



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

Directions to Candidates

- Answer **ALL** questions.
 - 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.
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1. Consider the following code:

```
int myNumber = 4;
switch(myNumber) {
    case 3:
        System.out.println("First result");
        break;
    case 4:
        System.out.println("Second result");
        break;
    case 5:
        System.out.println("Third result");
        break;
    default:
        break;
}
```

- What is the output of the above code? (1)
- Suppose the `break` statements were removed. What would the output of the code be? (2)
- What is the role of the default statement? (2)

(Total: 5 marks)

2. Consider the following code:

```
int count = 4;
while (count > 1) {
    for (int i = 0; i < count; i++) {
        System.out.print("*");
    }
    System.out.println();

    count -= 1;
}
```

- a. What is the output of the above code? (3)
- b. What datatype would you use to store the following values:
 - i. 1397; (1)
 - ii. true. (1)

(Total: 5 marks)

- 3. a. Distinguish between a public key and a private key. (2)
- b. IPv6 has a 128-bit long address. What is the maximum number of addresses that it can support? (1)
- c. Name and briefly describe **ONE** example of a network topology. (2)

(Total: 5 marks)

- 4. a. What is the purpose of multiplexing in a communications system? (1)
- b. Briefly expand and describe the acronyms TDM and FDM (using diagrams if necessary). (4)

(Total: 5 marks)

- 5. a. What is an Interrupt Service Routine? (2)
- b. Describe the role of the stack in interrupt handling. (2)
- c. Mention **ONE** way in which files can be stored using blocks. (1)

(Total: 5 marks)

- 6. a. What is memory fragmentation? (1)
- b. Mention and describe a technique which can be used to fix memory fragmentation. What is the result of such a technique? (3)
- c. Mention **ONE** way in which files can be protected against unauthorised access. (1)

(Total: 5 marks)

7. a. Mention **ONE** example of an application used to develop a database. (1)
 b. Consider the following table called Employee:

Employee ID	Name	Surname	Salary
1750	Matthew	Xuereb	25,000
1832	Maria	Borg	23,000
1635	Adrian	Mizzi	19,000
1938	Francesca	Attard	26,000

- i. Give an example of an attribute in this table. (1)
 ii. Give an example of a record in this table. (1)
 iii. Suggest a suitable primary key for this table. (1)
 iv. What would be the result of the following SQL query?

```
SELECT * FROM EMPLOYEE WHERE EMPLOYEE ID > 1850
```

(1)

(Total: 5 marks)

8. a. Name and briefly describe any **THREE** database models. (3)
 b. Explain what is meant by a secondary key. (2)

(Total: 5 marks)

9. a. Consider the following data structure:

[3,8,1,2,7]

7 is the first number added to the data structure, 2 is the second number added to the data structure, and so on until the number 3, which was the last number to be added.

- i. Assuming that 7 is the first number to be processed, what type of data structure is this known as? (1)
 ii. Assuming that 3 is the first number to be processed, what type of data structure is this known as? (1)

- b. Name **ONE** sorting algorithm of your choice and show how the list [3,8,1,2,7] would be sorted in ascending order using that algorithm. (3)

(Total: 5 marks)

10. a. Explain what is meant by a pointer. (1)
 b. Distinguish between a static and a dynamic data structure. (2)
 c. Mention **ONE** searching algorithm and briefly explain how it works. (2)

(Total: 5 marks)

Questions continue on next page

11. a. i. What is the largest binary number that can be represented in a 5-bit register? (1)
 ii. What is its decimal equivalent? (1)
 b. Build the truth table for the following logic expression:

$$Y = \bar{A}BC + A\bar{B}C + AB\bar{C}$$

(3)

(Total: 5 marks)

12. a. Using two's complement code four-bit representation, write down the representation for:
 i. -7 (1)
 ii. 3 (1)
 iii. -4 (1)
 b. Briefly explain why the numbers 8 and -9 **cannot** be represented. (2)

(Total: 5 marks)

13. a. Mention **THREE** differences between dynamic and static RAM. (3)
 b. Give an example application of each type of RAM. (2)

(Total: 5 marks)

14. a. What do the terms RISC and CISC stand for? (2)
 b. What is the difference between RISC and CISC? (2)
 c. Mention **ONE** benefit of using a RISC architecture over CISC. (1)

(Total: 5 marks)

15. a. A memory IC has an address-bus that is 8-bits wide. What is the maximum number of addresses that can be accessed by the IC? (2)
 b. How wide should an address-bus be to access a memory IC with 32,768 locations? Show your working. (3)

(Total: 5 marks)

16. a. What are the differences between an assembler, a compiler and an interpreter? (3)
 b. Name **ONE** example of a language that is compiled and **ONE** language that is interpreted. (2)

(Total: 5 marks)

17. a. Expand the acronyms BNF and EBNF. (2)
 b. What is a debugging tool, and at which stage can it be used? (2)
 c. Differentiate between the syntax of a language and its semantics. (1)

(Total: 5 marks)

18. The Waterfall Life Cycle is used during the design and implementation of a system. Mention the main stages of this system life cycle. (5)

(Total: 5 marks)

19. Black box and white box testing are two methods used to verify the functionality of a system.
- a. What is the difference between the two methods? (3)
 - b. Why is white box testing more effective? (2)

(Total: 5 marks)

20. The following is part of an assembly program. By showing your working (writing the values of registers AX, CX, DX, EX),
- a. Determine the contents of the register EX after execution. (3)
 - b. What does this program do? (2)

```
start:      MOV AX, 7           ; set AX = 7
            MOV EX, 1         ; set EX = 1
            MOV CX, 1         ; set CX = 1
            MOV DX, 0         ; set DX = 0

loop:       CMP AX, 0         ; compare
            JZ end            ; jump if AX = 0
            ADD DX, EX, CX    ; set DX = EX + CX
            MOV EX, CX        ; set EX = CX
            MOV CX, DX        ; set CX = DX;
            DEC AX            ; decrement AX
            JMP loop          ; unconditional jump

end:        HLT              ; end program
```

(Total: 5 marks)



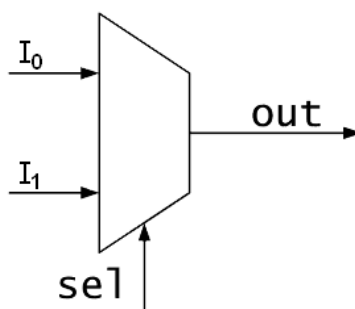
SUBJECT:	Computing
PAPER NUMBER:	II
DATE:	28 th September 2020
TIME:	9:00 a.m. to 12:05 p.m.

Directions to Candidates

- Answer any **FIVE** questions.
 - 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.
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1. A multiplexer is a combinational logic circuit that forwards a particular input to an output, based on a selector. For example, a 2-to-1 multiplexer has two inputs (I_0 and I_1), a single select bit (sel), and an output (out). If $sel = 0$, then $out = I_0$, else if $sel = 1$, then $out = I_1$. Thus, the output can be written as:

$$out = \overline{sel}.I_0 + sel.I_1$$



The company that you are working for requires to connect 4 devices ($I_0 - I_3$), one at a time, to a single machine through the use of a 4-1 multiplexer.

- a. How many bits are required to successfully control the multiplexer? (2)
- b. Draw the truth table for the multiplexer and extract the logic equation for the output. (8)
- c. Draw the logic circuit to show how this multiplexer can be implemented. (5)
- d. The company that you are working for has decided to connect 8 devices ($I_0 - I_7$) instead of 4. Draw a block diagram to show how this can be done by using two 4-to-1 multiplexers, and a single 2-to-1 multiplexer. (5)

(Total: 20 marks)

2. Consider the following short assembly program.

```

MOV AX, 100      ; Move 100 into register AX
MOV BX, 7        ; Move 7 into register BX
MOV CX, 0        ; Move 0 into register CX
JMP LOOP        ; Jump instruction
LOOP: SUB AX, BX ; Subtract BX from AX, storing the value in AX
      INC CX    ; Increment the value of CX
      CMP AX, BX ; Compare AX with BX
      JGE LOOP  ; Jump if greater or equal
END:  HALT

```

- a. From the code above, give an example of:
 - i. a conditional jump instruction; (1)
 - ii. a pseudo-directive; (1)
 - iii. an arithmetic operation; (1)
 - iv. a mnemonic. (1)
 - b. By performing a dry run, how many iterations are needed for the program to complete? (6)
 - c. What are the contents of registers AX, BX and CX at the end of execution? (2)
 - d. Suppose that the value of register BX has been changed to 10, without changing anything else. What are the final contents of registers AX and CX? Show your working. (6)
 - e. What operation is this program performing and what is the final value of AX called? (2)
- (Total: 20 marks)**

3. a. Describe the function of the following buses:
 - i. Address Bus; (1)
 - ii. Data Bus; (1)
 - iii. Control Bus. (1)
 - b. What is the function of the system clock? (2)
 - c. Explain the function of the Control Unit and the Arithmetic Logic Unit. (4)
 - d. A generic processor needs to interface with an n -bit memory having 2^k addressable locations. Draw a block diagram of the system highlighting clearly the **THREE** main buses, together with their widths (where possible). (6)
 - e. Describe how an instruction is fetched from memory during the fetch stage of the fetch-decode-execute cycle. Your description should include the registers and buses used, together with the role of the main memory. (5)
- (Total: 20 marks)**

4. a. The compilation process consists of **THREE** main stages. Briefly describe these stages and the process performed at each stage. (6)
- b. Explain, by giving a relevant example, the difference between a syntax error and a semantic error. (4)
- c. A compiler translates the following infix arithmetic operations into RPN. What are their post-fix forms?
 - i. $(A * B) + (C - D)$ (2)
 - ii. $- C / A * 5 / (B - D)$ (3)
- d. Assuming that $A = 5$, $B = 3$, $C = 2$ and $D = 4$ write the infix arithmetic operation and work out the following expression written in RPN form using a stack structure:

$$A B C + D - /$$

(5)

(Total: 20 marks)

5. a. What is device handshaking in terms of I/O operations? Describe how such a procedure would be carried out. (4)
- b. A company would like its employees to have desktop computers with minimal storage requirements, which would not be sufficient to install an actual operating system on each machine. The computers are however equipped with a fast internet connection.

Mention which type of operating system can be used for these computers, and describe its functionality. (4)

- c. An operating system uses a scheduling system for processes in which each process is allocated a fixed time slice.
 - i. What is the name of the scheduling system being used? (2)
 - ii. Mention **ONE** advantage and **ONE** disadvantage of such a scheduling system. (2)
 - iii. Describe another scheduling system, naming **ONE** advantage and **ONE** disadvantage. (4)
- d. What is meant by software polling, and in which context is it used? (4)

(Total: 20 marks)

6. a. State which type of communication mode is being used in each of the following cases:
 - i. mobile phones; (1)
 - ii. walkie-talkies; (1)
 - iii. keyboard to computer. (1)
- b. Why is analogue wave modulation important in communications? Mention **ONE** analogue wave modulation technique. (3)
- c. Satellite communications is a wireless communication medium. Mention and describe **TWO** other wireless communication media. (6)
- d. The OSI seven-layer protocol stack is an important feature in computer networks.
 - i. Explain why it is important. (2)
 - ii. Name and describe **TWO** layers in this protocol stack. (6)

(Total: 20 marks)

Questions continue on next page

7. Consider the following table.

Name	Address	Telephone number	Movies rented
Joe Attard	3, Rock Street, Lija	32903	Avengers, Pirates of the Caribbean
Rose Borg	53, Orange Street, Qrendi	17930	Titanic
Martin Said	8, Flower Street, Sliema	89302	Midnight in Paris, The Lion King
Rose Borg	13, Fish Street, Bugibba	230231	Pokemon Detective Pikachu

- Transform the table above to 3rd Normal Form showing **all** steps involved including explanations. Be sure to show the results after each step. (12)
- State **TWO** advantages of the 3rd Normal Form. (4)
- Explain **TWO** responsibilities of a database administrator. (4)

(Total: 20 marks)

8. a. Consider the following Java method:

```
public static int myMethod(int n) {
    if(n == 0){
        return 1;
    }
    if(n == 1 || n == 2) {
        return 2;
    }
    return myMethod(n-2) * myMethod(n-1);
}
```

- What type of programming is being used by this method? (2)
- Name **ONE** advantage and **ONE** disadvantage of this type of programming. (2)
- Write down the output when the following code which makes use of the above method is executed:

```
int maxNumber = 6;
for(int i = 1; i < maxNumber; i++){
    System.out.print(myMethod(i) + " ");
}
```

(4)

- b. Consider the following two Java classes:

```
public class Employee {
    public int getSalary() {
        return 30000;
    }
}

public class Programmer extends Employee {
    public void writeCode() {
        System.out.println("Hello World");
    }

    public static void main(String[] args) {
        Programmer programmer = new Programmer();
        programmer.getSalary();
    }
}
```

- i. Describe what is meant by inheritance, and indicate where it is being exploited in the example above. (4)
- ii. Suppose the following two lines of code are added to the main method in the Programmer class:

```
Employee employee = new Employee();
employee.writeCode();
```

Would an error result? Give a reason for your answer. (2)

- c. List **THREE** characteristics of a good hashing function. (6)

(Total: 20 marks)

SUBJECT:	Computing Practical Tasks
PAPER NUMBER:	Task 1
DATE:	30 th January 2019
TIME:	2 hours 5 minutes

General Instructions:

- Answer all questions.
- This task should be completed within 2 hours 5 minutes. The first 5 minutes are reading and noting time.
- This paper has three questions with a total of 30 marks.
- Only the "BlueJ" programming environment shall be used throughout the practical task.
- Candidates are not allowed to make use of the `Math` class throughout the paper.
- The path where the project folder should be created and saved is to be set to the Computer Desktop or as otherwise instructed. It should be named to *Name Surname Id Card Number* (e.g. Joe Borg 123456M). All work must be saved in this project folder.
- Candidates are requested to include an inline comment with their name, surname and ID card number before starting each question.
- At the end of the exam, candidates are to print a copy with the help of the technician and save a copy of their project folder on the USB stick provided by MATSEC.
- Candidates are to sign each of their printouts.
- Before leaving, candidates are to sign the attendance sheet, write down the time at which they leave the examination room (Time Out) and the username if any on the attendance sheet.
- Marks will only be awarded if the above instructions are followed.

1. *Include an inline comment with your details before starting the question. Good practices such as brief inline comments, indentation and naming standards are expected.* [1]

Design and implement a program using one class called 'Task1Question1' which performs the following:

- a) The factorial of a non-negative integer n is defined as $n!$, which is the product of all integers up to and including n (E.g. $4!=4*3*2*1=24$). Obtain an integer from the user and using a *for-loop*, compute and print out the factorial of the integer provided by the user. [3]
- b) Check whether the factorial which you have computed is greater than 1000. If yes, then print out "Greater than"; if no then print out "Less than". [2]
- c) Calculate the average and difference between the factorial you computed and the number 1000. Store these values in appropriate variables and print out both answers. [4]

(Total: 10 marks)

2. *Include an inline comment with your details before starting the question. Good practices such as brief inline comments, indentation and naming standards are expected.* [1]

Design and implement a program using one class called 'Task1Question2' which performs the following:

- a) obtains **TWO** decimal numbers from the user; [2]
- b) calculates the addition, difference, multiplication, average and maximum of the two numbers, stores these values in appropriate variables and prints out the values. [5]
- c) keeps asking for an integer input number from the user until the integer "0" is entered to exit. Count the number of user inputs until the user finally enters "0", and then print out the answer. For example, if the user enters "5", "2", "6", "0", then the value 3 should be printed out. [2]

(Total: 10 marks)

3. *Include an inline comment with your details before starting the question. Good practices such as brief inline comments, indentation and naming standards are expected.* [1]

Design and implement a program using one class called 'Task1Question3' which performs the following:

- a) prompts the user to input a digit (number from 0 to 9). Using a switch statement, if the digit is a prime number (i.e. 2,3,5,7) then print out "Prime", otherwise print out "Not Prime". [4]
- b) Using the value input by the user as the radius of a circle, compute the area and circumference of a circle ($\pi*r^2$ and $2*\pi*r$) respectively, and print out the answers. [3]
- c) swaps the two variables containing the area and the circumference. [2]

(Total: 10 marks)

Print all your work (3 questions) and save a copy of your work on the pen drive provided by MATSEC. All printouts shall be signed.



SUBJECT:	Computing Practical Tasks
PAPER NUMBER:	Task 2
DATE:	29 th May 2019
TIME:	2 hours 5 minutes

General Instructions:

- Answer **ALL** questions.
- This task should be completed within 2 hours 5 minutes. The first 5 minutes are reading and noting time.
- This paper has three questions with a total of 30 marks.
- Only the "BlueJ" programming environment shall be used throughout the practical task.
- The path where the project folder should be created and saved is to be set to the Computer Desktop or as otherwise instructed. It should be named to *Name Surname Id Card Number* (e.g. Joe Borg 123456M). All work must be saved in this project folder.
- Candidates are requested to include an inline comment with their name, surname and ID card number before starting each question.
- At the end of the exam, candidates are to print a copy with the help of the technician and save a copy of their project folder on the USB stick provided by MATSEC.
- Candidates are to sign each of their printouts.
- Before leaving, candidates are to sign the attendance sheet, write down the time at which they leave the examination room (Time Out) and the username, if any, on the attendance sheet.
- Marks will only be awarded if the above instructions are followed.

1. *Include an inline comment with your details before starting the question. Good practices such as brief inline comments, indentation and naming standards are expected.* (1)

You are to design and implement a program using one class called `BubbleSort` which contains a method called `bubbleSort`, which takes as a parameter an integer array, performs the bubble sort on the array, and returns the sorted array. Ensure that only methods within the `BubbleSort` class can call the `bubbleSort` method. (9)

(Total: 10 marks)

2. *Include an inline comment with your details before starting the question. Good practices such as brief inline comments, indentation and naming standards are expected.* (1)

This question builds upon Question 1.

- a. Overload the `bubbleSort` method such that it can also sort arrays that contain float values. (2)
- b. Declare an integer array which stores the numbers: 9, 4, 7, 1, 3, and a float array which stores the numbers 3.2, 1.7, 44.3, 22.9, 17.4. (3)
- c. Test both methods by printing out the results of the respective sorted arrays. (4)

(Total: 10 marks)

3. *Include an inline comment with your details before starting the question. Good practices such as brief inline comments, indentation and naming standards are expected.* (1)

You are to design and implement a program using one class called `LinearSearch` as follows:

- a. Contains a method called `linearSearch`, which takes two parameters: an integer array and an integer value. The method will contain code which performs a linear search to determine whether the integer value is present in the integer array. If the value is present, then the index of its location in the array is returned. If it is not present, then the method returns the value -1. (7)
- b. Test the implementation in part (a) using the array [3, 8, 9, 2, 1] and the value 9. (2)

(Total: 10 marks)

Print all your work (3 questions) and save a copy of your work on the pen drive provided by MATSEC. All printouts shall be signed.

SUBJECT:	Computing Practical Tasks
PAPER NUMBER:	Task 3
DATE:	5 th February 2020
TIME:	3 hours 5 minutes

General Instructions:

- The paper consists of **ONE** question which carries a total of 40 marks.
- This task should be completed within 3 hours 5 minutes. The first 5 minutes are reading and noting time.
- Only the "BlueJ" programming environment shall be used throughout the practical task.
- Candidates are **not** allowed to make use of the `Math` class throughout the paper.
- The path where the project folder should be created and saved is to be set to the Computer Desktop or as otherwise instructed. It should be named to *Name Surname Id Card Number* (e.g. Joe Borg 123456M). All work must be saved in this project folder.
- Candidates are requested to include an inline comment with their name, surname and ID card number before starting each question.
- At the end of the exam, candidates are to print a copy with the help of the technician and save a copy of their project folder on the USB stick provided by MATSEC.
- Candidates are to sign each of their printouts.
- Before leaving, candidates are to sign the attendance sheet, write down the time at which they leave the examination room (Time Out) and the username, if any, on the attendance sheet.
- Marks will only be awarded if the above instructions are followed.

An estate agent sells apartments and houses. Each property has an identification number, a location and a price. Three classes have been identified:

- `Property`
- `Apartment`
- `House`

The classes `Apartment` and `House` are related, by single inheritance, to the class `Property`.

a. Write code for the `Property` class, which includes the following:

Attributes:

- Identification number – must be unique
- Location
- Price

Methods:

- Getters and setters for all attributes
- The use of the `toString()` method to display the property details (i.e. the identification number, location and price).
- A method called `displayProperties`, which takes as an input parameter a data structure containing the list of entered properties and makes use of the `toString()` method above to display all properties.

b. In the `Apartment` and `House` classes, override the `toString()` method to display "Apartment" or "House" (depending on the class) in addition to the property details.

c. Write a test class called `Main` which displays and performs the functionality of the following main menu:

1. Enter New Apartment
 2. Enter New House
 3. Display Apartments and Houses
 4. Edit Apartment price by ID
 5. Edit House price by ID
 6. Exit
- After pressing (1) or (2), a new instance of `Apartment` or `House` should be created, and the user should input values for the identification number, location and price.
 - The `Main` class should create an array of type `Property` to store the `Houses` and `Apartments` created.
 - All created properties can be viewed by pressing (3) in the main menu.

- Apartment and House prices may be edited by pressing (4) and (5).
- The program exits when (6) is pressed on the keyboard.

(Total: 40 marks)