



SUBJECT: **Computing**
DATE: 25th September 2020
TIME: 9:00 a.m. to 12:05 p.m.

Directions to Candidates

Answer **ALL** questions in Section A and **ONE** question from 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. IP addresses are an important element to the functioning of the Internet.
 - a. Answer True or False.
 - i. IP addresses identify the type of device on the network. (½)
 - ii. Printers, routers and modems on a network all have their own IP address. (½)
 - b. IPv4 is an Internet protocol that uses an address based on a 32-bit number.
 - i. Translate the IP address 172.16.254.1 to a 32-bit binary number. (2)
 - ii. How many different IP addresses can be generated on IPv4? (1)
 - c. Today the Internet is slowly transitioning to IPv6 which is another Internet protocol but which is based on a 128-bit number.
 - i. IPv6 addresses are represented as eight groups (separated by colons) of four hexadecimal digits.

Complete the decimal version of the IPv6 address given in hexadecimal below: (1)

Hexadecimal	2001:	0db8:	0000:	0000:	0000:	8a2e:	0370:	7334
Decimal	8193:	3512:	0:	0:	0:	35374:	____:	29492

 - ii. The increase in the types of devices that can be accessed via the Internet has brought about a new dimension to computing, that of the Internet of Things (IoT). This has made IPv6 more of a necessity. Explain. (1)

(Total: 6 marks)

2. Despite its fairly old technology, magnetic tape is still used in certain areas of data storage.
 - a. Suggest **ONE** property of magnetic tape that has helped keep it relevant. (1)
 - b. Magnetic tape is not ideal for handling patient records in a hospital emergency ward.
 - i. Explain the above statement in terms of access mode. (2)
 - ii. Name a storage device that would be ideal for the application described in part b above. (1)
 - iii. Give **TWO** reasons justifying your answer in part b(ii). (2)

(Total: 6 marks)

3. Different scenarios often require different types of operating systems.
- a. Explain how real time operating systems are suited for self-driving cars. (1)
 - b. Which of the terms below best describes an Operating System which would be ideal for each of the following applications?
 - i. An operating system for a multi-access school system;
 - ii. An operating system for a banking system;
 - iii. An operating system for a mobile phone.

Single-user OS	Multi-user OS	Batch OS	Real Time Transaction System
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- (3)
- c. Name **TWO** types of utility software and describe how they can help keep a system healthy. (2)
- (Total: 6 marks)**

4. Simplex, half duplex and full duplex are three kinds of communication channels in telecommunications and computer networking.
- a. State which of the following are simplex, duplex or full duplex communication
 - i. In fiber optic communication, one strand is used for transmitting signals and the other is for receiving signals. (1)
 - ii. A Walkie-talkie has a "push-to-talk" button which can be used to turn on the transmitter but turn off the receiver. (1)
 - b. Give **ONE** advantage of full duplex communication. (1)
 - c. When one listens to music on a smartphone via your headphones, the digital signal from the phone is converted to analog through a DAC.
 - i. What does DAC stand for? (1)
 - ii. Briefly explain the role of a DAC in this scenario. (2)
- (Total: 6 marks)**

5. A coffee shop is overhauling its loyalty scheme. It is replacing a system that involved stamping of a loyalty card, with a mobile app. The new app will generate a barcode for the user to scan with every coffee bought in order to get points.
- a. The system is about to be implemented.
 - i. Name **TWO** things that are done during implementation. (2)
 - ii. Which **TWO** of the following steps precede implementation? (1)
 - a) System development and testing
 - b) Control and Review
 - c) Drawing up of feasibility study
 - d) System Changeover
 - b. A few months down the line, the system needs maintenance. What type of maintenance is involved in each of the situations below?
 - When the user claims points on his card, an error deducts double the points it should.
 - The user requests that a 'tell a friend' option is introduced in the app.
 - A change is required to enable the app to run on more than one mobile operating system. (3)

(Total: 6 marks)

6. a. Explain the difference between source code and object code. (2)
 b. Explain the difference between a compiler and an interpreter. Give **ONE** advantage of each. (2)
 c. Java uses a compiler to produce byte code which then has to be run by the Java Virtual Machine. What is the main advantage and disadvantage of this approach? (2)
(Total: 6 marks)

7. a. Minimise the following Boolean expression:

$$x = \overline{((a + b) \cdot (a + \bar{b}))} + \bar{a} \cdot c \quad (2)$$

- b. A logic circuit is to be designed to accept three inputs X, Y and Z representing a 3-bit binary number. The circuit will give an output of 1 if the binary number given is odd and is less than 6, otherwise it will output 0. Copy the truth table below on to your script and fill out the missing values in the output column to show the function of this circuit.

X	Y	Z	Output
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

- (1)
 c. Draw the Karnaugh Map for the truth table in part (b) and derive the minimised expression. (2)
 d. Draw the circuit for the expression derived in part (c). (1)
(Total: 6 marks)

Please turn the page.

8. Consider the following Java Class:

```
public class StringUtils {
    public static String process (String s) {
        // convert string s into array temp of char
        char temp [] = s.toCharArray();
        char t = temp[0];
        for (int i = 1; i < temp.length; i++) {
            temp[i-1] = temp[i];
        }
        temp[temp.length-1] = t;
        return new String(temp); // return array as String
    }
}
```

- a. What will be stored in String s after the following statement has been executed?

```
String s = StringUtils.process("Testing");
```

 (2)

- b. What will be the output of the following code for each iteration?

```
String n = "1234";
for (int i = 1; i <= 4; i++) {
    n = StringUtils.process(n);
    System.out.println(n);
}
```

 (2)

- c. What is the difference between an instance method and a class method? Is the method process() a class method or an instance method? (2)

(Total: 6 marks)

9. a. Mention **TWO** ways a System Analyst can gather information about the current system. (2)
- b. It is important that large systems are developed using a modular approach. Mention how modularity can be achieved using the OOP paradigm. (2)
- c. The following Java code was designed to test if an inputted exam mark falls within a given range (0 to 100). However it doesn't function as it was expected to. What is wrong with this code?

```
Scanner keyb = new Scanner (System.in);
int mark = keyb.nextInt();
while (mark < 0 && mark > 100) {
    System.out.println("Error - please input again");
    mark = keyb.nextInt();
}
```

 (1)

- d. It is important that programmers find standard ways how to represent algorithms. Mention **ONE** way an algorithm can be expressed. (1)

(Total: 6 marks)

10. a. What does FTP stand for? What is it used for? (2)
- b. Give **TWO** reasons why e-mail has largely replaced traditional hand delivered mail. Mention **TWO** disadvantages of e-mail. (2)
- c. What does EFT stand for? What important role does EFT play in the Internet? (2)

(Total: 6 marks)

SECTION B

Answer ONE question from this section.

1. a. Consider the following assembly language code:

```

mov CX, [1000H] ; store in CX value found in 1000H
mov AX, 1       ; store 1 in AX

rept:
add AX, AX      ; add the contents of AX to AX
sub CX, 1       ; subtract 1 from CX
cmp CX, 0       ; compare CX to 0
jg rept         ; jump if not 0 to rept
mov [1001H], AX ; store AX to location 1001H

```

i. What is the overall function of the above code? (1)

ii. What is the specific function of the following part of the above code in the context of the above code? (2)

```

jg rept         ; jump if not 0 to rept

```

iii. Why are jump instructions important in assembly language? (2)

iv. From the above code, give an example of:

- (a) direct addressing; (1)
- (b) immediate addressing; (1)
- (c) register addressing. (1)

v. What will the contents of location 1001H be if location 1000H contains each of the following decimal values? Show your workings. Give your answer in decimal.

(a) 3 (2)

(b) 6 (2)

vi. What is the effect of the following assembly snippet?

```

push AX
push BX
pop
pop

```

b. A particular micro-controller has a 32-bit processor.

i. What is the difference between the data bus and the address bus? (2)

ii. What is the size of the data bus for this computer? (1)

iii. The micro-controller mentioned in part (b) above is to be used to control a small mobile robotic equipment. It was decided that an EEPROM chip will be used for this application.

(a) What role would an EEPROM chip have in this application? (1)

(b) What makes the EEPROM chip better than other forms of storage for this application? (1)

iv. Distinguish between the MAR and the MDR registers found in the CPU. (2)

(Total: 20 marks)

2. a. A database is being created as a back-end to an app called 'Kotba Għalina', an app where users can mark Maltese books they have read, review them as well as look for interesting books to read. There is a social community aspect to the app as readers add friends on their contact list to view and react on their readings, reviews etc.
- i. The data dictionary contains data about the database set up for the app. Name **TWO** types of records you expect to find in this data dictionary. (1)
 - ii. What is the main function of a query? Give an example of its use in the above database. (2)
 - iii. The database consists of three principle tables: Books, Authors and Readers. The table Books contains the following attributes/fields:
 - Reference Number (consecutive number),
 - Title,
 - Author Code (initials of author),
 - Year of Publication,
 - Name of Publisher, and
 - Library Index Code (sequence of letters and numbers).
 - (a) Give the field types of each attribute. (3)
 - (b) Indicate the primary key field. (1)
 - iv. Describe the relationship the Books Table is likely to have with the Authors Table including and explaining:
 - (a) the type of relationship; (2)
 - (b) the foreign field and the primary key field for this relationship. (1)
- b. i. Describe an insertion sort algorithm. (3)
- ii. The app requires the sorting of the following list of names in alphabetical order.

[Joseph], [Francis], [David], [Anne]

Show the values in the above list of names at each step of the process of sorting the list when using a Bubble sort. (3)

- iii. A user can search the 'Kotba Għalina' database for a given book. Describe an algorithm in point form for a linear search to achieve this function. (3)
- iv. Name **ONE** other feature you think would be useful to users of 'Kotba Għalina'. (1)

(Total: 20 marks)