

REPUBLIC OF CAMEROON
Peace- Work-Fatherland

MINISTRY OF SECONDARY EDUCATION

SOUTH REGIONAL DELEGATION

TEACHERS' RESOURCE UNIT
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REPUBLIQUE DU CAMEROUN
Paix-Travail-Patrie

MINISTÈRE DES ENSEIGNEMENTS SECONDAIRES

DÉLÉGATION RÉGIONALE DU SUD

CELLULE D'APPUI A L'ACTION PEDAGOGIQUE
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MARCH 2024

ADVANCED LEVEL

The Teachers' Resource Unit in collaboration with the Regional Inspectorate of Pedagogy	SUBJECT CODE NUMBER 0795	PAPER NUMBER 2
GENERAL CERTIFICATE OF EDUCATION REGIONAL MOCK EXAMINATIONS	SUBJECT TITLE COMPUTER SCIENCE	
DATE: Friday 22nd March 2024 (AFTERNOON)		

Time Allowed: **TWO AND A HALF HOURS**

INSTRUCTIONS TO CANDIDATES

Mobile phones are NOT ALLOWED in the examination room.

Answer any SIX questions

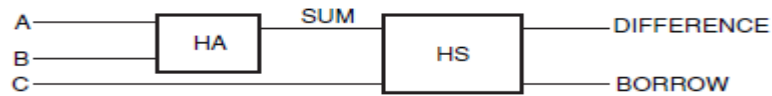
All questions carry 17 marks each. For your guidance, the approximate mark for each part of a question is indicated in brackets.

You will be marked on your ability to use good English, to organize information clearly and to use specialist vocabulary where appropriate.

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

Turn Over

1. i) a) Perform the following operation using 8-bit 2's complement arithmetic
 $21_{10} - 50_{10}$ (3 Marks)
- b) Consider the figure below. The half adder (HA) and Half subtractor (HS) are represented using block diagrams. Write the simplified Boolean expressions for DIFFERENCE and BORROW outputs in the figure below. (4 Marks)



- ii) a) Determine the number of address lines and the number of bytes that can be stored in the specified memory $4G \times 64$ (2 Marks)
- b) Explain briefly why the DRAM loses its content if not constantly refreshed. (2 Marks)
- iii) a) Describe three characteristics of a CPU that can affect the overall performance of a computer. (3 Marks)
- b) A computer has 32-bit instructions and 12-bit addresses. If there are already 250 two-address instructions, how many one-address instructions can be formulated? (3 Marks)

2. i) The machine instruction cycle is the process by which a program instruction is fetched, decoded, executed and the results are stored.
- a) Explain the **fetch phase** of the machine instruction cycle using the **register transfer notation**. (3 Marks)
- b) Describe the roles played by different buses in the machine instruction cycle. (3 Marks)
- ii) a) A digital circuit receives a 4-bit input, $A_{3:0} (A_3, A_2, A_1, A_0)$ and produces 2-bit output, $Y_{1:0} (Y_1, Y_0)$ indicating the most significant bit of the input that is TRUE. For example, if the input is 0010, the output Y should be 01 that is Y_1 is 0 and Y_0 is 1. Ignore the case where all the inputs are FALSE. Give a simplified Boolean equation for each output. (4 Marks)
- b) An instruction is stored at location 300 with its address field at location 301. The address field has the value 400. A processor register R1 contains the number 200. Evaluate the effective address if the addressing mode of the instruction is **direct; immediate; relative; register indirect; and index with R1 as the index register**. (5 Marks)
- iii) Describe the stored program concept in Von-Neumann machine architecture (2 Marks)

3. i) Memory management is one of the functions of an operating system. Part of a computer's memory is represented below. The operating system divides the memory into equally sized chunks.



- a) State the name of the type of memory management used. (1 Mark)
- b) The operating system needs to load program C into memory but there is not enough space. Describe how the operating system would use virtual memory to load program C. (3 Marks)
- c) State one disadvantage of using this type of memory management. (1 Mark)

- ii. Consider the following set of processes, assumed to have arrived at time 0 in the order P_1 , P_2 , P_3 , P_4 , & P_5 , with the length of the CPU burst given in milliseconds. The execution of these processes is done using a combination of Round-Robin and priority scheduling in such a way that the system executes the highest-priority process and runs processes with the same priority using round-robin scheduling.

Process	Burst Time	Priority
P_1	4	3
P_2	5	2
P_3	8	2
P_4	7	1
P_5	3	3

- a) Using priority scheduling (a smaller priority number implies a higher priority) with round-robin (time quantum of 2 milliseconds) for processes with equal priority, draw a Gantt chart for these processes **(3 Marks)**
- b) Calculate the average waiting time and average turnaround time for these processes **(4 Marks)**
- c) Calculate the throughput of the operating system **(1 Mark)**
- iii. a) Draw a resource allocation diagram with three processes (P_1 , P_2 , and P_3) and three resources (R_1 , R_2 , and R_3) each having one instance, where the three processes are deadlocked. In your diagram, P_1 should be holding the resource R_2 and requesting for R_1 . **(3 Marks)**
- b) How could an operating system recover from a deadlock situation? **(1 Mark)**

4. i. With the help of a diagram in each case, explain the difference between the following pairs of terms:
- a) Synchronous data transmission and asynchronous data transmission **(3 Marks)**
- b) Serial data transmission and parallel data transmission **(3 Marks)**
- ii. Each layer of the OSI model provides specific functions not provided by any other layer.
- a) State the functions of the **Transport and Network layers** of the OSI Model. **(4 Marks)**
- b) State an example of a device that functions in the Network layer. **(1 Mark)**
- iii. A school Local Area Network (LAN) uses the TCP/IP protocol to communicate between computers. The school wants to connect to the Internet. Every computer in the LAN is given an IP address with a network ID of 192.168.4 and a subnet mask of 255.255.255.0.
- a) Give **two** examples of IP addresses for this LAN. **(2 Marks)**
- b) How many different host IDs are there? **(2 Marks)**
- c) The school is worried about the possible risks of viruses and data security threats through the Internet connection. Explain what measures they should take to minimize the risk of: **virus attack** and **unauthorized access to data held on the laptop computers**. **(2 Marks)**

5. i. a) Describe what is meant by the term **relational database**. **(2 Marks)**
- b) Define the following terms in the context of databases:
Data model, Candidate key and Foreign key **(3 Marks)**
- c) Explain **TWO** properties of a primary key **(2 Marks)**

- ii) A company offers training courses to teachers on the use of mobile devices in schools. The company uses a database system to manage its bookings. The following describes a database table: **Booking** (*bookingNo, schoolCode, bookingDate, trainingDate, delegates*)

a) Write an SQL command that will create this table using appropriate data types and sizes.

(2 Marks)

The Booking table and School table have been created and populated with the following data:

Booking Table				
bookingNo	schoolCode	bookingDate	trainingDate	delegates
BK00783	M77	18/03/2022	18/04/2022	6
BK00786	P75	18/03/2022	15/04/2022	7
BK00784	B82	17/02/2022	16/04/2022	9

School Table		
schoolCode	schoolName	City
M77	Evans School	Ebolowa
P75	ABC School	Sangmelima
B82	H & J School	Ebolowa

- b) Explain the terms **referential integrity and entity integrity** as used in databases. How does it affect the records in a database table? Explain your answer using this database (4 Marks)
- d) Write an SQL command to output the bookingNo and schoolCode of schools with bookings in April with 7 or more delegates (2 Marks)
- e) Write an SQL command to output the schoolCode of schools with a trainingDate before 20/04/2022 (2 Marks)

6. i. a) Explain what is meant by the term **linked list**. Describe one benefit and one drawback of using a linked list compared with using an array. (3 Marks)
- b) Explain the differences between stack and queue ADT. (2 Marks)
- c) Construct a binary tree whose nodes in inorder and preorder are given as follows: (2 Marks)
- Inorder : 10, 15, 17, 18, 20, 25, 30, 35, 38, 40, 50 and
 - Preorder: 20, 15, 10, 18, 17, 30, 25, 40, 35, 38, 50
- ii. a) Briefly explain the following in relation to programming languages: (2 Marks)
- syntax and semantics**
- b) Functional programming and logic programming are both declarative programming paradigms. Explain these two paradigms, giving an example language in each case. (4 Marks)
- iii. a) Define the term **algorithm**. (1 Mark)
- b) Write a subroutine in pseudocode to calculate and return the greatest common divisor of two positive non zero integers, a and b, received as parameters such that $a > b$ using the following principle: (3 Marks)
- Principle:** *The GCD (Greatest Common Divisor) of two numbers a and b can be obtained by dividing a by b, then dividing b by the remainder obtained, and so on until we obtain a zero remainder. The last divisor is then the GCD of a and b.*

7. i.. When writing a program, programmers may use low-level or high-level languages. (2 Marks)
- a) Differentiate between low-level languages and high-level languages. (1 Mark)
- b) Explain why a low-level language is more suitable for programming a processor. (2 Marks)
- ii. a) Describe the procedure for converting an infix expression into prefix using stacks. (2 Marks)
- b) Using stacks, determine the postfix and prefix of the infix expression

$$P + (Q - R) * A/B$$

(4 Marks)

c) Give one major advantage of using RPN rather than infix in computers.

(1 Mark)

iii.. Consider the following subroutine written in pseudocode;

PROCEDURE calc(int d, int q)

Start

Integers $r \leftarrow 0$, $p \leftarrow 0$;

WHILE ($q \geq d * p$) **DO**

$p \leftarrow p + 1$;

ENDWHILE

$p \leftarrow p - 1$;

$r \leftarrow q - (d * p)$;

Print("p ");

Print("r ");

Stop

a) Differentiate between call by reference and call by value

(2 Marks)

b) Construct the trace table for the subroutine call *calc(8, 37)*.

(3 Marks)

c) Assuming that the arguments are both positive, state the operation performed by this subroutine.

(1 Mark)

d) Give a formula that relates **p, r, q & d**

(1 Mark)

8. i) a) Briefly explain the term **prototyping** as used in software development.

(2 Marks)

b) State two benefits of prototyping to the end user.

(2 Marks)

c) Differentiate between management information system and transaction processing system

(2 Marks)

ii) A software system failed shortly after entering service with the customer even though it passed all phases of testing successfully including *acceptance testing*.

a) What is meant by *acceptance testing*?

(2 Marks)

b) Name **one** manual other than the user manual that would be provided with a new software system.

(1 Mark)

c) State **two** reasons why a software system will require maintenance.

(2 Marks)

iii) A payroll program is being designed which will calculate the pay for hourly-paid employees. A programmer is asked to write a function

CalculateGrossPay (Hours, PayRate). The function will take as parameters the number of whole hours an employee has worked in the week and the basic rate of pay of the employee.

– The first 35 hours a week are paid at the basic rate of pay.

– Hours over 35 are paid at the premium rate of 1.5 times the basic rate of pay.

– No employee is paid for more than 48 hours in any week.

Choose **three** suitable sets of test data for the parameter Hours, which between them adequately test the functionality of this function. Justify your choice in each case

(6 Marks)

END!!!

STOP!

GO BACK AND CHECK YOUR WORK.