Section A

(Answer ALL questions in this section)

A1 (a) Computer systems divide software in two major classes.

(i) Name the TWO classes. [1]

System software and Application Software.

(ii) Briefly describe the difference between the TWO types and give an example of each type.

System Software: provides the basic functions for computer usage and helps run the computer hardware and system e.g. device drivers, OS, etc.

Application Software: developed to perform in any task that benefits from computation e.g. spreadsheets, databases, etc.

(iii) Authoring software

Used to create instructional material that uses the CAL approach [1]

(b) (i) What is process control? [1]

When the output of a process is used again as input of another process

(ii) Name and briefly explain a system which uses process control.

Controlling machines in factory, etc. (1 mark for suitable example with brief explanation) [1]

A2 (a) (i) What does the acronym EFT stand for? [1]

Electronic funds transfer.

(ii) Define EFT giving a suitable use to justify your answer. [2]

Transfer of money from one account to another through computer-based systems. Ex. Employees’ payments or relevant use.

(b) (i) Define the term remote access. [1]

Means of communication with a data processing facility from a remote location through a data link.

(ii) What method is usually used to provide remote access? [1]

VPN

(iii) What is usually required to optimize safety and traceability to the source? [1]

Individual authorization credentials

A3 (a) Two’s complement and Sign and Magnitude are TWO representations for binary
numbers. Using an 8-bit register, what is the range in decimal of both representations?

\[ 2C = -128 \text{ to } 127 \]
\[ \text{S&M} = -127 \text{ to } 127 \]

(b) Using 1 byte and with an imaginary binary point fixed after the fourth digit convert the decimal number 14.1875 to binary.

11100011

(c) Give TWO main differences between a compiler and an interpreter.

Two from:
- Interpreter one line at a time/compiler compiles program all at once
- Interpreter: errors found easy/Compiler: more difficult
- Interpreter: slow in execution/Compiler: faster in program execution

A4
(a) Draw the logic circuit for this boolean expression:

\[ F = A.B + B.C.(B + C) \]

(b) Simplify the expression and redraw the optimised logic circuit.

\[ F = AB + BC(B+C) = AB + BBC + BCC = AB + BC + BC = AB + BC = B(A + C) \]

A5
(a) What is the System bus?

A system bus encompasses all the buses that serve as a means of communication between computer components.

(b) The Data bus is part of the system bus. Identify the TWO other buses.

- Address bus
- Control bus.

(c) Give TWO different examples of how the two buses identified in (b) are used.

- Address Bus – CPU accesses a particular memory location;
- Control Bus – CU requests data from external storage.
(d) Briefly explain how the width of the data bus may effect the performance of the computer system.

Increasing the width of the data bus means more data is transferred per unit time and therefore a faster system

A6 (a) *Batch, Online* and *Network* are three types of OSs. Define the THREE types of operating systems and for each type give a suitable application.

*Batch* - a job runs from beginning to end without intervention from the user. Use – payrolls *or relevant*.  
*Online* - Various users can access the computer system from local or remote terminals. Use – *with relevant use.*

*Network* – Allows OS to manage data, users, groups, security, applications etc

(b) Real time systems require yet another OS

(i) Mention two characteristics of a real time system

Two from: ● support non-sequential applications;  
● deal with threaded processes at unpredictable moments;  
● reactive in a specified interval of time;  
● ensure success of safety-critical & fail-safe operations.

(ii) Give an example of where such a system may be implemented.

Airline reservation system, Online auction, radar system.

A7 (a) What is an *Assembler*?

Assembler converts Assembly language into machine code.

(b) Identify THREE instructions associated with an assembler.

Three from MOV, ADD, SUB, INC, CMP, JG, JL, JE, PUSH, POP. Together with operation performed

(c) Differentiate between immediate and direct addressing mode.

Immediate – the operand is actual data

Direct – the operand is an address in memory

A8 (a) Identify THREE *Programming language paradigms* and for each name one language.


(b) (i) What is a looping construct.
Repetition of instructions until a certain condition is reached.  

(ii) Differentiate between a pre tested and a nested loop.

Pre tested – the condition is tested each time before the loop is executed
Nested – loops within loops.

A9 (a) The memory of a computer system typically consists of various types.

(i) Mention one main characteristic of cache memory.

Extremely fast memory/very short access time

(ii) Briefly explain how cache memory may improve the performance of the currently running program.

Found between the CPU and the main store. Sections of a program and its data are copied there to take advantage of the short fetch cycle.

(iii) Memory store protection is an important memory management task. Why is this task necessary?

To prevent processes from accessing storage allocated to other jobs.

(b) Explain the function of two important registers that are directly involved during the fetch decode execute cycle.

Instruction pointer/PC – stores address of next instruction to be fetched
Current Instruction register – stores a copy of the instruction during decoding and execution.

Accept also the MAR and MDR

A10 Data over a communication medium may be transmitted in different modes.

(a) Name and explain the THREE modes of transmission.

Simplex, half duplex, full duplex. Simplex: communication in one direction; half duplex: communication in 2 directions but not simultaneously; full duplex: communication in both directions simultaneously.

(b) For each type give an example.

Simplex: e.g. TV; Half duplex: e.g. two-way radio (‘walkie-talkie’); Full duplex: e.g. telephone.  

Accept relevant answers.
Section B

(Answer ONE question from this section)

B1 (a) (i) What is a data structure?

A group of related data items organised in the computer [1]

(ii) What is the purpose of Data Structures?

The purpose of a DS is to organise data in a systematic way that can be efficiently and effectively manipulated. [1]

(b) Data Structures could be built-in a programming language or could be constructed by the programmer.

(i) Name THREE types of built-in or developed by a programmer;

Three from:
- Stacks;
- Lists;
- Queues;
- Arrays. [3]

(ii) Explain what are the specific characteristics of each of the data structures named in (b)(i).

Three from:
- LIFO/FILO;
- Direct insertion;
- FIFO/LILO;
- Series of rows and columns using 1 label and indexes. [3]

(iii) Give a practical example of where each of the data structures named above can be employed.

Three from:
- Stock taking of items packed in a container;
- A person’s agenda;
- Printing documents on a network printer;
- Exam marks for all students in a school. [3]

(c) Assume that you have a very large group of different numbers and need to search for a particular number X. Use a flowchart or pseudocode to design the linear search of X. Your algorithm must end by displaying whether X has been found or not, since you

Page 6 of 8
must take into account that X may not be part of the group of numbers.

Input number X
Set a pointer to first element in group
Set found to false
While end of elements in group not reached OR found equals false
   Compare X with element.
   If X equals element
      then set found to true
   else move pointer to next element
End of while
If found equals true
   then show that X is in group
   else show that X is not in group.
B2  a.  
i.  DBA responsibilities: design, implementation, maintenance and repair of an organization’s db. (*Allocate 2 marks for 2 responsibilities*)

ii.  *Allocate 1 mark each* from: Transferring Data, Replicating Data, Maintaining database and ensuring its availability to users, Maintaining the data dictionary, Controlling privileges and permissions to database users, Monitoring database performance, Database security Stop, Data fragmentation, Give authority to access data base to the authorized person.

b.  
i.  Collection of tables in which relationships are modeled by shared attributes.

ii.  Relations (table), Attributes, Domains (accept Tuple).

iii.  Relations: tables with columns and rows. Attributes: the columns of the table. Domains: set of values the attributes are allowed to take.

iv.  *Allocate 1 mark for each table if data types are correct (4 marks); 1 mark for each good relationship (3 marks) and 1 mark for highlighting the key-fields.*