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|-----------------|-----------------------------------------------------|-----------------|---------------|
| <b>SUBJECT</b>  | <b>Information Technology</b><br>Theory Examination | <b>DATE</b>     | November 2022 |
| <b>GRADE</b>    | Grade 11                                            | <b>MARKS</b>    | 125           |
| <b>EXAMINER</b> | D Kench                                             | <b>DURATION</b> | 2.5 hours     |

**NAME:**

**PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY:**

1. This paper consists of **19** pages. Please check that your paper is complete.
2. Answer ALL questions.
3. Read each question carefully before answering.
4. Write neatly and legibly.
5. Write your name on the cover page.
6. Extra space is provided at the back. Write the question number next to any additional answers.

| <b>QUESTION</b>       | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b>  | <b>5</b>  | <b>6</b>  | <b>7</b>  | <b>TOTAL</b> |
|-----------------------|----------|----------|----------|-----------|-----------|-----------|-----------|--------------|
| <b>Possible Marks</b> | <b>7</b> | <b>5</b> | <b>5</b> | <b>25</b> | <b>30</b> | <b>15</b> | <b>38</b> | <b>125</b>   |
| <b>Actual Marks</b>   |          |          |          |           |           |           |           |              |

## SECTION A – TERMINOLOGY

17 MARKS

## QUESTION 1 - MATCH THE COLUMNS

7 MARKS

Choose the letter from **Column B** that matches the statement in **Column A**. Write your answer next to the question in the **Answer** column.

| Column A |                                                                                                         | Answer | Column B               |
|----------|---------------------------------------------------------------------------------------------------------|--------|------------------------|
| 1.1      | The amount of data a register in the CPU can hold at a given time.                                      | D      | A. Low Level Language  |
| 1.2      | When a program is broken down into parts, each part is executed simultaneously on different processors. | K      | B. IMAP                |
| 1.3      | A program that is machine dependent and can only be executed on the machine on which it has compiled.   | A      | C. Malware             |
| 1.4      | Non-unique numerical label assigned to each device on a network.                                        | E      | D. Word Size           |
| 1.5      | An email protocol that allows users to keep their emails on the server.                                 | B      | E. IP address          |
| 1.6      | An access modifier that allows fields and methods of the class to be accessed outside the class         | I      | F. High Level Language |
| 1.7      | A seemingly harmless program that, when activated, causes harm to the computer system                   | J      | G. MAC Address         |
|          |                                                                                                         |        | H. POP3                |
|          |                                                                                                         |        | I. Public              |
|          |                                                                                                         |        | J. Trojan Horse        |
|          |                                                                                                         |        | K. Parallel Processing |
|          |                                                                                                         |        | L. Private             |
|          |                                                                                                         |        | M. Multiple Processing |

**QUESTION 2 - SHORT ANSWERS****5 MARKS**

2.1 What is a MAC address?

Unique identifier of a network card. ✓

(1)

2.2 Define processor cache.

Static memory in or near the CPU to store next few instructions and data ✓

(1)

2.3 UEFI has replaced the traditional BIOS systems. Give an advantage that UEFI has over BIOS.

Boot from larger hard disk drives

Can run in 32 or 64 bit mode

Set up screens are more user friendly

Secure boot/ networking features/ does lot more than BIOS/ stored in flash memory or HDD ✓

ANY ONE

(1)

2.4 Define topology.

The physical set up of a network ✓

(1)

2.5 What is spoofing?

Fraudulent email or website address that appears valid ✓

(1)

## QUESTION 3 - MULTIPLE CHOICE..

5 MARKS

## CIRCLE THE CORRECT OPTION

- 3.1 The smallest signed number that can be represented using 4 bits is:
- a. 0
  - b. 16
  - c. -8
  - d. -7
- 3.2 The section of the CPU that sends read or write signals to memory is:
- a. Control Unit
  - b. Arithmetic Logic Unit
  - c. Register
  - d. Cache
- 3.3 Which is not required in Web 4.0?
- a. Cookies
  - b. Server-side scripting
  - c. Device location
  - d. Webmaster
- 3.4 An assembler is classified as:
- a. A driver
  - b. An operating system
  - c. System software
  - d. Application software
- 3.5 Give the correct sequence of the machine cycle
- a. FETCH, DECODE, EXECUTE, STORE
  - b. STORE, FETCH, DECODE, EXECUTE
  - c. FETCH, DECODE, STORE, EXECUTE
  - d. DECODE, STORE, EXECUTE, FETCH

## SCENARIO

A high school called **New High School** hosts an annual event to showcase students' projects across all grades and subjects. Various venues are used to display the projects to other students, teachers and family members. The projects are available online for those who cannot attend the in-person event.

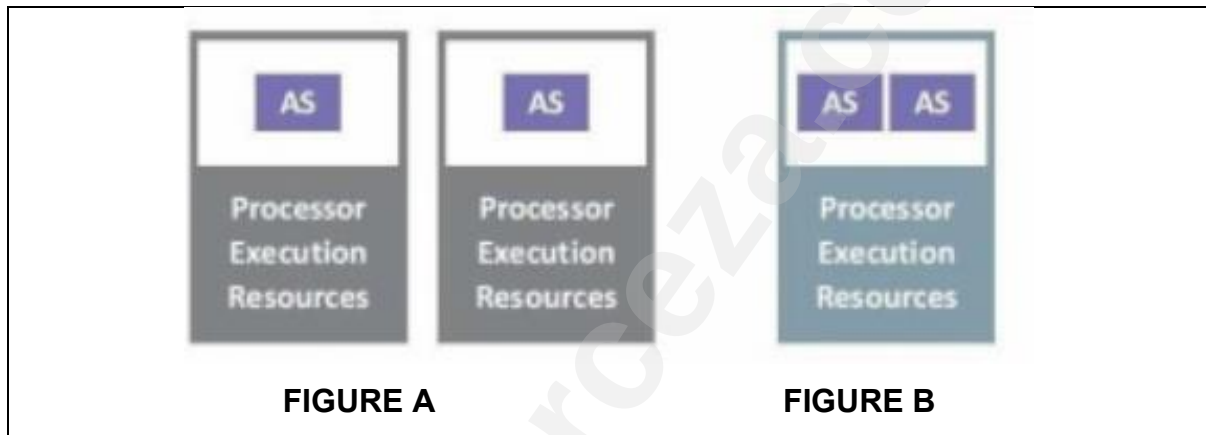
## SECTION B – SYSTEM TECHNOLOGIES

25 MARKS

### QUESTION 4

25 MARKS

- 4.1 Some students brought their own devices for the showcase. Figure A and B show the architecture of 2 different processors. **AS** refers to registers, and **Processor Execution Resources** refer to the Cores on the CPU,



- 4.1.1 Name the hardware processing technique used in:

Figure A: Multiprocessing ✓

Figure B: Hyperthreading ✓

(2)

- 4.1.2 Describe how the CPU will execute processes in Figure A compared to Figure B.

Multiprocessing: each core will execute a different process separately at the SAME TIME. ✓

Hyperthreading: one process will be preloaded on the CPU's registers while the CPU executes another process. They are not executed simultaneously. ✓

Accept explanation from incorrect answer in 4.1.1

(2)

- 4.2 The teacher opens a desktop computer in the computer lab to show the motherboard components, internal devices and busses.

- 4.2.1 Many peripherals connect using a USB port. Give ONE reason why USB is commonly used.

standardise the connection✓ OR both communication and power supply

(1)

- 4.2.2 Older Solid State Drives (SSD)s used to connect to the motherboard via a SATA bus.

- a) Name ONE newer communication bus that has replaced the SATA connection.

PCIe✓ OR NVMe  
Do NOT accept M.2

(1)

- b) Give ONE reason why the SATA bus would be replaced.

NVMe OR PCIe - Faster transfer rate/lower latency/read/write at higher frequency✓

-PCIe - Can be used for other devices

Do NOT accept faster – it must be explained why

(1)

- 4.3 The Basic Input Output System is low-level software that assists with loading the Operating System (OS).

- 4.3.1 Why is BIOS classified as firmware?

Software on a chip ✓ OR semi-permanent software OR resides on ROM.

(1)

- 4.3.2 Explain any TWO functions performed by BIOS.

Function 1:

Check hardware OR obtain list of hardware from CMOS OR Perform POST✓

Function 2:

Load OS kernel✓ ANY TWO

(2)

- 4.4 While preparing to present their projects on their computers, students listen to music and download files.

- 4.4.1 What is this software processing technique called?

Multitasking✓

(1)

4.4.2 How is this software technique achieved using a single-core CPU.

Each process has a set amount of time on the CPU✓

When that time is up or there is an IO request ✓

An interrupt occurs and the CPU switches to the next process. ✓

(3)

4.4.3 Some students work on many assignments at the same time. They have multiple programming projects and word-processing documents open.

Give ONE reason why the computer has slowed down.

Using virtual memory OR run out of RAM✓

(1)

4.5 Each student's computer uses virtual memory.

4.5.1 Explain how virtual memory is different to processor cache?

Virtual memory uses secondary storage as an extension to RAM. ✓

Processor cache uses CPU memory to speed up slower RAM ✓

(2)

4.5.2 Describe why virtual memory slows down a computer's performance.

RAM is faster than secondary storage✓ AND processes need to be swapped in and out of RAM, which takes time. ✓

(2)

4.6 Students have coded projects in Delphi, Java and Python, all examples of translator software.

4.6.1 Define the following terms:

|                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interpreter: Converts high-level language/source code to executable code✓<br>line by line✓                                                               |
|                                                                                                                                                          |
|                                                                                                                                                          |
| One-stage Compiler: Converts high-level language/source code to executable code✓ by first checking for errors then creating a separate object code file✓ |
|                                                                                                                                                          |
|                                                                                                                                                          |
| Two-stage Compiler: Compiles high-level language/source code to a separate object code file ✓ which is then interpreted✓ using the OS virtual machine    |
|                                                                                                                                                          |
|                                                                                                                                                          |

(6)

## SECTION C – INTERNET & COMMUNICATION TECHNOLOGIES

30 MARKS

### QUESTION 5

30 MARKS

5.1 Twisted pair cables are a commonly used bounded medium of communication.

5.1.1 Give ONE reason why the wires are twisted.

Reduces interference OR propagates signal✓

(1)

5.1.2 UTPs and STPs are two types of twisted pair cables. What is the difference between a UTP and an STP cable?

STP has a protective shield / outer layer✓

(1)

5.1.3 Give TWO advantages and TWO disadvantages of UTP cable.

| Advantage                  | Disadvantage                               |
|----------------------------|--------------------------------------------|
| Cheap✓<br>Easy to install✓ | Attenuation✓<br>Crosstalk✓<br>Eavedropping |

|                              |                                                 |
|------------------------------|-------------------------------------------------|
| Common technology<br>ANY TWO | Affected by lightning strikes<br>EMI<br>ANY TWO |
|------------------------------|-------------------------------------------------|

(4)

- 5.2 The school's network consists of many networking devices. Write the correct device name next to each description:

| Description                                                   | Device                     |
|---------------------------------------------------------------|----------------------------|
| A device that connects network segments and reduces traffic.  | Bridge or wireless bridge✓ |
| A device that connects networks with different protocols.     | Gateway✓                   |
| A device in a star topology with many ports to connect nodes. | Switch✓                    |
| A general term for any networked device.                      | Node✓                      |
| A device that boosts the network signal.                      | Repeater✓                  |

(5)

- 5.3 At the event, many mobile devices must connect to the school's network. In the school, there are various wirelessly connected devices. The school decides to set up a Wireless Mesh Network (WMN).

- 5.3.1 Explain what a Wireless Mesh Network is?

|                                                                                                         |
|---------------------------------------------------------------------------------------------------------|
| Network that is mostly not cabled✓ and uses bandwidth to transmit messages and maintain the connection✓ |
| At least one node is cabled to a switch✓                                                                |
| ANY TWO CORRECT FACTS                                                                                   |
|                                                                                                         |
|                                                                                                         |

(2)

- 5.3.2 Give TWO advantages of a WMN.

|                                                                                                |
|------------------------------------------------------------------------------------------------|
| Advantage 1: Easy to extend and adapt OR Self healing – if one node fails network still works✓ |
|                                                                                                |
| Advantage 2: No cables OR cheaper than cabled✓                                                 |
|                                                                                                |

(2)

- 5.4 The English department wants to air their students' poem recitals to many venues at the same time. Would you suggest they use a point-to-point or broadcast communication channel?

5.4.1 Place a cross next to your choice.

Point-to-point

☐

Broadcast

☒

(1)

5.4.2 Give ONE reason for your choice.

Needs to be sent to all devices. ✓

(1)

5.4.3 Give ONE disadvantage of this choice.

Signal can be intercepted ✓

(1)

5.4.4 Explain how this disadvantage can be remedied.

Encrypt the data OR ensure that network users are authenticated/passwords and only some have permission to receive the broadcast. ✓

(1)

- 5.5 Every device on the network has two types of IP addresses

IP Address Type 1: 10.10.16.49

IP Address Type 2: fe80::d4a8:6435:d2da:d9f3

5.5.1 Write the name next to each type.

|                                              |        |
|----------------------------------------------|--------|
| IP Address Type 1: 10.10.16.49               | IPv4 ✓ |
| IP Address Type 2: fe80::d4a8:6435:d2da:d9f3 | IPv6 ✓ |

(2)

5.5.2 Explain the difference between the two IP address types in terms of the number of bits and the structure.

|           | IP Address Type 1:<br>10.10.16.49 | IP Address Type 2:<br>fe80::d4a8:6435::d2da::d9f3 |
|-----------|-----------------------------------|---------------------------------------------------|
| Bits used | 32 bits ✓                         | 128 bits ✓                                        |

|                  |                                                                       |                                                                              |
|------------------|-----------------------------------------------------------------------|------------------------------------------------------------------------------|
| <b>Structure</b> | 4 groups of numbers 0 to 255✓<br>no number can be left out<br>ANY ONE | 8 groups of hex numbers✓<br>OR numbers can be left out if<br>0000<br>ANY ONE |
|------------------|-----------------------------------------------------------------------|------------------------------------------------------------------------------|

(4)

5.6 TCP and UDP are transportation protocols used for communication over the internet.

5.6.1 TCP is connection-oriented, and UDP is a connectionless protocol. How do TCP and UDP deal with lost packets?

|                | <b>TCP</b>     | <b>UDP</b>          |
|----------------|----------------|---------------------|
| Packet is lost | Resend packet✓ | Ignore lost packet✓ |

(2)

5.6.2 Which protocol would be suitable to stream the poem recital mentioned in Question 5.4?

|      |
|------|
| UDP✓ |
|------|

(1)

5.6.3 What information in the data packet allows the receiver to reorder the packets.

|                |
|----------------|
| Packet number✓ |
|----------------|

(1)

5.6.4 Where would this information be placed in a packet?

|         |
|---------|
| Header✓ |
|---------|

(1)

## SECTION D – SOCIAL IMPLICATIONS AND SECURITY

15 MARKS

### QUESTION 6

15 MARKS

6.1 Only the student's family members are invited to attend the event. When they arrive at the school, each person is requested to provide the name of their student relation.

6.1.1 How can the school ensure the given student's name is valid?

|                                            |
|--------------------------------------------|
| Look up the name in the school's database✓ |
|                                            |
|                                            |
|                                            |

(1)

- 6.1.2 If the student's name is valid (i.e. there is a student in the school with the given name), how can the school ensure that the person is related to the student?

Each student is given tickets for their family✓

Students must provide a list of family members who are attending

ANY ONE

Cannot assume the relations are stored in the database

(1)

- 6.1.3 One person gives the name "DROB TABLE" for a student's name. What is the name of this malicious input?

SQL injection✓

(1)

- 6.1.4 Explain why your answer in Question 6.1.3 can be harmful to the school.

The database table of all students✓ could be deleted. ✓

(2)

- 6.2 The school is concerned that the school's network could be hacked or damaged during the event.

- 6.2.1 Name TWO hardware threats to the school.

Hardware threat 1: Power surge✓ do not accept power failure

Hardware threat 1: hard drive failure✓ OR stolen cables

(2)

- 6.2.2 Name TWO different software threats.

Software threat 1: Malware virus, trojan✓

Software threat 1: Phishing, spoofing, DOS, DDOS✓

(2)

- 6.2.3 Name and explain THREE social engineering techniques that could be used at this event.

| Technique Name    | Explanation                                                |
|-------------------|------------------------------------------------------------|
| Shoulder surfing✓ | Look over a student's shoulder when typing their password✓ |

|                                   |                                                                                                         |
|-----------------------------------|---------------------------------------------------------------------------------------------------------|
| Dumpster diving✓                  | Look in the school's trash for NB or private documents✓                                                 |
| Role-playing✓<br>ANY CORRECT TERM | Pretend to be a school official to gain a person's details✓<br>THE TERM USE MUST RELATE TO THE SCENARIO |

(6)

## SECTION E –DATA & INFORMATION MANAGEMENT AND SOLUTION DEVELOPMENT

38 MARKS

### QUESTION 7

38 MARKS

7.1 What is the purpose of a primary key in a database table?

Uniquely identifies a record✓

(1)

7.2 Rewrite the following query to remove duplicates and sort the result in alphabetical order of the mission type.

```
SELECT MissionType
FROM tblMission
```

SELECT DISTINCT✓ MissionType  
FROM tblMission  
ORDER BY MissionType; ✓

(2)

7.3 Analyse the following SQL query:

```
SELECT COUNT(*)
FROM tblMission
WHERE MissionType = 'Crewed Lunar%'
```

7.3.1 What is the function of COUNT(\*) in the above query?

Counts the number of records✓ that start with Crewed Lunar✓

(2)

- 7.3.2 The query was meant to be for all the missions starting with "Crewed Lunar" but does not return the expected result. Explain and correct the error.

Explanation: Using = means the string must be exact use LIKE to find patterns✓

Correction:

WHERE MissionType LIKE✓ 'Crewed Lunar\*' (MS Access)

Accept "Crewed Lunar%" for MySQL

(2)

- 7.4 Methods can be declared as either static or non-static.

- 7.4.1 What is the difference between static and non-static methods?

Static method belongs to the class✓ OR are called with the class name.

ANY TWO

Non static method belongs to the class object✓ OR are called using the object.

ANY TWO

(2)

- 7.4.2 A public method `returnBooking(int num)` is declared as static in a class named `Venue` and returns a `Booking` object. Write the code to call this method and assign the result to an appropriately declared variable. Use `3` as a parameter. The method will be called outside the `Venue` class.

`Booking✓ bkg = Venue✓.makeBooking✓(3) ✓;`

(4)

## 7.5 OBJECT-ORIENTED PROGRAMMING

7.5.1 Complete the UML class diagram to design a **Venue** class. Include the following details:

### Fields:

- venueName
- capacity (number of people that the venue can accommodate).
- totalCapacity (the total number of people that can be accommodated in all the instantiated **Venue** objects)

Choose appropriate data types. Ensure the fields are not accessible outside the class.

### Methods:

- parameterised constructor to assign values to the fields.
- mutator method for **venueName** field.
- an accessor method called **getTotalCapacity** to return the value of the **totalCapacity** field.
- **toString** method that returns the class field values as a string.

Each method must be available outside the class.

| Venue                                                                                                                                                                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| - venueName: string ✓<br>- capacity: integer ✓<br>- <u>totalCapacity : integer</u> ✓ underlined (static) ✓                                                            |
| + Constructor ✓ (nm : string, c : integer) ✓<br>+ setVenueName(nm : string) ✓<br>+ <u>getTotalCapacity() : int</u> ✓ underlined (static) ✓<br>+ toString() : string ✓ |

|  |
|--|
|  |
|--|

(10)

7.5.2 How is encapsulation achieved using Object Oriented Programming in the Venue class?

Fields and methods ✓ are combined in a class ✓

|  |
|--|
|  |
|  |
|  |
|  |

(2)

7.6 Arrays are data structures that store a collection of values of the same type. The array **arrVenue** stores the names of the ten event venues and is declared as:

```
String [] arrVenue = new String[10];
```

The array has the following data values:

**arrVenue**

| 0   | 1   | 2    | 3   | 4  | 5  | 6  | 7   | 8  | 9  |
|-----|-----|------|-----|----|----|----|-----|----|----|
| B15 | B16 | RM14 | REA | E3 | E1 | C2 | C12 | G2 | E4 |

The following code should display the venues but generates an error.

```
for (int i=0; i<=10; i++)
{
    System.out.print (arrVenue[i]);
}
```

7.6.1 Explain why the code produced an error when executed.

Index out of range error OR For loop goes to index 10 the array stops at 9. ✓

|  |
|--|
|  |
|  |
|  |

(1)

7.6.2 Write down the corrected line of code.

for (int i=0; i<10; i++) ✓

OR

```
for(int i=0;i<=9;i++)
```

```
OR for(int i=0;i<arrVenue.length;i++)
```

(1)

7.7 The **shiftLeft** method is used to delete a venue. The index of the item to be deleted is passed as a parameter called **position**.

```
1 static void shiftLeft (int position)
2 {
3     for (int i = position; i < 10; i++)
4     {
5         arrVenue[i] = arrVenue [i + 1];
6     }
7 }
```

**arrVenue**

| 0   | 1   | 2    | 3   | 4  | 5  | 6  | 7   | 8  | 9  |
|-----|-----|------|-----|----|----|----|-----|----|----|
| B15 | B16 | RM14 | REA | E3 | E1 | C2 | C12 | G2 | E4 |

7.7.1 The code has a runtime error. Complete the trace table using **7** for the value of **position**. Include the provided line numbers. Stop when the runtime error occurs.

|         |          |    |         | arrVenue |     |      |     |    |    |    |     |     |    |
|---------|----------|----|---------|----------|-----|------|-----|----|----|----|-----|-----|----|
| Line No |          |    |         | 0        | 1   | 2    | 3   | 4  | 5  | 6  | 7   | 8   | 9  |
|         | position | i  | i < 10? | B15      | B16 | RM14 | REA | E3 | E1 | C2 | C12 | G2  | E4 |
| 1✓      | 7✓       |    |         |          |     |      |     |    |    |    |     |     |    |
| 3       |          | 7✓ | T✓      |          |     |      |     |    |    |    |     |     |    |
| 5       |          |    |         |          |     |      |     |    |    |    | G2✓ |     |    |
| 3       |          | 8  | T       |          |     |      |     |    |    |    |     |     |    |
| 5       |          |    |         |          |     |      |     |    |    |    |     | E4✓ |    |
| 3       |          | 9  | T       |          |     |      |     |    |    |    |     |     |    |
|         |          |    |         |          |     |      |     |    |    |    |     |     |    |
|         |          |    |         |          |     |      |     |    |    |    |     |     |    |
|         |          |    |         |          |     |      |     |    |    |    |     |     |    |

(6)

## 7.8 Analyse the given statement:

I will eat pizza if it has a thin crust(C). Additionally, there should be no avocados(A) or no mushrooms(M) on it.

This statement is represented using the Boolean expression

$$P = C \cdot (A+M)'$$

## 7.8.1 Negate the expression using De Morgan's law.

$$\begin{aligned} P' &= (C \cdot (A+M)')' \checkmark \\ &= C' + (A+M) \checkmark \end{aligned}$$

(2)

7.8.2 Complete the truth table for the **original statement** when the pizza will be eaten:  $P = C \cdot (A+M)'$ 

| C | A | M | (A+M) | (A+M)' | C · (A+M)' |
|---|---|---|-------|--------|------------|
| 0 | 0 | 0 | 0     | 1      | 0          |
| 0 | 0 | 1 | 1     | 0      | 0          |
| 0 | 1 | 0 | 1     | 0      | 0          |
| 0 | 1 | 1 | 1     | 0      | 0          |
| 1 | 0 | 0 | 0     | 1      | 1          |
| 1 | 0 | 1 | 1     | 0      | 0          |
| 1 | 1 | 0 | 1     | 0      | 0          |
| 1 | 1 | 1 | 1✓    | 0✓     | 0✓         |

-1 for each mistake.

(3)

END

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