

0795/2/2022
Computer Science A/L

**SOUTH WEST REGIONAL MOCK EXAMINATION
GENERAL EDUCATION**

THE TEACHERS' RESOURCE UNIT (TRU)
Cellule d'appui à l'action Pédagogique

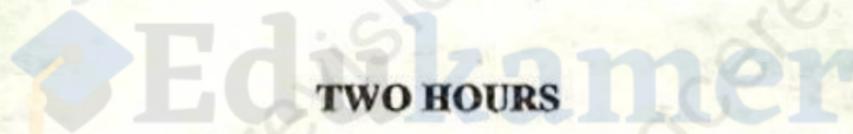
IN COLLABORATION WITH
En collaboration avec

**THE REGIONAL INSPECTORATES OF PEDAGOGY AND
THE SUBJECT TEACHERS' ASSOCIATIONS (STA)**

MONDAY, 04/04/2022

ADVANCED LEVEL

Subject Title	COMPUTER SCIENCE
Paper Number	Paper 2
Subject Code Number	0795



INSTRUCTIONS TO CANDIDATES:

Answer any SIX questions.

All questions carry 17 marks each. For your guidance, the approximate mark for each part of a question is indicated in brackets.

You are reminded of the necessity for good English and orderly presentation in your answers.

In calculations, you are advised to show all the steps in your working, giving your answer at each stage.

1. (i) Describe the function of each of the following in a computer system.
- (a) Address bus (1 mark)
 - (b) Program Counter (1 mark)
 - (c) Hard disk drive (1 mark)
- (ii) Explain the difference between sequential access and random access, giving in each case, an example of a storage medium that supports it. (4 marks)
- (iii) (a) Determine the hexadecimal equivalent of the binary number 1111011.1010111 (2 marks)
- (b) Using 8-bit one's complement notation, add the numbers 99 and -67. (4 marks)
- (c) A floating-point number is stored using 4 bits for the mantissa and 4 bits for the exponent, both in two's complement. Express the binary number 11011110 in normalized floating-point. (4 marks)

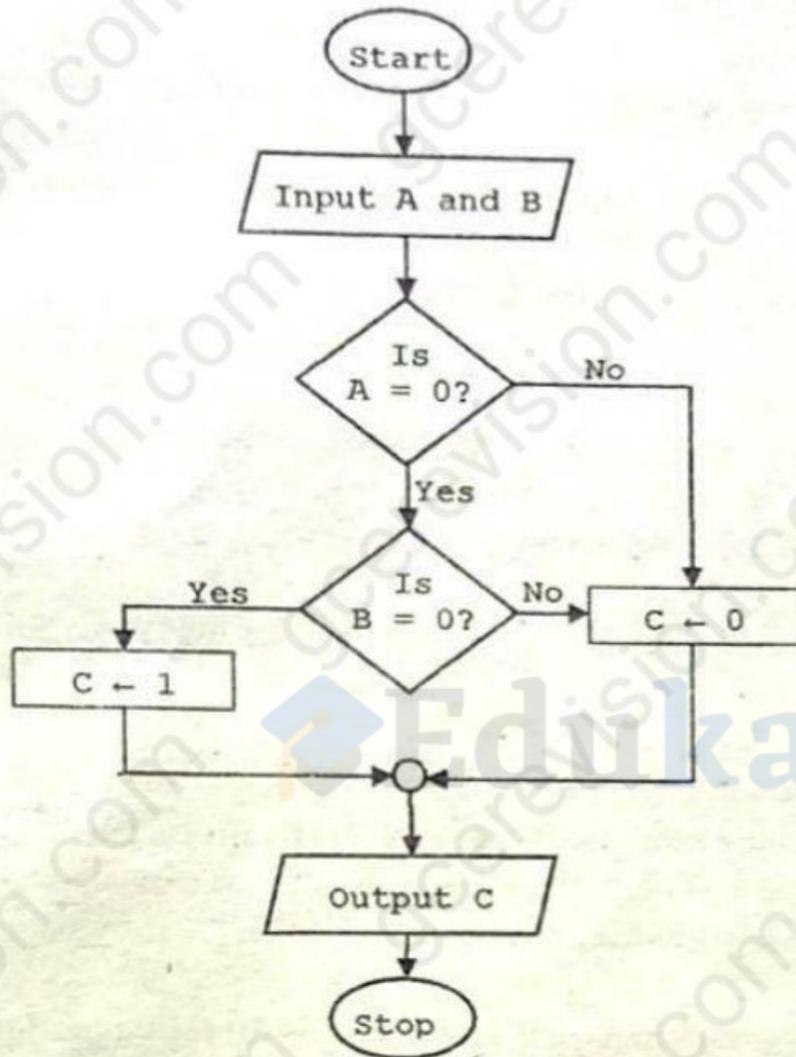
2. (i) (a) What do you understand by the stored program concept in Von Neuman Architecture? (2 marks)
- (b) A machine instruction is made of two main parts. Describe each of these parts. (4 marks)
- (c) State two important things that should be considered when designing an instruction set. (2 marks)
- (ii) Consider the truth table below with inputs A and B, and outputs X and Y.

A	B	X	Y
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

- (a) Deduce Boolean expressions for X and Y. Simplify where necessary. (2 marks)
- (b) Construct a corresponding logic circuit for the above table with inputs A and B, and outputs X and Y. (3 marks)
- (iii) (a) Explain how increasing the size of RAM can improve the performance of a computer. (2 marks)
- (b) How many bits are required to address a $4K \times 8$ main memory if the memory is byte-addressable? (2 marks)

3. (i) Describe the following terms as used in operating systems.
- (a) System call (2 marks)
 - (b) Context switch (2 marks)
 - (c) Interrupt (2 marks)
- (ii) Multiprogramming operating systems are built around the concept of processes.
- (a) What is a process in operating system context? State two activities of the operating system in relation to process management. (3 marks)
 - (b) Explain the difference between a CPU-bound process and an I/O-bound process. (2 marks)
- (iii) Four processes P1, P2, P3, and P4 are scheduled to use a single CPU. The following table shows the arrival time and duration of each of the four processes.

7. (i) (a) What is a counting loop? What three actions do counting loops typically perform using the counter variable? **(2 marks)**
- (b) When a loop is used to compute the sum of a set of numbers, why is it critical that an accumulator variable for the sum be properly initialized? What must the initial value of the accumulator be? **(2 marks)**
- (c) State two main differences between a while loop and a repeat loop. **(2 marks)**
- (ii) Using the hash function $h(\text{key}) = \text{key} \bmod 9$, insert in the order given, the keys: 5, 29, 20, 0, 27 and 18 into a hash table of size 9. Use linear probing to handle collisions. **(6 marks)**
- (iii) The flowchart below describes the logic of a certain logic gate where the values of A and B are binary digits.



- (a) Determine the output of the above algorithm for the following pairs of values of A and B: (0,0), (0,1), (1,0) and (1,1). Present your answer in tabular form with column headings correctly labeled. **(4 marks)**
- (b) State the logic gate whose logic is described in the above flowchart. **(1 mark)**

Process	Arrival time	Duration (secs)
P1	0	7
P2	2	4
P3	4	1
P4	5	4

If the system uses a preemptive shortest-job-first scheduling algorithm,

- (a) Draw a Gantt chart that shows how these processes will be scheduled. (2 marks)
- (b) Determine the average waiting time and average turnaround time for these processes. (4 marks)

(i) The following schema represents a relation from a school database. The underlined fields are key fields.

tblResult(StudentId, StudentName, DateOfBirth, SubjectCode, SubjectTitle, Grade, GradePoint)

- (a) State three types of dependencies that exist between the attributes in the above relation, giving an example of each. (6 marks)
 - (b) Mindful of how relational databases are designed, show how the above relation will be represented in third normal form (3NF). (3 marks)
- (ii)
- (a) Write an SQL statement which creates a new table called *tblStudent*, with three fields: *StudentId*, *StudentName*, and *DateOfBirth*. Make *StudentId* the primary key. (3 marks)
 - (b) Write an SQL statement for the table *tblStudent* that would change the name of a student from "Jane Ahone" to "Ahone Jane". (3 marks)
 - (c) Write an SQL statement for the table *tblStudent* that would return the total number of students in the table. (2 marks)

- (i) One of the components of a data communication system is the protocol.
- (a) What is a protocol? State two reasons why protocols are necessary in data communications. (3 marks)
 - (b) Describe the protocols HTTP and TCP, stating the OSI layer in which each operates. (4 marks)
 - (c) Describe two other components of a communication system. (2 marks)

- (ii) With the help of a diagram in each case, explain the difference between the following networking terms.
- (a) Serial transmission and parallel transmission (4 marks)
 - (b) Client-server network and peer-to-peer network. (4 marks)

- (i)
- (a) What is a prototype in software development? (2 marks)
 - (b) Explain the difference between incremental prototyping and evolutionary prototyping. (4 marks)
 - (c) State two advantages of prototyping. (2 marks)

- (ii) Most businesses utilize information systems, each with functionality that assists in managing a particular unit or organizational level.
- (a) What is an information system? Name two types of information systems that can be used at the operational level in an organization. (3 marks)
 - (b) Describe two types of reports that can be generated by a management reporting system. (4 marks)
 - (c) Describe one way by which data entered into a computer-based information system can be verified. (2 marks)

8. (i) (a) Explain what is meant by a programming paradigm? (2 marks)
(b) Distinguish between imperative programming and declarative programming. (2 marks)
- (ii) (a) State two differences between an array and a linked list. (2 marks)
(b) The letters P, W, O, E, L, R, U, T and Y are to be inserted, in the given order, into an initially empty binary search tree. Draw the corresponding binary search tree. (4 marks)
(c) Which node is the post-order predecessor of node U in the binary search tree in ii(a) above? (1 mark)
- (iii) Consider the pseudo code fragment below where `this ()` is a subprogram, `x`, `y`, `num1` and `num2` are positive integers.

```
1.  Sub this(x,y)
2.    x ← x + y
3.    y ← x - y
4.    x ← x - y
5.  EndSub
/*Main program*/
6.  Begin
7.    Get num1
8.    Get num2
9.    this(num1,num2)
10.  print(num1, num2)
11. End
```

- (a) Give one example each of an actual parameter and a formal parameter used in the pseudo code fragment above. (2 marks)
- (b) State the output on line 10, given that the input values for `num1` and `num2` are 3 and 5 respectively and parameters are passed by value. (2 marks)
- (c) Is the subprogram `this ()` a function or a procedure? Explain why. (2 marks)