 5

14 MARKS

Essential-Offices are responsible for protecting their clients for cybersecurity threats while working on their network. They like to keep their clients informed and up to date on the current risks.

5.1 Give TWO approaches on how the Essential-Offices technical staff can keep up to date about learning about new cyberthreats. (2)

Approach 1:

Approach 2:

- 5.2 Despite having installed a firewall on the network, Essential-Services will not let clients access the network if they do not have anti-virus software installed on their laptop.

5.2.1 Why is it insufficient to install an anti-virus solution only on the firewall? (2)

5.2.2 Would an anti-virus safeguard against social engineering? Justify your answer (2)

5.2.3 Name and describe TWO social engineering techniques. (4)

Name 1:

Description:

Name 2:

Description:

- 5.3 As Essential-Offices is making their facilities available to many clients they ask all clients to sign an AUP.

5.3.1 Explain what an AUP is. (1)

5.3.2 Give THREE guidelines you feel are necessary in an AUP. (3)

Guideline 1:

Guideline 2:

Guideline 3:

SECTION E SOLUTION DEVELOPMENT

The booking requests for **Essential-Services** are saved in a database.

QUESTION 6

19 MARKS

The database has the following two tables.

tblClients

ClientID	Company	Name	Contact
101	Cube Interiors	Callum	076980124
102	Allan Auditors	Allan	098765546
103	Sizwe Traders	Sizwe	018765554
104	Wellington Upholsterers	Samuel	098776554

tblBookings

Booking ID	Client ID	Location	Date	Start Time	End Time	Duration	Room	Room Max	Cost/ hour
2001	101	Sandton	2020/07/14	08:15	09:15	01:00	Private Office	2	200
2002	102	Sandton	2020/07/05	09:00	11:00	02:00	Co-Working	15	150
2003	104	Rosebank	2020/07/02	10:30	15:30	05:00	Boardroom	10	250
2004	101	Midrand	2020/07/12	08:00	09:00	01:00	Co-Working	15	150
2005	103	Sandton	2020/07/20	11:00	13:00	02:00	Co-Working	15	150
2006	104	Rosebank	2020/07/25	10:30	13:30	03:00	Boardroom	10	250
2007	102	Rosebank	2020/07/25	09:00	13:00	04:00	Co-Working	15	150

- 6.1 The database has been normalised to second-normal form.
- 6.1.1 List THREE reasons why database tables should be normalised. (3)
- Reason 1:
-
-
- Reason 2:
-
-
- Reason 3:
-
-
- 6.1.2 Describe the term *derived data*. (1)
-
-
- 6.1.3 Identify an example of *derived data* in **tblBookings** (1)
-
-
- 6.2 The primary key for **tblClients** is **ClientID**.
The primary key for **tblBookings** is **BookingID**.
- 6.2.1 Define the term *primary key*. (2)
-
-
-
-
- 6.2.2 Name the term given to the field **ClientID** in the **tblBookings** table. (1)
-
-

6.3 The **tblBookings** table can be transformed to 3rd Normal Form.

6.3.1 Describe TWO characteristics of 3rd Normal Form (2)

Characteristics 1:

Characteristics 2:

6.3.2 Define the term update anomaly. (1)

6.3.3 Identify an update anomaly that can occur in the **tblBookings** table. (1)

6.3.4 Use the diagram below to draw and label ONLY the **transitive** dependencies in the bookings table. (3)

<u>BookingID</u>	ClientID	Location	Date	Start Time	End Time	Duration	Room	Room Max	Cost/hour
------------------	----------	----------	------	------------	----------	----------	------	----------	-----------

- 6.4 Using the original definitions for **tblClient** and **tblBookings** consider the following SQL statement.

```
SELECT Company, Count(*) AS NumBookings
FROM tblClients INNER JOIN tblBookings
ON tblClients.ClientID = tblBookings.ClientID
GROUP BY Company
ORDER BY NumBookings
```

- 6.4.1 Explain what the above SQL statement will do. (2)

- 6.4.2 How would you change the statement if you only wanted to get information about clients who had made more than 5 bookings. (2)

QUESTION 7**26 MARKS**

The software developer is busy writing an OOP application for **Essential-Offices**. One of the classes in the OOP application will be used to define the **Facility** objects. There are also classes for **Rooms Bookings** and **Clients**.

The **Client** class will have the following instance fields:

clientID : integer
 name : string
 contactNumber : string
 membershipType : integer

All instance fields of the **Client** class are **private**.

It will have the following static constants describing the membership type.

DAILY = 1
 WEEKLY = 2
 MONTHLY = 3

The constants are **public** fields.

The **Client** class will have the following methods

- A parameterised constructor that will accept 4 parameters named **cID** (integer) , **n** (string) , **cN**(string), **m** (integer)
- **Accessor** method for the **membershipType** field
- **Mutator** method for the **membershipType** field. This method will have a parameter **m**, of the correct type to match the corresponding field.
- A **toString** method.

7.1 You are required to assist the developers by completing a class diagram for the **Client** class: (8)

Fields
Methods

- 7.2 The class diagram illustrates the use of **encapsulation**. Explain how this is achieved. (2)

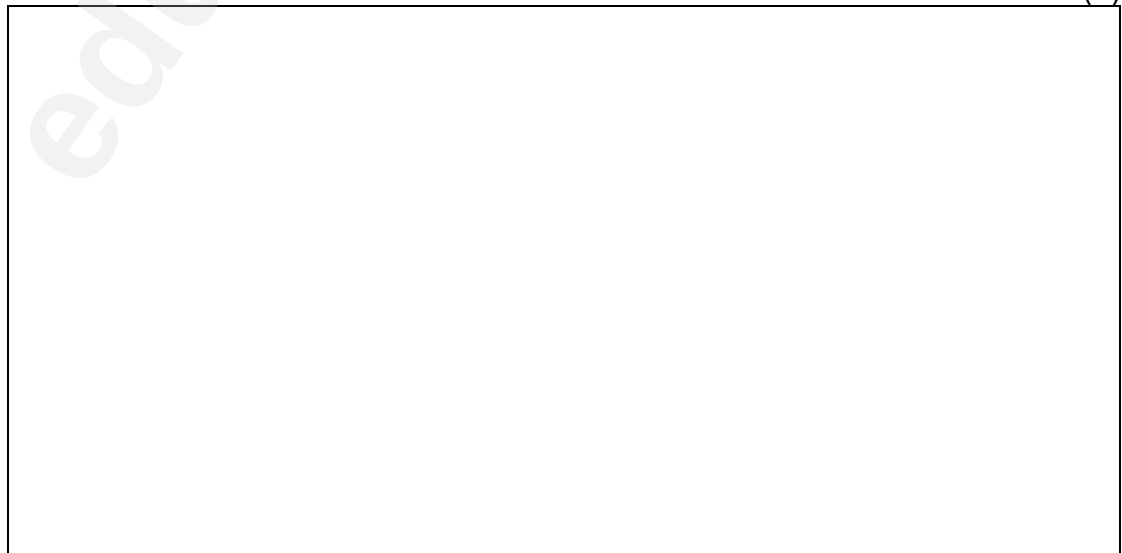
- 7.3 **Essential-Offices** would like to offer special accounts to corporate clients. Corporate clients can select if they would like meals included with their membership.

They would need to store the following additional information for corporate clients.

- Corporate ID – the unique ID of the corporation
- Meal – a boolean field to indicate if meals are included
- Corporate discount – a value between 5 and 15

- 7.3.1 Describe the concept of inheritance. (2)

- 7.3.2 Draw an inheritance diagram to show how the class CORPORATE-CLIENTS could be implemented as a subclass of the CLIENT class. (3)



7.4 The following data structures can be used in the application programs:

- Array
- Database
- Text file

Which ONE of the above data structures will be most suitable to use in EACH of the following cases:

NOTE: Each data structure from the list above can be used only once as an answer.

7.4.1 A large amount of data about the bookings needs to be saved to be used at a later stage. (1)

7.4.2 Sorting a list of clients in alphabetical order. (1)

7.4.3 A small portable file for storing one days' results of a client satisfaction survey. (1)

- It can only contain digits
- The first digit must be a 0
- There must be 10 digits

Write an algorithm (using pseudocode) to determine whether the **contact** value entered is valid.

Indicate each type of error messages

(8)

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QUESTION 8

10 MARKS

- 8.1 The OOP application that is being developed will hold an array of available rooms. The room codes are stored in the array as a string. Once a room is booked it is removed from the array. The programmer has implemented the “shift left” algorithm, but his code is not working correctly. The algorithm he used to code his program is given below.

Assume the array has the following values.

The room with code R103 needs to be removed from the array.

roomArr[0]	roomArr[1]	roomArr[2]	roomArr[3]
R101	R103	R201	R203

1	size $\leftarrow$ number of elements in roomArr
2	found $\leftarrow$ false
3	input roomCode
4	count $\leftarrow$ 0
5	while not found
6	if roomArr[count] = roomCode
	then begin
7	for i $\leftarrow$ count to < size -1
	begin
8	roomArr [count] = roomArr [count + 1]
	end loop
9	found $\leftarrow$ true
	endif
10	count $\leftarrow$ count + 1
11	end loop

- 8.1.1 Complete the trace table in **Appendix B** to analyse the algorithm. The first few lines have been completed for you. (8)

- 8.1.2 Enter the final values in the array below. (1)

roomArr[0]	roomArr[1]	roomArr[2]	roomArr[3]

- 8.1.3 Suggest how to correct the algorithm. (1)

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