

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA
MATRICULATION EXAMINATION
INTERMEDIATE LEVEL
SEPTEMBER 2017

SUBJECT:	COMPUTING
DATE:	1st September 2017
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. The method `calculateDays()`, listed below, is called by the statement:

```
double days = calculateDays(hours);

public void calculateDays(double hrs)
{
    double days = hrs/24;
    return days;
}
```

An attempt is made to compile the program.

- a. Define the term compilation. (1)
- b. By considering the code given above, identify the type of error that would cause the compilation process to fail. (1)
- c. Explain the reason why this error has occurred. (2)
- d. Re-write the code without any errors. (2)

(Total: 6 marks)

2. An information system is used to manage the pharmacy of a hospital. It includes a computerised database management system (DBMS) that contains the availability of different types of medicine. Data about patients who are taking specific medicines is also stored in this database. This database can be used by the database administrator, internal hospital staff and also by staff of nearby hospital.

- a. Outline **TWO** roles of a database administrator in the hospital. (2)
- b. Outline what is meant by a data dictionary in the above context. (2)
- c. What is DDL in the above context? Give **ONE** example how DDL may be used in the above hospital database system. (2)

(Total: 6 marks)

3. a. Given CPU-bound tasks, choose the best algorithm for the following systems and specify why you chose the algorithm.
- i. A multi-programmed system where each process is treated according to its importance. (2)
 - ii. An interactive, time-sharing system. (2)
- b. State and briefly explain **TWO** different ways in which a deadlock will be created. (2)
- (Total: 6 marks)**

4. A program is written to help farm management. The following class is used to create objects representing fields in a farm.

```
public class FarmField
{
    String fieldname;
    int fieldSize;
    int soilType;
    int fertilizerType;
    int cropType;    //Crop type: 1=Carrots, 2=Cauliflower, etc.
}
```

- a. Write the code required to create an instance of an empty `FarmField` object named `firstField`. (1)
- b. Construct the statements that will assign a field name "Field One" and a field size 12,000 square metre to the `firstField` object. (2)
- c. The `FarmAnimals` class is used to create objects representing fields in which animals are kept.

```
public class FarmAnimals
{
    String fieldname;
    int fieldSize;
    int animalType;    //Animal type: 1=Cow, 2=Sheep, etc.
    int animalNumber; //The number of animals.
}
```

- Suggest with the use of code how inheritance could be used in this program. (3)
- (Total: 6 marks)**

5. Criminal justice agencies (for example, local police, drug enforcement agencies) require a lot of information about crimes and people. Instead of using a manual system, a computerised system can be used.
- Outline the difference between data and information in such a system. Give an example. (2)
 - Briefly explain **TWO** advantages for the criminal justice agency if the system is computerised. (2)
 - Discuss the issue of data privacy in such a system. (2)

(Total: 6 marks)

6. Computers and the Internet have created a new reality and new opportunities for learning.
- List and briefly explain **TWO** characteristics that can distinguish e-learning from face-to-face learning. (2)
 - Many modern schools have a Virtual Learning Environment (VLE).
 - What is a VLE? (1)
 - Mention and briefly describe **TWO** features you would expect to find on a VLE. (2)
 - Briefly explain **ONE** way how a VLE and e-learning generally may disadvantage certain students. (1)

(Total: 6 marks)

7. Computer data representation is binary-based.
- Explain why data representation is by necessity binary-based. (1)
 - Convert 78_{10} to 8-bit binary. (1)
 - Convert 78_{16} to 8-bit binary. (1)
 - What is the range in decimal of 8-bit decimal representation? (1)
 - What is the range in decimal of 8-bit two's complement representation? (1)
 - Represent 14.5_{10} in 8-bit fixed point representation as shown. (1)

<i>Integer part</i>				<i>Fractional part</i>			

(Total: 6 marks)

Please turn the page.

8. In network communication, the choice of transmission medium depends on a number of factors.
- a. Name **TWO** factors that determine the choice of transmission medium. (2)
 - b. Hence, compare twisted-pair with fibre optic cable. (2)
 - c. LANs are often used in schools. Name **TWO** other types of networks and briefly describe their use. (2)
- (Total: 6 marks)**
9. The Internet is at the heart of modern reality be it in government, business, education or entertainment.
- a. Briefly explain the role of a web server in our Internet experience. (1)
 - b. In November 2016, *Google Chrome* had a 51% of the web browser market share across all platforms.
 - i. What is the role of a web browser? (1)
 - ii. A new computer system often comes with a pre-installed browser, name **ONE** factor that may still lead a user to switch to another browser. (1)
 - c. Within the above context, what is HTML? (1)
 - d. Remote login can give the user access to a data processing system from a remote location. Name **TWO** ways how to ensure that unauthorised access is not made through remote login. (2)
- (Total: 6 marks)**

10. Banks keep a computerised database of accounts in order to maintain records of their clients bank transactions, the updated balance held by each client, the account description as well as their personal details. The following tables and their associated fields were identified for such a database.

CUSTOMER	
Customer Government ID	(Unique)
Surname	
Name	
Address	
Telephone No.	

ACCOUNT	
Bank Account Number	(Unique)
Customer Government ID	
Account Type	

TRANSACTION	
Bank Transaction Reference	(Unique)
Bank Account Number	
Date of Transaction	
Type of Transaction	
Value of Transaction	

ACCOUNT BALANCE	
Bank Account Number	(Unique)
Balance	

- a. What do you understand by the term relational database? (1)
- b. Name **ONE** advantage of implementing a relational database rather than flat file database. (1)
- c. In the context of a relational database distinguish between a one-to-one and a one-to-many relationship. Give an example of each of these types of relationships that could be drawn from the database described above. (2)
- d. Give an example of **ONE** primary key and **ONE** foreign key from the database described above. Give a reason for each choice. (2)

(Total: 6 marks)

Please turn the page.

SECTION B

Answer **ONE** question from this section.

1. This question is about Assembly Language.
 - a. List **THREE** operations performed by an assembler during the assembly process. (3)
 - b. List **TWO** disadvantages of writing a piece of code in Assembly Language as opposed to writing the same code in a high level language. (2)
 - c. How is conditional branching achieved using assembly language? Give an example of **TWO** different commands used in conditional branching and explain their function. (2)
 - d. The mnemonic for the addition operation is ADD. Explain the difference between the instructions ADD AX, [50] and ADD AX, 50 in the context of:
 - i. direct addressing; (1)
 - ii. immediate addressing. (1)

- e. Write the equivalent of the assembly program below in **ONE** line of Java code.

MOV AX, sum	Set AX equal to sum	
ADD AX, BX	Add contents of register BX to AX	
ADD AX, CX	Add contents of register CX to AX	
ADD AX, DX	Add contents of register DX to AX	
MOV sum, AX	Set sum equal to AX	(2)

- f. Determine the contents of register BX after the execution of the following instruction. Result should be in hexadecimal.

MOV BX, 6666H	Set BX equal to hex 6666	
ADD BX, 3FFFH	Add hex 3FFF to BX	(3)

- g. Consider the assembly program below.

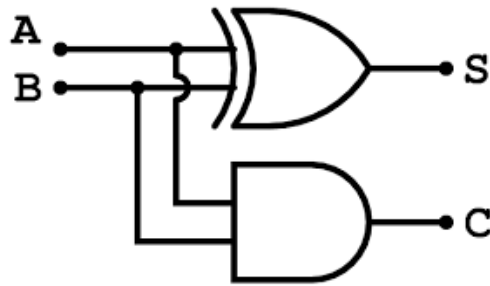
MOV AX, 0	Set AX equal to 0	
Lb1: INC AX	Increment AX	
CMP AX, BX	Compare AX with BX	
JL Lb1	Jump if AX is less than Y	

- i. Show the contents of the accumulator and the variables AX and BX during execution if BX is equal to 3. (3)
- ii. Draw the flowchart for the above assembly program. (3)

(Total: 20 marks)

2. a. What is the role of logic circuits within a computer system? (1)

b. Consider the logic circuit shown below:



- i. Draw the truth table to represent the above logic circuit. (3)
- ii. Hence give the Boolean expressions for S and C. (2)
- iii. Redraw the above circuit using NOR gates only. (3)
- iv. Suggest **ONE** function of the above circuit. (1)

c. The truth table for a given logic circuit is represented as

INPUT			OUTPUT	
A	B	C _{in}	S	C _{out}
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

- i. Use a Karnaugh map to give the Boolean expressions for S and C_{out} in the above truth table. (5)
- ii. Hence draw the logic circuit described above. (4)
- iii. Suggest how the logic circuit drawn in part c(ii) is an improvement of the one shown in part b above. (1)

(Total: 20 marks)