L-Università ta' Malta

SUBJECT:	**Computing**
DATE:	5th September 2023
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. It is common knowledge that the technology industry is ever on the increase. However, this success comes at a heavy price since Cyber-crime is also on the increase.

    a. Give **TWO** examples of computer crime. (2)

    b. For each of the two examples mentioned in part (a), explain how technology can help prevent or minimise such a crime. (2)

    c. Cybercrime also affects the data privacy of consumers in many ways. Give **TWO** examples of potential losses to an individual or organisation when data privacy is violated. (2)

    (Total: 6 marks)

2. Unicode and ASCII are the most popular character encoding standards that are currently being used all over the world.

    a. Name **ONE** difference between the two codes. (1)

    b. When a key is pressed on the keyboard, the computer stores the ASCII representation of the character typed into main memory. The ASCII representation of A is 65 (denary), for B is 66 (denary) and so on. There are two letters stored in the following memory locations:

Location 1	A
Location 2	D

    Show the contents of Location 1 and Location 2 as:

    i.   an 8-bit binary value; (2)

    ii. a hexadecimal value. (2)

    c.   State the Binary Coded Decimal representation of the decimal number 10. (1)

    (Total: 6 marks)

    Please turn the page.

3. Software testing is one of the most critical processes of the software development life cycle (SDLC) as it requires close attention to detail. There are different types of testing, such as alpha and beta testing.

    a.   Name **ONE** difference between alpha and beta testing.   (1)

    b.
        i.   Name **TWO** other types of testing.   (2)
        ii.   Name **ONE** difference between the two types of testing identified in part b(i).   (1)

    c.   A system has a validation to ensure that only integers between 1 and 10 are entered as an input. Give **TWO** examples of test data that would be used for this type of validation.   (2)

(Total: 6 marks)

4. The following truth table represents a circuit where A, B, and C are inputs and F is the output.

    a.   Create a Karnaugh map for the truth table below and minimise it.   (3)

A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

    b.   Using Boolean algebra show that:

$$\overline{\overline{XY} + X\overline{Y}} = XY + \overline{X}Y$$

    (3)

(Total: 6 marks)

5. a. Explain the concept of the OSI model and its importance in computer networking. (2)

   b. Name and briefly explain **TWO** layers found in this model. (2)

   c. Identify **TWO** reasons why standard protocols are important to network security. (2)

   (Total: 6 marks)

6. A department store uses an application to manage all retail aspects. In this application, one class is called *Item* and another is called *Staff*.

   a. For each of the following statements, indicate if it is true or false. (1)
      i. In this application items for sale would be objects of class *Item.*
      ii. An object is the blueprint for a class.

   b. A constructor method creates an instance of a class. State which of the following method signatures may be used in the application described in part a. (1)
      i. `void Itm ()`
      ii. `void Item(int x)`
      iii. `Item()`
      iv. `Item (int x, int y)`

   c. Java is an imperative, object-oriented language.
      i. Briefly explain the term imperative in this context. (1)
      ii. Give **TWO** advantages that may be offered by using object-oriented languages in well-designed programs. (2)

   d. The retail application handles a vast business involving many entities. This is because the system needs to handle aspects involving members of staff from various departments and grades, and a variety of items ranging from clothing to household goods etc. Briefly explain how inheritance can be fruitfully implemented in such an application. (1)

   (Total: 6 marks)

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7. An automated voting app allows voters to vote Y ('Yes') or N ('No') on given issues and then outputs the winning vote. To set up a vote, the administrator sets the question to be voted on as well as the number of people taking the vote. Below is the Java code for the inputting of the votes.

```
void takeVote(){

        String vote;

        String question = getVotingQuestion();

        int participants = getNumberOfParticipants();

        for(_____){

            do{

                System.out.println(question);

                 System.out.println("Enter Y or N: ");

                 vote = input.next();

            }while (!validateVote(vote));

        }

    }
```

a. Name the method that is being called to allow the administrator to get the text for the voting question. (1)

b. Complete the code for *takeVote* such that all participants vote. (1)

c. Write the method declaration for *validateVote.* (1)

d. Write the method *validateVote* that validates the user input for vote, ensuring this input is either Y or N. (3)

(Total: 6 marks)

8. *ListenTech* is a company that produces sound technology including speakers, wired and wireless earbuds and wired and wireless headphones. It currently has mobile apps for each of their product ranges but is now working on a new version which will include one mobile app through which the user can control all his devices from *ListenTech*.

a. Suggest **ONE** reason specific to this context why the company may have opted for this new app. (1)

b. Suggest **TWO** aspects that will need to be considered during the feasibility study. Clearly relate your points to this context. (2)

c. Briefly explain how a Unified Modelling Language (UML) can be useful in the development of a new system. (1)

d. Briefly describe top-down system design. (1)

e. Name **ONE** advantage of a top-down system design. (1)

(Total: 6 marks)

9. Internet connectivity is at the heart of the modern home, with many households having several devices linked through a LAN.

   a. Briefly explain why simplex communication is **not** suitable for an Internet connection. (1)

   b. Distinguish between full duplex and half duplex communication. (1)

   c. Briefly explain what is noise with regards to data transmission. (1)

   d. In recent years optic fibre is more commonly used in LANs. State which of the following may be a reason for this: (1)
      i. The technology has become more affordable.
      ii. Network traffic has become heavier.
      iii. LANs are now more likely to be wireless.
      iv. Many more people live in remote rural areas these days.

   e. Besides optic fibre cabling, other types of cabling are used in LANs.
      i. Suggest **ONE** other type of cabling used in LANs. (1)
      ii. Give **ONE** reason why users might opt for this type of cable. (1)
      (Total: 6 marks)

10. In general, a higher clock speed means a faster CPU. However, in determining CPU performance, many other factors can come into play as well.

   a. A CPU with a clock speed of 3.2 GHz executes 3.2 billion cycles per second.
      i. What is a CPU cycle? (1)
      ii. Name and briefly describe **ONE** other factor that impacts CPU speed. (2)

   b. The System bus is a means of communication between components.
      i. Outline how the width of the data bus may impact system performance. (1)
      ii. Outline the role of the address bus in a CPU cycle. (1)
      iii. Outline the role of the Memory Address Register. (1)
      (Total: 6 marks)

Please turn the page.

SECTION B
Answer ONE question from this section.

1. Android OS is a freely available mobile operating system from Google. The latest release is Android 13 and developers are expecting the new Android version to be released in the third quarter of 2023.

   a. New versions of most mainstream Operating Systems (OS) are released yearly. Why are developers interested in such releases? (1)

   b. Smartphones provide various multitasking features.
      i. Mention and explain **ONE** feature of the user interface offered by an OS that can facilitate multitasking. (2)
      ii. Mention and explain **ONE** memory management feature which allows the OS to handle multiple running apps efficiently. (2)

   c. Explain how the role of the OS in process management can affect a system's overall performance. (2)

   d. Despite being available for free, Android OS has generated millions in revenue for Google. Suggest **ONE** way in which this revenue is indirectly generated through Android OS. (1)

   e. Volatile primary memory can be classified into L1 and L2 Cache as well as the larger main memory itself.
      i. Outline the purpose of cache memory and its main benefit. (1)
      ii. Which of the above uses DRAM? (1)
      iii. Give **TWO** characteristics of DRAM and explain how it is useful to its above-mentioned role. (2)

   f. Whilst early Android smartphones implemented a 32-bit architecture, most current smartphones are 64-bit. Briefly outline how this move from 32-bit to 64-bit impacts the amount of RAM one can find on a modern smartphone. (2)

   g. Android OS provides a utility called Files that allows the user to manage files on their smartphone. Files offers a hierarchical directory structure.
      i. Define hierarchical directory structure. (1)
      ii. Outline how a hierarchical directory structure can help increase security and efficiency. (2)
      iii. What are file attributes? (1)
      iv. Name **TWO** file attributes. (2)
   **(Total: 20 marks)**

2. a. For the following Boolean expression:

$$X = A\bar{B} + \bar{B}C + AC$$

    i.   Draw the complete logic circuit directly from the expression. (2)
    ii. Give its complete truth table. (3)

  b. The circuit below can be simplified into one logic gate. Show how this can be achieved by:
    i.   finding the Boolean expression from the circuit; (1)
    ii. simplifying the Boolean expression; (1)
    iii. identifying and drawing the resulting logic gate. (2)
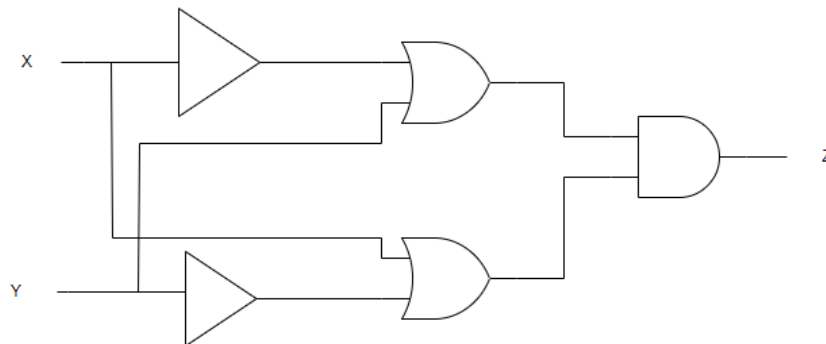
  c. Digital logic plays a crucial role in understanding and programming in an assembly language. With the aid of a diagram, explain the key steps involved in the assembly process. (5)

  d. In the assembly language for the 8086 architecture, the mnemonic SUB is used to represent the subtraction operation. Explain the instruction SUB AX,12 when the second operand of the instruction is:
    i.   a direct address; (1)
    ii. an immediate address. (1)

  e. A university's relational database system includes tables for students, courses, and lecturers. Each student can be enrolled in multiple courses and each course can have multiple students. A lecturer can lecture multiple courses. For this university database system identify:
    i.   the attribute to be used as a primary key for each table and any foreign key/s; (3)
    ii. the ideal type of language to manipulate data and extract useful information from this database. (1)

(Total: 20 marks)