



SUBJECT: **Computing**
DATE: 23rd June 2021
TIME: 9:00 a.m. to 12:05 p.m.

Directions to Candidates

Answer **ALL** questions in Section A and the question in Section B.

- Good English and orderly presentation are important.
- All answers are to be written on the booklet provided.
- The use of flowchart templates is permitted but calculators may **not** be used.

SECTION A

Answer ALL questions in this section.

1. The Task Manager utility allows users of *MS Windows 10* to view their processor's cache memory size. This displays L1, L2 and L3 cache.
 - a. Answer **true** or **false**
 - i. Cache memory is volatile. (½)
 - ii. Cache memory is less expensive per MB than RAM. (½)
 - b. SRAM and DRAM are two types of RAM. In this light, briefly explain which of these types of RAM is used for cache and how this helps improve system performance. (2)
 - c. Briefly describe each of the following, showing clearly the difference between them:
 - i. L1 cache; (1)
 - ii. L2 cache. (1)
 - d. Main Memory also includes ROM; of which two types are PROM and EEPROM.
 - i. What do PROM and EEPROM stand for? (1)
 - ii. Modern Operating Systems are built to connect to various Internet of Things (IOT) devices in the home and office. For instance, the user may require the facility of connecting office lighting from his computer. This requires a smart lighting device with a switching schedule that can be programmed by the user and stored in the device even if there is a power cut. Which of these two types of memory (PROM and EEPROM) would you expect to find on such a device? Explain your answer. (2)

(Total: 8 marks)

Please turn the page.

2. a. Microcontrollers are used in car engine control systems. These use a number of sensors and actuators to ensure optimal engine performance. All the devices in the system need the services of the CPU. Briefly explain how polling can be used in the above scenario. (1)
- b. In some ways an interrupt-based system can be seen as an improvement on polling.
 - i. Briefly describe **ONE** shortcoming of polling compared to an interrupt-based system. (1)
 - ii. Explain how an interrupt-based system would address this shortcoming. (1)
- c. A process can be in one of three basic states. Name and briefly describe **each** state. (3)
- d. In attending to memory management, the Operating System uses **Memory Compaction** to reverse **Memory Fragmentation**. Briefly explain the terms in bold. (2)

(Total: 8 marks)

3. a. What is the main purpose of the OSI model in the context of data communications? (1)
- b. The OSI model has a 7-layer architecture. Select the layer/s from the ones below that apply to **each** of the descriptions that follow:

Physical layer	Presentation Layer	Network Layer	Session Layer	Applications Layer
----------------	--------------------	---------------	---------------	--------------------

- i. Responsible for the transmission and reception of raw data between a device and a physical transmission medium. (½)
- ii. Controls the connections between computers. It establishes, manages and terminates connections between the local and remote application. (½)
- c. Briefly describe the role of the Data Link layer within the context of the OSI model (1)
- d. Switching directs a signal or data element toward a particular hardware destination.
 - i. Give **ONE** distinguishing feature of circuit switching. (1)
 - ii. Give **ONE** advantage of packet switching. (1)
- e. Choose and write down the correct answer for the following statement and briefly explain your choice:
 Email is an example of (circuit switching, message switching, packet switching). (1)
- f. Briefly explain how parity checking works and how it helps achieve accurate transmission between nodes during communication. (2)

(Total: 8 marks)

4. a. A University is introducing a new VLE. Once the system has been created and tested, it will need to be implemented. During implementation of this system, a system changeover procedure needs to be carried out. Name **TWO** things that should be considered when deciding on a changeover procedure in such a situation. (2)
- b. Different changeover procedures have their own pros and cons. Name a possible advantage associated with **each** of the following:
- i. direct changeover; (1)
 - ii. phased changeover. (1)
- c. Name **TWO** other activities that are normally done during system implementation. (2)
- d. Name and briefly describe the step that normally follows implementation. (2)

(Total: 8 marks)

5. This question is about the Internet and the world-wide web.
- a. Briefly explain the function of **each** of the following terms:
- i. web server; (1)
 - ii. browser; (1)
 - iii. plug-in; (1)
 - iv. Uniform Resource Locator (URL); (1)
 - v. search engine. (1)
- b. ISDN and ADSL are two ways of connecting to the Internet. Associate **each** of the following statement with ISDN or ADSL
- i. an 'always on' connection; (1/2)
 - ii. is the slower of the two. (1/2)
- c. The rise of technology has made Data Protection legislation even more relevant. State **TWO** principles of Data Protection legislation. (2)

(Total: 8 marks)

6. a. The term modem is short for 'modulator-demodulator'. Briefly explain modulation and demodulation in order to explain how a modem carries out its role. Clearly identify which term you are referring to in **each** description. (2)
- b. Transmission media can greatly impact the quality of a network connection.
- i. Give **TWO** differences between twisted-pair and optical fibre cable. (2)
 - ii. Name **ONE** other type of network cable. (1)
 - iii. Suggest a suitable use for the medium mentioned in part (b ii). (1)
- c. What is network noise? (1)
- d. Name a possible source of network noise on a Wi-Fi connection. (1)

(Total: 8 marks)

Questions continue on next page

7. a. Consider the hexadecimal number $8E_{16}$, write down its decimal equivalent if it is interpreted as:
- an unsigned, number; (1)
 - an 8-bit two's complement number; (1)
 - an 8-bit sign and magnitude number. (1)
- b. Represent the number 247 in 12-bit BCD. (1)
- c. Consider a fixed point 12-bit number in the format $\langle 8.4 \rangle$ (8 bits for the integer part and 4 bits for the fraction):
- write down the unsigned binary equivalent of $28\frac{3}{8}$; (1)
 - give the decimal equivalent of 00101100.1100. (1)
- d. Name **TWO** standard character codes in use today. (2)

(Total: 8 marks)

8. A car's warning system A goes on if the ignition G is on and one or both of the door sensors S1 and S2 are on.
- Write down the logic formula for the circuit. (1)
 - Draw the truth table for the car alarm A. (3)
 - Draw the logic circuit for the warning system using NAND gates **only**. (2)
 - Use boolean algebra and indicate which law is applied to prove that:

$$x \cdot (\bar{x} + y) = x \cdot y$$
 (2)

(Total: 8 marks)

9. Consider the following assembly language code:

```

        mov CX, 1      ;store 1 in register CX
        mov AX, 0      ;store 0 in AX
rep:    add AX, CX      ;add CX to AX
        inc CX         ;increment CX
        cmp CX, 5      ;compare CX to 5
        jl  rep        ;jump to label rep if less

```

- Mention **TWO** operand addressing modes found in this assembly snippet, and write down the instruction in which they are found. (2)
- Write down the contents of register AX and CX after the execution of the code. (2)
- Which language translator is used to translate assembly language? (1)
- In the context of assembly language, what is the role of a Linker? (2)
- Give **ONE** advantage of using assembly language over using a high-level language. (1)

(Total: 8 marks)

10. John is designing a database to keep track of the number of goals his team-mates scored in the school football league. He came up with the following tables and fields.

TABLE:	Players
FIELDS:	ID
	Name
	Surname
	Class
	Age

TABLE:	Goals
FIELDS:	Opponent Team
	Date
	Goals Scored
	Player ID
	Name and Surname

- a. Identify **ONE** improvement to the fields proposed for the Players Table and **ONE** improvement to the fields proposed for the Goals table. (2)
- b. Identify the primary keys for the **TWO** tables. (3)
- c. Which field in the Goals table is not required? Explain your choice. (2)
- d. Choose an appropriate foreign key for the Goals table. (1)

(Total: 8 marks)

Section B – This question is compulsory

1. A programmer is trying to implement a simulation of a logic circuit. These are the classes he started with:

```
public class LogicGate {
    public int function (int a, int b) {
        return 0;
    }
}

public class YGate extends LogicGate {
    public int function (int a, int b) {
        if (a == b) {
            return 0;
        } else {
            return 1;
        }
    }
}
```

- a. Which Object Oriented Programming (OOP) concept is being used in the code above? (1)
- b. Which keyword is responsible for using such concept? (1)
- c. Mention **TWO** advantages of the concept mentioned in part (a). (2)

Questions continue on next page

- d. Mention **ONE** disadvantage of the concept mentioned in part (a). (1)
- e. Write Java statement(s) to create an instance gate of class `YGate`. (3)
- f. Assuming that the parameters to the method function can be only 1 s and 0 s, copy and complete the following table, to show the result of the function in response to the parameters' input. (4)

a	b	function(a,b)
0	0	
0	1	
1	0	
1	1	

- g. What is the name of this logic gate being represented in Method `function`? (1)
- h. In part (e), an instance gate of the class `YGate` was created. What values will be stored in array `res` after executing the following Java code snippet using the instance `gate`? Show the contents of the array `res` after **each** iteration of the loop.

```
int num [] = {1,0,0,1};
int res [] = new int [num.length];
res[0] = num[0];
for (int i = 1; i < num.length; i++) {
    res[i] = gate.function(num[i-1], num[i]);
}
```

- i. Use the `do..while` loop to write Java code to display the contents of the array `res` in reverse. (3)

(Total: 20 marks)