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SUBJECT	Information Technology	DATE	Nov 2023
GRADE	11	MARKS	125
PAPER	Theory	DURATION	2.5 hours
EXAMINER	<<Insert name>>	MODERATOR	Ms Kench

NAME

MEMO

QUESTION 1**SHORT QUESTIONS****10 MARKS**

Select the term that correctly matches the definition. Write the letter of the correct term in the Answer column.

Write down the correct term for each definition:

	Definition	Answer		Term
1.1	A digital multimedia file format that is used for storing video and audio.	I	A.	Web 3.0
1.2	A translator that creates a separate file to the source code.	J	B.	UEFI
1.3	A network protocol that allocates IP addresses to mobile devices.	H	C.	DNS
1.4	An extension of the FTP protocol used edit files on remote servers.	N	D.	Point-to-point
1.5	Replaces the traditional BIOS on newer PCs.	B	E.	GUI
1.6	Maintains a directory of domain names and translates them into IP addresses.	C	F.	Web 2.0
1.7	An interactive website customised to your cookies and location.	A	G.	Web cache
1.8	Directly connects two nodes of a network.	D	H.	DHCP
1.9	Storing recently accessed websites on a local server	G	I.	MP4
1.10	A type of user interface associated with the use of icons and menus.	E	J.	Compiler
			K.	SMTP
			L.	Interpreter
			M.	MP3
			N.	WebDav
			O.	Broadcast
			P.	Browser cache

SCENARIO

Phindile is a successful social media influencer. She creates content while providing advice on travel locations. She has rented an open-plan office where she will work with two content editors and an office administrator.

Phindile has decided to purchase three laptops: two for the content editors and one for herself which she will use when she travels. The following laptop specifications are provided by an IT Technician consultant.

QUESTION 2

SYSTEM TECHNOLOGIES

31 MARKS

Lenovo Yoga 9i 14 2-in-1 14" Touchscreen Laptop 4K UHD	
Processor	Intel 3 GHz i7 family
Number of Processors	4
RAM	16 GB DDR4 SDRAM
Hard Drive	512GB PCIe SSD
Graphics Coprocessor	Integrated Intel Iris Xe Graphics
Screen Display Size	14 inches
Screen Resolution	3840 x 2160 pixels
Ports	USB-C and Thunderbolt

- 2.1 The laptop has 4 processors. Which is more likely? Four physical processors mounted on the motherboard or one quad-core processor? (1)

One quad-core processor ✓

- 2.2 Explain how the number of cores affects the laptop's processing speed. (2)

Each core can process data and instructions in parallel ✓, the more cores, the faster the processing. ✓

- 2.3 The laptop has an integrated GPU. What does this mean? (2)

The GPU is built into the same chip ✓ as the CPU. ✓

- 2.4 Phindile's work requires editing large video and image files.

2.4.1 Virtual memory is frequently used when processing large image and video files.

- a) Define virtual memory.

Use secondary storage ✓ as an extension to RAM. ✓ (2)

- b) Explain how will virtual memory affect the laptop's performance?

The laptop will be slower ✓ since the memory pages will need to be swapped in and of RAM. ✓ (2)

2.4.2 How can she improve her computer speed when processing graphics?

Install a graphics card. ✓

(1)

2.4.3 Justify your answer in Question 2.4.2 giving **TWO** reasons.

Graphics card has dedicated RAM ✓ (VRAM) to store the images – freeing up main memory. The GPU frees up the CPU to process images in parallel. ✓

(2)

2.5 The IT technician is considering overclocking her laptop.

2.5.1 Define overclocking.

(2)

Increasing the speed of all components ✓ by increasing the system bus ✓ speed
OR

Increasing the clock multiplication factor of one component to change its speed without affecting the others.

2.5.2 Give **ONE** advantage and **ONE** disadvantage of overclocking.

(2)

Advantage: improved performance ✓

Disadvantages: heat generation/reduced component lifespan/instability and crashes/power consumption. ✓

2.6 Complete the table to name and explain the stages of the machine cycle. Use the completed stage as an example.

STEP	EXPLANATION
FETCH	Retrieves an instruction from memory ✓
DECODE	Translate instructions into computer commands
EXECUTE	Commands which have been translated in the decode function are executed by the CPU ✓
STORE	The results of the operation are stored back into memory. ✓

(6)

2.7 The SSD secondary storage is connected with a PCIe bus. Name ONE other high secondary storage high-speed connection.

NVMe ✓

(1)

2.8 Phindile has multiple applications open on her laptop. Several programs appear to be running simultaneously.

2.8.1 What is the term used to describe this?

(1)

Multitasking ✓

2.8.2 Explain how the computer accomplishes this.

(3)

- Operating system schedules which processes have access to the CPU at a specific time. The OS prioritises the tasks. ✓

- Context switching – OS saves state of current process and loads the next process. Switching happens extremely fast allowing multiple processes to run in quick succession. So fast that it appear simultaneous. ✓
- Interrupts handle events that need immediate attention, like hardware interrupts (mouse click) or software exceptions (division by zero) ✓

QUESTION 3 INTERNET AND NETWORK TECHNOLOGIES 31 MARKS

Phindile is considering whether to install a bounded or wireless LAN in the office. The LAN will connect the three laptops, a printer, a large screen and multiple smartphones.

3.1 Which LAN type should she choose? Place a cross next to the correct answer.

Bounded		Wireless	X
---------	--	----------	---

(1)

3.1.1 Justify your answer with THREE reasons.

Wireless:

- Higher bandwidth/speed✓
- Easy to connect more devices✓
- Devices are potable / do not need to sit at dedicated desks✓

(3)

3.1.2 Name one extra device needed for your choice in Question 3.1.

(1)

Switch / WAP✓

3.2 Name the device needed to connect the LAN to the Internet.

Router✓

(1)

3.2.1 Give TWO functions of a router beside connecting to the Internet.

Convert packets to frames. ✓

Path selection✓

(2)

3.3 Explain the purpose of Address Resolution Protocol (ARP) in the network.

(2)

Links the MAC addresses of devices✓ to the IP addresses✓ of the devices

3.4 Use FOUR from the list below to complete the Ethernet data frame:

- Frame Check Sequence
- Protocol
- Packet
- Destination MAC address
- Destination IP Address
- Source MAC Address
- Source IP Address

Preamble and Start	A	B	Length/type	C	D	Inter-frame gap
--------------------	---	---	-------------	---	---	-----------------

8 bytes	6 bytes	6 bytes	2 bytes	up to 1500 bytes	4 bytes	12 bytes
---------	---------	---------	---------	------------------	---------	----------

- A Destination MAC Address✓
- B Source MAC Address✓
- C Data or Payload✓
- D FCS✓

(4)

3.5 A VLAN data frame adds a 'VLAN Tag' to the content of the frame.

3.5.1 What is the purpose of a VLAN tag?

The VLAN Tag identifies which **virtual network** the frame belongs to. OR logically✓ divides the network✓ into manageable parts

(1)

3.5.2 Would the data coming into Phindile's network need to have a VLAN tag? Briefly explain your answer. Place a cross next to the correct answer.

Yes		No	X✓
-----	--	----	----

(1)

3.5.3 Justify your answer to Question 3.6.2.

Phindile's LAN is too small ✓to justify dividing it into virtual networks.

(1)

3.6 Why would Phindile's IT technician set up her email to use the IMAP protocol instead of POP3? (2)

POP3 deletes the email from the server after it has been downloaded. ✓ The user can not access it again from another device. Phindile is working off several devices, as well as travelling, making IMAP more suitable as the email remains on the server ✓and can be accessed again from other devices.

3.7 Phindile's podcasts can be downloaded or streamed. Give TWO advantages of downloading the podcasts instead of streaming. (2)

Save on local computer / have a copy✓

Useful if Internet access is slow. ✓

3.7.1 Name the ideal protocol for downloading the podcasts.

FTP✓

(1)

3.7.2 In order for Phindile's podcasts to be uploaded quickly, compression technology must be used.

a) Name a suitable compression technology to allow for fast file uploading.

Lossy✓

(1)

b) Explain how the technology in Question 3.7.2a) works.

(2)

Reduction of the file size✓ by removing some data✓ that is considered less important to the recording.

c) List ONE disadvantage of the technology in Question 3.7.2a).

- 3.8 Phindile has a website where log in before they can download their podcasts. Phindile has been advised that she needs to add a cookie consent pop-up to her website shown below:

This site uses cookies

Select which cookies to opt-in to via the checkboxes below; our website uses cookies to examine site traffic and user activity while on our site, for marketing, and to provide social media functionality. [Read more details](#)

☒ Required ☐ Functionality ☐ Analytical ☐ Marketing

Save

- 3.8.1 The cookie consent pop-up is coded into the webpage using scripting.

- a) Would the consent pop-up be client-side or server-side scripting? Place a cross next to the correct answer.

Client-side	X✓	Server-side	
-------------	----	-------------	--

(1)

- b) Justify your answer to Question 3.8.1a) with ONE reason.

- the pop up does not need to be customised for the user. It is standard. ✓
- the popup will execute faster

(1)

- c) Explain why the website needs to notify the user about cookies.

It is illegal to store or use a user's personal data OR POPI act requires consent✓

(1)

QUESTION 4

SOCIAL IMPLICATIONS

13 MARKS

- 4.1 Write the correct term for the computer crime definitions below. (6)

- 4.1.1 Using observational techniques, such as looking over someone's shoulder, to gain private information such as a password.

Shoulder surfing✓

- 4.1.2 A browser attack to redirect a user's web traffic to another, bogus site.

Pharming✓

- 4.1.3 A vast number of Internet-connected devices that send transmissions (including spam or viruses) without the device owner's knowledge. Often used in a DDOS.

Botnet/zombie army✓

- 4.1.4 Obtaining discarded data such as invoices, phone records, organisational information, and sensitive data printouts to manipulate people.

Dumpster diving✓

4.1.5 A seemingly harmless program that when executed, causes harm to a computer system.

Trojan horse✓

4.1.6 An individual who gains unauthorised access to computer systems often with the intent of stealing data.

Hacker✓

4.2 Explain **TWO** ways that Phindile can safeguard her laptop data against criminal activity. (2)

- Use strong, unique passwords✓
- Antivirus software✓
- Keep OS and software up to date
- Be aware of email and online scams
- Backup data regularly
- Install a firewall
- Be cautious of public wifi connections

ANY CORRECT TWO

4.3 Phindile needs to ensure her website can be used as a reliable travel source with accurate information.

Name and explain TWO criteria used by users to evaluate the website as a valid data source.

Affiliation✓ (e.g. who supports the source?) ✓

- Audience ✓ (e.g. level at which it is written/who is it intended for?) ✓
- Authority (e.g. who is the author and what are his/her credentials?)
- Content (e.g. organisation of content and working links)
- Currency (e.g. is the information on the source up-to-date?)
- Design (e.g. is it easy to navigate and visually pleasing? How quickly does it download?)
- Objectivity (e.g. does it reflect any preconceptions?)

ANY CORRECT TWO + DESCRIPTION (4)

4.4 Phindile has a printer in the office. She wants to inform her employees to only print when necessary printing.

4.4.1 What is the name of the policy document that defines the set of rules for employees in an organisation?

AUP✓ (1)

4.4.2 Name ONE item that must be printed in this scenario, considering most data can be stored digitally.

AUP, Employee contracts, Posters about the company – such as Health and safety. ✓ ANY CORRECT ANSWER (1)

4.4.3 Justify your answer to Question 4.5.2 with ONE reason.

QUESTION 5 DATA & INFORMATION MANAGEMENT AND SOLUTION DEVELOPMENT 40 MARKS

5.1 Phindile has set up a database with a table called **tblFollower** to store details about the people who follow her podcasts. The table fields and first record is shown below:

ID	Surname	FirstName	DateJoined	DOB
	Naidoo	Jon	20-07-2018	16-12-1987

5.1.1 The ID number is generated using the following SQL statement:

MS Access:

```
UPDATE tblFollower
SET ID = YEAR(DOB) & LEFT(FIRSTNAME,2) &
        RIGHT(SURNAME,2)
WHERE surname = 'Naidoo' AND FirstName = 'Jon'
```

MySQL:

```
UPDATE tblFollower
SET ID = CONCAT((YEAR(DOB),LEFT(FIRSTNAME,2),
                RIGHT(SURNAME,2))
WHERE surname = 'Naidoo' AND FirstName = 'Jon'
```

Write down the ID generated value for Jon Naidoo.

1987✓Jo✓oo✓

(3)

5.1.2 Give an example of how the following data FOUR validation checks can be used to ensure the date fields are valid.

Validation Check	Example
Presence Check	Ensure the date of birth is filled in✓
Format Check	Both dates must be in the format dd-MM-yyy✓
Range Check	The date joined is not in the future✓
Logic Check	Ensure the date of birth is older than 18 ✓ OR the dob is before the date joined

(4)

5.2 A class called Follower has been created in a Java program. Using the information in the code below, create the class diagram for the **Follower** class.

```
public class Follower
{
    private String firstName;
    private String surname;
```

```
private LocalDate dateJoined;
private LocalDate dob;

private static int totalFollowers = 0;
private static final int MINAGE = 16;

public Follower(String fN, String sN, LocalDate dJ,
                LocalDate d)
{
    firstName = fN;
    surname = sN;
    dateJoined = dJ;
    dob = d;
    totalFollowers = totalFollowers + 1;
}

public String getSurname()
{
    return surname;
}

public static int getTotalFollowers ()
{
    return totalFollowers
}
}
```

Follower
- ✓ firstName ✓ : string ✓ - surname : string - dateJoined : Date - dob : Date - <u>totalFollowers : integer = 0</u> ✓ ✓ - <u>MINAGE : integer = 16</u> ✓
+ Constructor ✓ (fN : string, sN : string, dJ : Date, d : Date) ✓ + getSurname() : string ✓ + <u>getTotalFollowers() : integer</u> ✓

- ✓ private fields ✓ correct type ✓ correct names
- ✓ totalFollowers correct type and name ✓ underlined
- ✓ MINAGE underlined, correct type and name
- ✓ public constructor ✓ correct parameters
- ✓ correct getSurname
- ✓ getTotalFollowers correct and underlined

(10)

5.3 Explain why the totalFollowers field is declared as:

5.3.1 static

It does not belong to an object ✓ since it adds up all the follower objects instantiated. ✓ (2)

5.3.2 not declared as final

It is changed in the constructor ✓ (1)

5.4 A theoretical real number storage system on a computer uses 6 digits to store a rounded mantissa and its sign and three digits to store the exponents and its sign. Show how the real number:

$$0.434511677 \times 10^{105}$$

will be stored below and indicate any errors if any.

Mantissa sign	Mantissa	Exponent Sign	Exponent
+	43452✓	+	10 or 05✓ Overflow✓

(3)

5.5 Identify the types of addresses next to each address below.

Address	Type of address
192.168.0.1	IPv4 address✓
00:1A:2B:3C:4D:5E	MAC address✓
2001:db8:85a3:0:0:8a2e:370:7334	IPv6 Address✓

(3)

5.6 Phindile now has over 120 000 followers. You have been asked to write code to search an array of **Follower** objects given their unique **numerical** ID value. The array is sorted in ascending order of their **ID** field.

5.6.1 Which search algorithm will execute the fastest? (1)

Binary search✓

5.6.2 Explain how the algorithm in Question 5.6.1 executes. (2)

The sorted data is divided in half, ✓ and one half is discarded (reducing the number of comparisons). ✓ This process is repeated until the correct element is found.

5.7 The following program searches a String array called **strArr** using the parameter **st**.

Line	Code
	public int mySearch (String st)
	{
	i = -1;

1.	for (int i = 0; i < size; i++;)
	{
2.	if (strArr[i].equals(st) && strArr[i].charAt[0] >= 'M')
	{
3.	return i;
	}
	}
4.	return i;
	}

5.7.1 Complete the following trace table using the following data values:

size = 4
strArr = [Mbili, Howard, Smith, Zulu]
st = Smith

(5)

Line	i	i < size?	strArr[i].equals(st) && strArr[i].charAt[0] >= 'M'?	Return
1. ✓	0 ✓	true ✓		
2.			false ✓	
1.	1	true		
2.			false	
1.	2	true		
			true	
3.				2 ✓

One mark per column

5.8 Phindile wants to give away a new item of merchandise. She wants to use the following criteria: A person must be a follower and has liked more than 100 podcasts, or is not a follower and has bought more than 10 items of merchandise.

Let: F = is a follower,

L = liked more than 100 podcasts and

M = bought more than 100 items.

We can write a function to describe such a person as: $f(F,L,M) = (F.L) + (F'.M)$

5.8.1 Complete the truth table below to assist Phindile.

F	L	M	F'	F.L	F'.M	(F.L) + (F'.M)
0	0	0	1✓	0✓	0✓	0✓✓
0	0	1	1	0	1	1
0	1	0	1	0	0	0
0	1	1	1	0	1	1
1	0	0	0	0	0	0
1	0	1	0	0	0	0
1	1	0	0	1	0	1
1	1	1	0	1	0	1

(5)

5.8.2 Complete the following function which represents all the valid outcomes (3) determined through the truth table:

$$f(F,L,M) = (F'L'M) + (F'LM) \checkmark + (FLM') + \checkmark (FLM) \checkmark$$

(3)