SUBJECT:	COMPUTING
DATE:	5th September 2015
TIME:	4.00 p.m. to 7.00 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)

A1   a.   Using Karnaugh maps, **simplify** the following expression to its lowest terms:

$$F = A \cdot \overline{B} + \overline{A} \cdot \overline{B} + \overline{A} \cdot B$$ [2]

    b.   i.   From Boolean algebra give ONE **commutative** law and ONE **absorption** law.

         ii.   Use truth tables to **justify** the validity of each law mentioned in part 'b.i' above. [4]

A2   a.   The following are three situations related to the functioning of an operating system. What **term** is used to refer to each situation mentioned?

         i.   A **signal** that halts the running of a process so that the CPU attends to a higher priority process.

         ii.   Two computer programs sharing the same resource are effectively preventing each other from accessing the resource, resulting in both programs **ceasing to function**.

         iii.   Deciding which process to **run next**. [3]

    b.   User ID and password are two features used to protect files against unauthorized access.

         i.   What are **file access rights**?

         ii.   Name and briefly explain TWO **access privileges** which can be assigned to files. [3]

A3   a.   The following questions are related to a database management system (DBMS).

         i.   What is the main **use** of the query language?

         ii.   What is the **advantage** of using a query langauge?

         iii.   Name and briefly explain one other DBMS **language** besides the query language. [3]

    b.   List and explain THREE **responsibilities** of a database administrator (DBA). [3]

A4 Study the following partially designed table structures which are taken from a library database and then answer the questions below.

- **Borrower** (BorrowerID, Surname, Name, Address)
- **Book** (BookCode, Title, Author)
- **Loan** (BookCode, BorrowerID, DateDue)

a.	Give the name of ONE **primary** key.	[1]
b.	Give the name of ONE **foreign** key.	[1]
c.	What type of **relationship** should exist between the 'Borrower' and 'Book' tables?	[1]
d.	The librarian would like to know the town/village with the least number of borrowers. Which **table** should be amended and how?	[1]
e.	What is the difference between a **field** and a **record**?	[2]

A5 A logic circuit has three inputs (A, B and C) and one output (F). The output of the circuit is logic-1 when the binary value of the three inputs together is greater than 0 but less than 3. Otherwise the output F is logic-0.

a.	Draw the **truth table** of the circuit.	[2]
b.	Derive the **Boolean expression** of the circuit.	[2]
c.	Draw the **logic circuit**.	[2]

A6 a. Give an example of ONE:
    i. **Imperative** language;
    ii. **Object oriented** language;
    iii. **Formal** language. [3]

   b. A Java class in a banking application is called *Account*. It includes a method called *findInterest*. Write Java instruction/s to:
    i. **Create** and **instantiate** an object of *Account* called *account1*;
    ii. **Call** the method *findInterest* for *account1* (assuming this method does not expect any parameters). [2]

   c. How is an **instance** method distinct from a **static** method? [1]

A7 a. A Java method called *getHighest( )* implements a *for* loop that finds and returns the highest mark for ten student's examination marks.
Assuming the following array declaration:
    int[ ]marks = {80, 72, 35, 79, 91, 34, 66, 53, 29, 81};
Write the **method** *getHighest( )* to find and return the highest mark. [4]

   b. Name TWO other Java **looping** constructs. [1]

   c. How is the *for* loop **distinct** from the looping constructs you mentioned in part b. above? [1]

A8 a. Differentiate between **serial** and **direct** access storage devices. [2]
   b. Suggest ONE suitable **application** for direct access and justify your choice. [1]
   c. Suggest ONE suitable **application** for serial access and also justify your choice. [1]
   d. Besides the mode of access, mention TWO other **features** one should consider when comparing storage devices. [2]

A9   a.   Explain the difference between the two **language translators**, compiler and interpreter. [2]

      b.   Mention ONE programming language that is usually **compiled** and ONE other language that is usually **interpreted**. *Do not mention the Java language which has components of both translators.* [1]

      c.   Explain briefly the role of the **CPU** within the computer system. [1]

      d.   Name and briefly explain the role of ONE functional **subunit** within the CPU. [1]

      e.   CPUs make extensive use of registers. What is a **register**? [1]

A10 a.   What is a **WAN**? [1]

      b.   Briefly explain the role **modems** play in networking. [1]

      c.   Differentiate between **amplitude** and **frequency** modulation. [2]

      d.   Suggest ONE **medium** used for transferring data across wide geographical distances. [1]

      e.   In the context of networks, what is **noise**? [1]

Section B
(Answer **ONE** question from this section)

B1   *This question is about data representation and computer applications.*

      a.   **Convert**:
         i. 25_{10} directly to hexadecimal;
         ii. $3A_{16}$ directly to decimal;
         iii. $1A4_{16}$ to 16-bit binary;
         iv. 1011100_2 to decimal; and
         v. 25_{10} to 8421 Binary Coded Decimal. [5]

      b.   Represent **-25** in 8-bit:
         i.   Two's complement; and
         ii.   Sign and magnitude. [1]

      c.   Find the **range** of numbers (in decimal) that can be stored in 8-bit two's complement. [1]

      d.   What would be the **result** if the binaries of 56 and 83 are added together in 8-bit sign and magnitude registers? [1]

      e.   Mention ONE **advantage** of performing subtractions in two's complement. [1]

      f.   Mention ONE practical **application** of 8421 Binary Coded Decimal. [1]

      g.   i.   Name and briefly explain the representation of numbers having a **fractional component**.
         ii.   **Convert** the binary number 101.01 to decimal. [3]

      h.   i.   What is **ASCII** used for?
         ii.   If the letter 'a' is 65 in binary, what **decimal value** is assigned to the letter 'f'.
         iii.   Briefly mention ONE **advantage** of Unicode over ASCII. [3]

      j.   Explain briefly what the following two applications are used for:
         i.   **Computer aided design** (CAD) software; and
         ii.   **Process control software**.
      For each software listed above, mention ONE typical **input** device. [4]

B2   *This question is about computer architecture and assembly language.*

a.   Choose the correct answer:

   i.   **Converts** a low-level language into machine instructions.
        [a] Interpreter;
        [b] Assembler;
        [c] Compiler;
        [d] Translator.

   ii.   The words **MOV** and **ADD** in assembly language are the:
        [a] Opcodes;
        [b] Operands;
        [c] Operators;
        [d] Commands.

   iii. An assembler permanently **stores** the object code:
        [a] In ROM;
        [b] In cache;
        [c] In RAM;
        [d] On magnetic disk.

   iv.   The **utility program** used to fetch object code into memory for execution is the:
        [a] Linker;
        [b] Loader;
        [c] Extractor;
        [d] Fetcher.   [4]

b.   Consider the following assembly language snipet and then answer the questions below:

```
MOV    AX,  sum
ADD    AX,  x
ADD    AX,  y
ADD    AX,  z
MOV    sum, AX
```

   i.   Briefly explain what the program snipet above is **doing**.
   ii.   Give an example of a **mnemonic** from the snipet.
   iii. Write the above snipet as one **Java instruction**.   [4]

c.   Mention THREE **reasons** why programmers prefer to use a high level language like Java rather than assembly language.   [3]

d.   Most computers make use of both **dynamic** and **static** RAM.
   i.   Give TWO main **differences** between the two RAMs.
   ii.   Mention where each RAM is typically **found** in a computer system.   [4]

e.   The CPU has a **special register** consisting of a number of **flags**.
   i.   What is this **register** called?
   ii.   Name and explain the purpose of TWO **flags** of this register.
   iii. Which **group** of assembly language instructions typically test the contents of the flags?
   iv.   Name and explain the operation of ONE **instruction** from the group that was mentioned in part 'e.iii.' above.   [5]