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MARCH 2023

The Teachers' Resource Unit and the Regional Inspectorate of Pedagogy, in collaboration with Computer Science Teachers' Association(COSTA)	SUBJECT CODE NUMBER 0795	PAPER NUMBER 2
GENERAL CERTIFICATE OF EDUCATION AND ADVANCED TECHNICAL AND VOCATIONAL EDUCATION REGIONAL MOCK EXAMINATION	SUBJECT TITLE COMPUTER SCIENCE	
ADVANCED LEVEL		

Time Allowed: TWO and a half hours
INSTRUCTIONS TO CANDIDATES

Mobile phones are NOT ALLOWED in the examination room.

- ❖ *Answer Any Six Questions.*
- ❖ *All Questions carry Equal total Marks.*

TURN OVER

- (a) Briefly explain the following methods of memory access and state an example in each case: *sequential access and random access.* (3 marks)
- (b) What is a cache miss? Briefly describe what happens when a cache miss occurs. (2 marks)
- (c) With respect to speed, differentiate RISC and CISC CPU architectures. (2 marks)
- (ii) Given the IP address 172.30.128.19
- (a) State the class of this IP address? (1 mark)
- (b) What are the network identifiers and host identifiers of this IP address? (2 marks)
- (c) State the advantage of using an IP address to access a website rather than a URL. (1 mark)
- (iii) A RAM has a capacity of $8M \times 16$.
- (a) Determine the number of data lines for this RAM. (1 mark)
- (b) Determine the number of address lines for this RAM. (2 marks)
- (c) Determine the total number of addressable units for this RAMS. (2 marks)
- (d) Hence or otherwise Deduce, the number of input/output (I/O) lines. (1 mark)
2. (i) (a) Describe the two parts of a machine instruction. (2 marks)
- (b) Represent -12.25_{10} as a floating-point number using 6 bits mantissa and 4 bits exponent (4 marks)
- (ii) A system is to be designed to add in base 2. The system will add three bits to produce a sum (S) and a carry (C) as outputs.
- (a) Draw a truth table for the addition of the three bits A, B, and D (2 marks)
- (b) From the truth table in (a) above, derive the Boolean expressions for the output sum (S) and carry (C) and reduce them to their minimal form. (4 marks)
- (c) Give a suitable name for the circuit that can be implemented using the above logic expressions. (1 mark)
- (iii) (a) What is the decimal equivalent of the 8-bit two's complement number 10010001. (2 marks)
- (b) Add 45 and -23 in 8 bits two's complement. (2 marks)

3. (i) (a) Draw the process state diagram and explain the transitions between the process states. (4 marks)
- (b) Briefly explain the difference between a preemptive and non-preemptive scheduling policy. (2 marks)
- (ii) Given that the following processes arrived at for execution at the times indicated on the table below; each process will run for the amount of time listed (in microseconds).

Processes	Burst Time	Arrival time
P1	10	1
P2	8	8
P3	6	5
P4	12	4

Fig 1

- (a) Draw Gantt charts for "round robin" and for "shortest remaining job next" scheduling algorithms using a time quantum of 4 microseconds (2marks)
- (b) Calculate the average turnaround time for the processes in each case. (3marks)
- (c) Calculate the average waiting time for each process. (3 marks)
- (d) According to your results in (c) which of the algorithms would be best to implement? Justify. (3 marks)

4. (i) The three examples of code shown in Fig 2 are all equivalent to one another.

	Example 1	Example 2	Example 3
1.	a ← 4	MOV R0, #4	1001 0000 0100 0000
2.	b ← 3	MOV R1, #3	1001 0001 0011 0000
3.	IF a = b	CMP R0, R1	0100 0000 0001 0000
4.	THEN	BNE end	1010 0101 0000 0000
5.	c ← a + b	ADD R2, R0, R1	1100 0010 0000 0001
6.	ENDIF	end:	1111 0000 0000 0000

Fig 2

- (a) State which of the example(s) is/are in low level language(s)? (2 marks)
 (b) Assuming the code in Example 1 is written in a compiled language, explain the stages involved in the translation of the code to machine language. (4 marks)
 (c) State the addressing modes used in lines 2 and 5 of the code in example 2 above (2 marks)
 (d) Explain in terms of how the operand is obtained the TWO types of addressing modes stated in (c) above (2 marks)

- (ii) An organisation with two branches requires files to be sent between offices of different departments in both branches over a network. The organisation has a private network limited to operations within it only, and another one that allows it to interact with business associates.
 (a) Identify the two types of networks deployed by the Organisation, and differentiate between them. (3 marks)
 (b) One of the branches has just received a file, but realized the file content is not what was expected due to an error in transmission. One way to check the correctness of the file content is by using Echo check. State and explain 2 other error correction mechanisms. (3 marks)

5. (i) Explain the following database concepts.
 (a) Entity (2 marks)
 (b) Attribute (2 marks)
 (c) Cardinality (2marks)

(ii) The table below is a flat file database that records students' information for a University in Nigeria affiliated to a university in Cameroon. Study the table and answer the questions that follow

StdSSN	StdCity	StdClass	OfferNO	OfferTerm	OfferYear	EnrCode	CourseNO	CrsDesc
S1	Seattle	Jun	01	Fall	2006	3.5	C1	DB
S1	Seattle	Jun	02	Fall	2006	3.3	C2	VB
S2	Bothel	Jun	03	Spring	2007	3.1	C3	OOP
S2	Bothel	Jun	02	Fall	2006	3.4	C2	VB

Fig 3

One can perceive that there is redundant data in the table. Such a problem makes it difficult to carry out operations and leads to anomalies.

- (a) Using sample data from Fig 3 explain the following Anomalies that exist in the table: **Delete anomaly, Insertion Anomaly, Update Anomaly** (6 mark)
 (iii) (a) Determine the value of X_2 in binary, if $X_2 + 1100_2 = 117_8$ (3 marks)
 (b) Obtain the Truth table for the Boolean function: $Y = A\bar{B} + \bar{B}C + \bar{A}C$ (2 marks)

6. (i) (a) Briefly explain the terms, time and space complexity in algorithm analysis (2 marks)
 (b) A further maths student of GBHS Mboh has written an algorithm to verify if a matrix is an identity matrix. The matrix is given as A[4][4]. Below is his algorithm.

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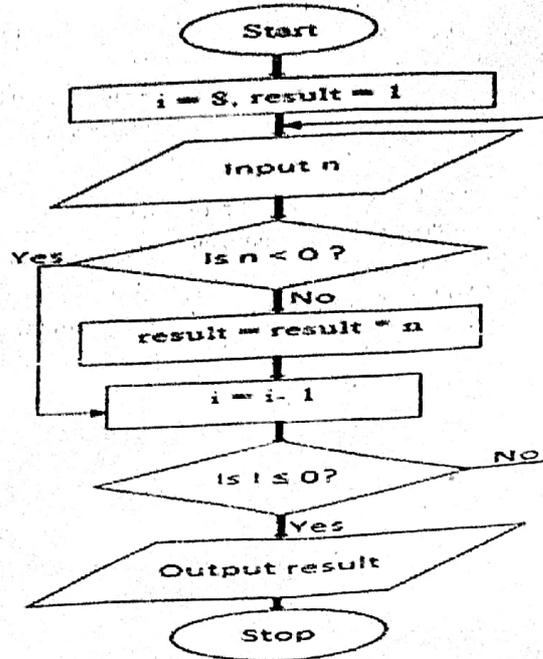
For(i=0; i<4; i++){
  For(j=0; j<4; j++){
    If(i=j){
      If(A[i][j] !=1){
        Break; }
      Else{
        Printf("Prime"); }
      }}}
    
```

For an input size N, Analyse the complexity of the student's algorithm and express it using Big O notation. (3 mark)

- (ii) The following growth functions are those derived from two different algorithms for a Power Engine.
- $F(n) = 2n + 3n^2$ (2 marks)
 - $F(n) = 2n^2 + n!$ (3 marks)
- (a) Express the complexity of both functions using Big O rules. (4 marks)
- (b) Which of the two algorithms can be implemented? Explain. (2 marks)
- (c) Differentiate between a Deterministic Polynomial problem and a Non-Deterministic Polynomial Problem giving an example to each case. (1 mark)
- (iii) Given the arithmetic expression: $(A+B) \div (C+D) * E$.
- (a) Determine the Reverse Polish form of the expression (2 marks)
- (b) State the importance of reverse polish notation? (1 mark)

7. (i) (a) Briefly describe each of the following software attributes: (3 marks)
- maintainability,
 - portability
 - Efficiency

Fig 4



- ii) Carefully study the flow chart in fig 4 with sequence and decision as control structure. Answer the questions that follow: (1 mark)
- (a) Identify any other programming construct present in the flowchart. (5 marks)
- (b) Dry run the flow chart with the following input (n) 1, 10, 7, 3, 10, 8, 5, 17. What are the values of sum and average when printed? Show how you arrive at your answer. (1 mark)
- (c) What does the flow chart do precisely? (4 marks)
- (d) Write the corresponding pseudo code for the flowchart. (2marks)
- (iii) Differentiate between the **Syntax** and **Semantics** of a programming languages.
8. (i) (a) Given the array below, describe how the principle of Divide and Conquer is applied in the Binary search of the element '5' in the array. (4 marks)

4	5	6	7	8	9	10
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- (b) Briefly explain 1 quality of a good algorithm (1 mark)
- (ii) Programming languages support different programming best practices and styles. Explain each of the following programming paradigm and state one example of a programming language that supports it. (6 marks)
- (a) Imperative Paradigm
- (b) Declarative Paradigm
- (c) Functional Paradigm
- (iii) A new information system has been developed for a hospital that has 5 branches. The project is in the implementation phase. State and briefly describe the different implementation method. (6 marks)

END