MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2010 SESSION

SUBJECT:	**Computer Studies**
PAPER NUMBER:	IIA
DATE:	4th May 2010
TIME:	9.00 a.m. to 11.00 a.m.

MARKING SCHEME

Directions to Candidates

Write your index number where indicated at the top of the page.

*Answer **ALL** questions in the spaces provided. You are not allowed to use extra sheets other than those provided in this booklet.*

Good English and orderly presentation are important.

*The use of flowchart templates is permitted. The use of calculators is **NOT** permitted.*

Question Number	1	2	3	4	5	**FOR MARKERS' USE**
For Markers' use only						Total number of Marks or Grade obtained by candidate
MARKS						

1. (a) IO devices are integral components of any computer system.

(i) What input system would you use to digitise a text document which may then be edited with a word processor?

OCR system OR Scanner with OCR software – 1 mark

(ii) Some output devices produce a raster image while others a vector image.

- Explain the difference between the two types of images.

Raster – image made up of an array of dots/pixels – 1 mark

Vector – image made up of geometrical shapes – 1 mark.

- Give an example of an output device that produces a raster image and another example of an output device that produces a vector image.

Raster image – monitor OR laser/inkjet printer - 1 mark.

Vector image – graphics plotter – 1 mark.

(iii) Pixel and resolution are two terms commonly associated with the screen of the monitor.

- How are they related to each other?

Resolution is the amount of pixels in the vertical and horizontal dimensions OR An increase in the number of pixels will increase the resolution of the image - 1 mark

- In a particular computer, a pixel can be one of 2^{20} different colours. How many bytes are required to code one pixel?

20 bits = 2.5 bytes = 3 bytes – 1 mark

(b) A DBMS is used to store and manipulate data.

The following shows the structure of two of the three tables of a database for a DVD rental outlet.

DVD table

DVD code	Title	Year of release	Genre	Loan days

Customer table

ID number	Name	Address	Telephone

The third table is the Loans table which records who has rented which DVDs.

(i) Name three important fields that you expect to find in the Loans table.

ID number, DVD code, Issue date or Due Date– 1 mark each

(ii) Which field/s form the relationship between the Loans file and the:

- DVD file; and

The DVD code fields – ½ mark. 1-to-1 – ½ mark.

- Customer file.

The ID number fields – ½ mark. 1-to-many – ½ mark.

For each relationship, state whether it is a 1-to-1 or 1-to-many.

(iii) Describe in your own words how a query may be set up to list the DVDs that are overdue.

'Issue date' in Loans file is compared with today's date to get number of days that the DVD has been out - 1 mark. If the number of days is greater than the 'Loan days' in DVD file then that record is listed - 1 mark.

(c) The hard disk drive is the principal secondary storage unit in many computer systems.

(i) Why is the hard disk considered a non-volatile medium?

Contents are retained after switching off the system – 1 mark

(ii) How does a computer system keep track of the files stored on a hard disk?

The concept of directory should be accepted. - 1 mark

(iii) Besides the file names, mention two other items of information that are typically kept by the system to keep track of files stored on a hard disk.

Two from File type, Address on disk, Date created/modified, File Size – ½ mark each

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2. (a) Data is represented using the binary number system.

(i) Use two's complement arithmetic and an 8-bit word to work out 120 – 31.

0111 1000 +

1110 0001

0101 1001

Correct conversion of both numbers – 1 mark. Correct result of 'addition' – 1 mark

(ii) What do the two two's complement numbers, 1000 0001 and 1000 0000 have in common?

Both start with a 1 therefore both are negative numbers – 1 mark

(iii) Provide two reasons for storing numbers in two's complement and not as unsigned binary numbers.

Numbers may be both positive and negative, no performance of subtractions if only positive can be stored – 1 mark each

(iv) What situation arises if the result of an addition operation does not fit in a register?

Numerical overflow – 1 mark

(v) What happens to the value of an unsigned binary number when the bits are shifted once, either to the left or to the right?
a. to the left *:Shift left – number is multiplied by 2 – 1 mark*

b. to the right *: Shift right – number is divided by 2 – 1 mark*

(b) ASCII is a common character coding system.

(i) Why is it desirable to have a standard character coding system for computers?
Data may be transferred and recognised on different machines – 1 mark

(ii) Given that the 8-bit ASCII code for the character 'B' is 0100 0010, show how the string BAD would be held in memory.
B - 0100 0010 A - 0100 0001 (1 mark) D - 0100 0100 (1 mark)

(iv) Some characters in the ASCII coding system are called 'control' or 'non-printable' characters. Name TWO keyboard keys that generate such characters.
Key 1 : *Two from printable, enter, escape, delete, or other control keys - ½*
Key 2 *: mark each*

(c) Binary data is processed with logic gates and circuits.

(i) Why are logic gates referred to as 2-state devices?
Because the variables (inputs, outputs) can attain only one of two values – 1 mark

(ii) A 3-input (A, B, C) logic circuit is required to produce an output (X) of 1 only if A is 0, B is 1 and C is either 0 or 1.

- Draw the truth table of the logic circuit.

A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

1 mark for correct combinations of all input. 1 mark for correct output

- Derive the Boolean expression of the circuit in terms of A, B, C and X.

$X = (\overline{A} \,.\, B \,.\, \overline{C}) + (\overline{A} \,.\, B \,.\, C)$

2 marks for a completely correct expression OR 1 mark for a partially correct expression. Accept also simplified expressions (though not in syllabus).

3. (a) A computer architecture describes the way components are connected together.

(i) What is the main task of the ROM when booting up a computer system?
Loads the essential components of the OS from the HDD into RAM – 1 mark

(ii) The width of the address bus determines the address space while the width of the data bus determines the word size.

- What are the address space and the word size?

  Address space *: – the memory capacity – 1 mark.*

  Word size *: – the amount of bits that can be handled in one operation – 1 mark.*

- Explain how the width of the address bus determines the address space.

  The wider the bus the greater the memory space that can be addressed – 1 mark

(iii) How does the CPU inform the memory unit that it either needs to fetch data from or to store data to memory?
Through the control bus OR the read/write line – 1 mark

(b) The operating system (OS) is the most important software in a computer system.

(i) The OS is said to be the 'manager of the computer's resources'. Name TWO such resources, and explain briefly how they are managed by the OS.

Resource 1 : *Memory – partitions the memory between the processes*

Resource 2 :*CPU – Decides which process to run next*

Filing System – stores and loads files into/from a secondary storage medium
I/O – transfers data to/from the device
2 marks for any two of the following. Accept also other relevant explanations of management

(ii) State whether each of the following four tasks would be performed by the OS or by an application program.
Award ½ mark for each correct answer.

- Transferring data from memory to hard disk : OS
- Getting a character from the keyboard : *OS*
- Performing a range check on input data : *Application*
- Calculating the amount of VAT due : *Application*

(iii) Why is batch processing is suitable for a payroll system while a nuclear power station requires a real-time system.
Payroll system - response time is not critical and all data has to be fetched - 1 mark.

Nuclear power station – data must be processed immediately that it is received because it influences the next action to be taken – 1 mark.

(iv) Explain how a multi-user system allows many users to access to a single processor.
1 mark for mentioning time sharing. 1 mark for explanation - fraction of time allotted to each user in round robin fashion.

(c) Nowadays, large commercial organisations have an IT department.

(i) Give two reasons why nowadays organisations are finding it necessary to set up an IT department.

Improve customer service, focal point for all IT activities, accept other relevant reasons -

1 mark each for any two

(ii) Mention two responsibilities of a web master.

Creation of website, uploading, designing, maintenance – 1 mark each for any two

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4. (a) Computer programs are developed to solve problems.

(i) Two constructs that are found in almost every programming language are the conditional branch and the loop. Use examples from Pascal to explain what these constructs are.

Conditional branch – Example from either If Then Else OR Case Of – 1 mark. Selects whether a statement is to be obeyed or not – 1 mark.

Loop – Example from For~Do OR Repeat Until OR While~Do – 1 mark. Repeatedly obeys one or more statements until a condition is satisfied - 1 mark.

(ii) Write a short program in Pascal that generates TEN random numbers between 1 and 50 and calculates their average.

```
program exam;
var      N : Array[1..10] of Integer;
         count, temp : Integer;
         Average : real;

         begin
           For count := 1 to 10 Do
                 N[count] := Random(49) + 1;
            Temp :=0;
            For count := 1 to 10 Do
                  Temp  := N[count] + temp;
           Average ;= temp/10;
           Writeln(Average);
         End.
```

The above is just ONE possible solution using arrays. Other solutions exist.
1 mark – correct declaration of array. 1 mark – correct loop structure. 1 mark – generation of correct random number. 1 mark – correct average

(b) Programs are written in computer languages.

(i) Mention one similarity and one difference between machine language and assembly language.

Similarity – *both low level, one-to-one relationship, long programs – 1 mark for any one.*

Difference – *AL needs translation, use of mnemonics, easier to debug – 1 mark for any one*

(ii) What type of programming error is detected during the translation of source code?
Syntax error - 1 mark

(iii) Which one of the following will generate a logical error?
- Dividing a number by 0.
- Initialising the total for a bill to 1.
- Using the equal sign (=) as the assignment symbol.

Initialising the total for a bill to 1 – 1 mark

(iv) Mention two features that make source code more readable and understandable to another programmer.
Feature 1 : 1 mark each for any two – meaningful identifiers, indentation, in-line
Feature 2 : *comments, structured design.*

(c) Few programmers nowadays use assembly language.
The following section of assembly language program is intended to loop twice and then stop.

```
        LDA   #3      ; Load the accumulator with the number 3
again:  SUB   #2      ; Subtract the number 2 from the accumulator
        JNZ   again   ; Jump to 'again' if the accumulator does not contain a zero
        HLT           ; Stop
```

(i) Name a label from the program above.
again – 1 mark

(ii) Why does the program as it is, never reaches the 'stop' instruction?

Accumulator never gets to 0 – 1 mark

(iii) Modify one operand from the program above such that the program terminates after two loops.
LDA #4 - 1 mark

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5. (a) Computers are networked to share resources.

(i) What is the difference between serial and parallel communication?

Serial communication *: – bits are transferred one after another along a single line – 1 mark*

Parallel *: – groups of bits are transferred simultaneously along a number of lines – 1 mark.*

(ii) When data is transferred over a network it is important to maintain its security and integrity.

- Differentiate between data security and data integrity.
  Data security : *– safeguarding data against unauthorised access – 1 mark*

  Data integrity : *– safeguarding the accuracy of the data during transfer – 1 mark*

- Describe one measure to maintain the security of data and one measure to preserve the integrity of data being transferred over a network.
  Security – encryption, jumbling up of data before transmission – 1 mark

  Integrity – parity checking, the insertion of a parity bit to make the number of 1's odd/even – 1 mark

(iii) Large files are usually compressed before sending them over a network. Why?
Take less time to be transferred – 1 mark

(b) Computers are increasingly finding their way into various areas of society

(i) The following are six computer applications:

Weather forecasting, Stock control, Lending libraries,
Flight simulation, Patient's information system, Cinema booking.

Match the best application with one of the categories listed below:

Commercial data processing	Community	Technical
Stock control *Cinema booking*	*Lending libraries* *Patients' info system*	*Weather forecasting* *Flight simulation*

½ mark each

(ii) The Data Protection Act became law in Malta in 2001.

- The law applies equally to the public and private sectors. Mention one example of a public organization to which the law applies.
  Government OR any government department – 1 mark

- The law also mentions that a person shall be responsible for ensuring that organizations comply with the Act. What is this person called?

  Data commissioner – 1 mark

(c) Systems analysis is the process of computerising or upgrading a system.

(i) Provide a reason to show why the systems analyst has to undertake each of the following three tasks.

Feasibility study: *– to check whether computerisation is possible or not – 1 mark*

Present system study: *– to be knowledgeable on the operations of the current system and the resources being used – 1 mark*

Control and review: *– checks whether the new system is working as planned and make any necessary modifications – 1 mark*.

(ii) The new computerised system must be easy-to-use (user-friendly). Mention two items which the systems analyst may include in his/her software design for a user-friendly computerised system.

Two from the following, menu driven, error trapping, icon-based operations, accept other relevant features – 1 mark each

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