



SUBJECT: **Computing**
DATE: 25th May 2022
TIME: 4:00 p.m. to 7:05 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 a. Operating Systems may be classified into different types including:

Batch Processing OS, Real Time OS, Multi Programming OS.

Which type of Operating System should be used on an office user's laptop? Give a reason for your answer. (2)

b. What is the function of utility software? (1)

c. Briefly explain how a modern operating system increases file-handling efficiency by providing a hierarchical directory structure. (2)

d. Data in all its forms needs to be protected from a variety of threats. Briefly describe **TWO** ways in which operating systems can help protect files. (2)

e. What are file attributes? (1)

(Total: 8 marks)

2. A Personal Area Network (PAN) interconnects electronic devices within one's personal workspace.

a. Name **TWO** devices a user can interconnect via his PAN. (1)

b. Describe **TWO** applications of a PAN, clearly naming the devices used in **each** case. (2)

c. Suggest **TWO** advantages of adopting a Star Network Topology on one's PAN rather than a Bus Network Topology. (2)

d. Give **ONE** advantage of a Bus network over a Star Network. (1)

e. Suggest **TWO** advantages of a full-duplex over a half-duplex Ethernet connection. (2)

(Total: 8 marks)

Please turn the page.

3. watchOS is an operating system that runs on a smartwatch.
- a. To avoid background tasks abusing system resources and draining the battery, watchOS implements an algorithm to control how often these tasks can be triggered and how long they can run. The algorithm includes the following restrictions:
 - Each app gets an individual allotment of background execution time.
 - The system won't trigger any background task if the device's battery runs very low or the system conditions are very poor.
 - Throttling background execution when the user is performing activities, such as working out or navigating.
 - i. To which **ONE** of the operating system functions below does the above description relate to:
 - scheduling;
 - memory handling;
 - buffering? (1)
 - ii. Based on the above information, name a feature which watchOS prioritises. (1)
 - iii. Name **TWO** features you would expect in watchOS interface and briefly explain the reason why you regard them important. (2)
 - b.
 - i. Briefly explain Round Robin scheduling. (1)
 - ii. Suggest **ONE** reason why Round Robin scheduling may not be appropriate for a mobile phone operating system. (1)
 - c. Briefly describe the following Operating System functions: Disk Management; and User Interface Management. (2)

(Total: 8 marks)

4. A supermarket has commissioned a new computerised online shopping system to replace their existing system, which is based on placing orders over the phone.
- a. Suggest **ONE** advantage the supermarket could enjoy from such a system. (1)
 - b. The following are all important stages in the lifecycle of the new system:
 - implementation;
 - testing;
 - requirements analysis;
 - design.
 - i. Write the above stages in the order they are carried out. (1)
 - ii. Briefly explain what needs to be done during the requirements analysis stage. (1)
 - iii. System implementation involves a changeover procedure. Give **ONE** reason to explain why a direct changeover would be suitable here. (1)
 - iv. Name and briefly describe **ONE** other changeover approach. (2)
 - c. During system testing it was discovered that when the user buys more than one unit of an item, he is still charged for one item.
 - i. Identify the type of programming error involved? (1)
 - ii. Suggest **ONE** testing technique for identifying such errors. (1)

(Total: 8 marks)

5. This question is about the Von Neumann architecture.

- a. Briefly explain the role of the following:
 - i. Control Unit; (1)
 - ii. ALU. (1)
- b. Distinguish between a mainframe and a microcomputer. (2)
- c. Main Memory is a central component to the Von Neumann Architecture.
 - i. Addresses uniquely identify a location in the memory. Distinguish between logical and physical addresses. (2)
 - ii. Explain how memory fragmentation can occur. (1)
 - iii. Briefly explain why memory fragmentation is undesirable. (1)

(Total: 8 marks)

6. a. The table below compares three processors found in devices currently on the market.

	Processor A	Processor B	Processor C
Word length	32-bit	64-bit	64-bit
CPU Cache	16 KB	12 MB	16 MB
CPU Speed	133 MHz	2.4 GHz	3.5 GHz
Cores	2	6	8

The word length is the number of bits a processor can store and handle at each processing step and is a key feature that gives Processor A a poorer performance than the other two. The word length is also equivalent to the number of lines on the address bus for each of these processors.

- i. What is the address space of:
 - Processor A; (1)
 - Processor B. (1)
- ii. Outline how this difference may impact the system’s performance? (1)
- b. An automatic lighting system is being assembled. This will vary its light intensity according to the ambient light, increasing or decreasing its brightness of the bulbs attached to it accordingly.
 - i. Name an input device necessary to this system. (1)
 - ii. Name an output device necessary to this system. (1)
 - iii. Name a storage device you would expect to be used to hold the program for the application described in part b. above. (1)
 - iv. Distinguish between serial and direct access, clearly stating which access mode would be ideal in this scenario. (2)

(Total 8 marks)

Please turn the page.

7. a. Assuming an 8-bit register, with the Most Significant Bit (MSB) as a sign bit, complete the following table with its equivalent values. (3)

Decimal	Sign & Magnitude	Two's Complement
-11 ₁₀		
		01100001 ₂
	10011010 ₂	

- b. Using an 8-bit register (4 bits for the integer part and 4 bits for the fraction), represent:
- i. the unsigned binary number 1011.0110₂ in decimal; (2)
 - ii. the unsigned binary equivalent of decimal $15 \frac{13}{16}$. (2)
- c. The ASCII code for the letter "W" is 01010111₂. What is the ASCII code for the letter "Z" in binary? (1)

(Total: 8 marks)

8. a. For each of the following statements concerning the assembly language, give the appropriate term/s:
- i. These are used to write Assembly language programs.
 - ii. These are very important in any program as they explain what the program is doing.
 - iii. In this type of addressing mode, the operand address is contained in the instruction.
 - iv. This code specifies which operation is to be performed.
 - v. The process of assembling a source code program into machine code. (5)

- b. A short assembly language program has the following instructions.

MOV AX, 0 ; move 0 into AX

MOV BX, 03 ; move 03 into BX

loop: ADD AX, BX ; add AX and BX storing in AX

DEC BX ; decrement BX

JG loop ; if result is greater than zero branch to loop

MOV BX, 03 ; move 03 into BX

What are the contents of AX after the execution of the code? (3)

(Total: 8 marks)

9. a. An engineer needs to build a gate circuit to perform the following function:

$$X\bar{Y} + \bar{Z}(X + Y)$$

Draw a logic circuit for the above function. (2)

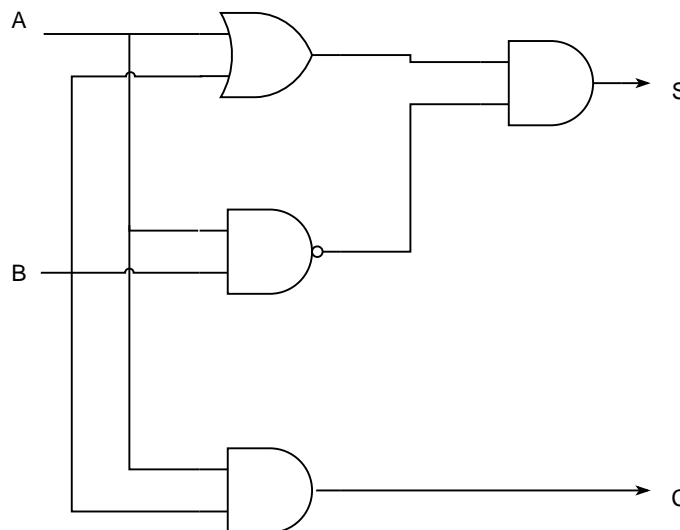
b. The engineer also needs to simplify the following truth table.

A	B	C	OUTPUT
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

Through the use of a Karnaugh map, simplify the above truth table. (3)

c. Explain why the NAND and NOR gates are said to be universal gates. (1)

d. The following is a 2-input, 2-output half adder circuit which can be used to build a full adder circuit. C is the carry bit, and S the sum bit. Show, through the use of a truth table, that this circuit does indeed perform the half adder function.



(2)

(Total: 8 marks)

Please turn the page.

10. a. In which database model is normalisation used? (1)
- b. What is the aim of normalisation? (1)
- c. Why is a Primary key required in database tables? (1)
- d. The following tables show parts of the *Clients Table* and the *Vehicles Table* used by a car supplier. Study the tables and then answer the questions below.

Table 1: Clients Table

<u>ClientID</u>	Name	Surname	Address	Female	Age
1	Teddy	Borg	11, Main Street, Mosta	<input type="checkbox"/>	50
2	Charlie	Camilleri	5, Bishop Lane, Valletta	<input type="checkbox"/>	34
3	Daisy	Farrugia	1, Indri Borg Str; Rabat	<input checked="" type="checkbox"/>	25
4	Zoe	Micallef	51, St.Paul's Str; Attard	<input checked="" type="checkbox"/>	43

Table 2: Cars Table

<u>CarID</u>	Buyer	Brand	Date of Purchase	Price
1/21	1	Toyota	02-01-2021	€ 25000
2/21	3	Opel	21-02-2021	€ 15000
3/21	2	Ford	27-02-2021	€ 15500
4/21	1	Porsche	04-05-2021	€ 61850

- i. Which field (from each table) would be used to relate both tables? What is this field known as? (2)
- ii. What would be a more practical primary key for the *Clients* table? (1)
- iii. Why is the *Age* field of the *Clients Table* not suitable? What field would be best suited? (2)

(Total: 8 marks)

SECTION B**Answer ALL questions in this section.**

1. a. In the context of Object Oriented programming (OOP), discuss how encapsulation can help a programmer implement security features in one's application and briefly explain how this can be implemented in an object oriented program. (2)
- b. Write down the declaration in Java for a two-dimensional array *StudentMarks* for storing the marks of 10 students for 5 different subjects. (2)
- c. What is the output of the following program? (1)

```
public class TestArray
{
    public static void main(String[] args)
    {
        String[] myArr = new String[10];
        for (int i = myArr.length -1; i >= 0; i--)
        {
            myArr[i] = "b" + (i -1);
        }
        System.out.println("Value: " + myArr[5]);
    }
}
```

- d. Is the following program correct or incorrect? Briefly explain why. (2)

```
public class QuestionJ
{
    public static void main(String[] args)
    {
        int[] intArr = {1, 2, 3, 4, 5, 6, 7, 8, 9};
        for (int i = 1; i <= 9; i += 2)
        {
            System.out.print(intArr[i] + ", ");
        }
    }
}
```

- e. Consider the following Java Class containing two methods.

```
class MethodClass {
    public void display(char c)
    {
        System.out.println(c);
    }
    public void display(char c, int num)
    {
        System.out.println(c + " "+num);
    }
}
```

- i. Which Object Oriented feature is being used in the above methods? (1)
- ii. Name **ONE** advantage of using such a feature. (1)

Please turn the page.

- f. A school is in the process of developing a school software application. This application includes a method called *displayStudent*.
- i. Create and instantiate an object of *Student* called *student1*. (1)
 - ii. Assuming this method does not expect any parameters, call the method *displayStudent* for *student1*. (1)
- g. A variable in Java must be a specified data type.
- i. Name any **FOUR** of these data types, briefly describe their use and give an example value of each. (6)
 - ii. What happens if a value stored in one type of variable was permitted to be assigned to another variable of a different type and vice versa? Use any **TWO** of the variable types you mentioned in part g(i) above? (2)
 - iii. When programming in a high level language, why is it important for the programmer to declare the type of each variable being used? (1)

(Total: 20 marks)