

Computer Science 2
0795

CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD
General Certificate of Education Examination

JUNE 2018

ADVANCED LEVEL

Subject Title	Computer Science
Paper No.	2
Subject Code No.	0795

Two and a Half Hours

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.

Calculators are allowed.

Where an imperative programming language is required to write program code, either standard (ISO) Pascal or the standard (ANSI C or C11) programming language may be used.

Turn Over

1. (i) A computer stores fractional numbers in floating point binary representation. Equal numbers of bits are used to represent mantissa and exponent. All numbers are stored in two's complement form.
- (a) By using $2\frac{1}{2}$ as an example, explain how real numbers can be shown in normalized form in this representation. (2 marks)
 - (b) State the floating point binary representation of $-3/4$ in this representation. (2 marks)
- (ii) (a) Describe what is meant by Von Neumann Architecture. (3 marks)
- (b) Explain the purpose of each of the following special registers in the processor:
- Program counter (Sequence Control Register).
 - Current Instruction Register.
 - Memory Address Register.
 - Memory Data Register.
 - Accumulator.
- (2 x 5 marks)
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2. (i) Concurrent processes in execution can end up producing an undesired phenomenon called the "race condition". Describe this phenomenon using an example of your choice. (5 marks)
- (ii) One way to avoid the race condition is to implement mutual exclusion in concurrent processes.
- (a) Explain mutual exclusion in the light of concurrent processes, saying how it helps in avoiding the race condition. (5 marks)
 - (b) What problem can possibly be created when there is mutual exclusion? (1 mark)
- (iii) (a) Describe four major advantages of a mono-programming operating systems over multi-programming operating systems. (4 marks)
- (b) What major advantages do multiprogramming systems have over mono-task systems? (2 marks)
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- 3 (i) (a) State the THREE different types of interrupts that may occur and say in what order they will be handled if they all arrive at the processor together. Give a reason to your answer. (4 marks)
- (b) Describe two types of scheduling that are used by computer processing systems. (4 marks)
- (c) Explain how interrupts are used in Round Robin Scheduling operating systems. (3 marks)
- (ii) (a) Explain the difference between paging and segmentation when referring to memory management techniques. (2 marks)
- (b) Describe how virtual memory can allow a word processor and a spreadsheet to run simultaneously in the memory of a computer even though both pieces of software are too large to fit into the computer's memory. (3 marks)
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4. A research department of a teaching hospital needs to share the results of its research with others interested bodies and individuals. At present research is published and discussed via the internet.
- (i) (a) The National Association of Teaching Hospitals (NATH) is considering the use of private intranet for such communications. Discuss the advantages and disadvantages of using an intranet in this example (5 marks)
- (b) Pages on the intranet are produced using hypertext markup language (HTML). Describe three HTML methods that can be used to enhance free text to make the pages user friendly. (6 marks)
- (ii) LANs are used to help communication around a company. As part of the NATH computer network, explain the purpose of:
- (a) Routers.
 - (b) Bridges.
 - (c) Modems.
- (6 marks)
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- 5 (i) (a) What is an information system? (2 marks)
 (b) Explain two types of information systems. (2 marks)

(ii) In a small shop in your quarter, the shopkeeper has two record books; one for his daily sales and the other for his debtors and creditors. He adds up sales per day to know how much money he has made on that day. He equally adds up amounts loaned to him and borrowed out (in articles) to know how much he owes and how much he is owed respectively. He also subtracts money loaned to him from money owed him to know his debt balance. In the end he adds the balance to his sales to know his business state of account. That is whether he runs on surplus or deficit.

- (a) Has this shop got an information system? Explain! Give the type of information system in case of a yes. (4 marks)
 (b) This shopkeeper gets someone to design a database for his shop. The designer brings out a table as shown below

Buyer_ID	Borrower_ID	Creditor_ID	Amount	Date
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- (c) In what normal form is the table above? Why? (2 marks)
 (d) Given your knowledge of the situation in the shop, put the supposed database (the table) in its 3rd normal form (3NF). (6 marks)
 (e) Give the various database entities that result from the normalisation in (c) above, with their various attributes. (1 mark)

6. (i) (a) Describe briefly the principle of binary search of an element in an array (3 marks)
 (b) State the nature (iterative or recursive) of the algorithm "binary search". Justify your choice. State the time complexity of this algorithm. (3 marks)
 (ii) What do you understand by algorithmic complexity? (2 marks)
 (iii) Study the algorithm below and answer the questions that follow.

Algorithm *INSERT (RealT[], Integer n)*

Begin

Integer i, k;

Real Aux;

For(*k = 2 to k = n*) do

Aux ← T[k];

i ← k-1;

While (*i ≥ 1 and T[i] > aux*) do

T[i+1] ← T[i];

i ← i-1;

Endwhile

T[i+1] ← aux;

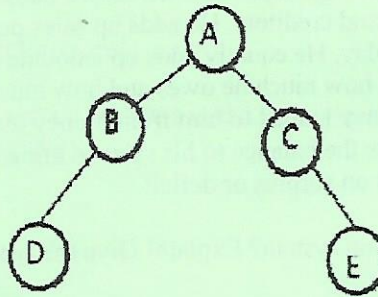
Endfor

End

- (a) Estimate the time complexity of this algorithm in terms of *n*, considering the main operation of the algorithm to be "*T[i+1] ← T[i]*". (3 marks)
 (b) Do a dry run of this algorithm with the array having as configuration at the beginning of the process. (5 marks)
 (c) Deduce what the algorithm does, giving your reason. (1 mark)

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- 7 (i) Define a pointer. What is a null pointer? (4 marks)
- (ii) (a) What is a complete binary tree? (3 marks)
- (b) Represent the following Binary tree using an array representation. (4 marks)



- (iii) (a) What is Object-Oriented Programming (OOP)? (2 marks)
- (b) What are the various elements of OOP? (4 marks)
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8. (i) List IN ORDER the various steps of the software development cycle. (5 marks)
- (ii) What is the advantage of using prototype software development model instead of waterfall model? Explain the effect of defining a prototype on the overall cost of the software project? (6 marks)
- (iii) Define software reliability. What is the difference between hardware & software reliability? (6 marks)
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9. (i) Simplify the following Boolean expressions using Boolean algebra. (4 marks)
- $$A\bar{B}C + \bar{A}BC + \bar{A}\bar{B}C + \bar{A}BC + A\bar{B}C$$
- (ii) Use NAND gates, NOR gates, or a combination of both to implement the following logic expressions: $X = A\bar{C}\bar{D} + \bar{E}F + \bar{A}\bar{F}$ (4 marks)
- (iii) A microprocessor uses RAM chips of 1×1024 capacity.
- (a) How many chips will be required and how many address lines will be connected to provide capacity of 1024 bytes. (6 marks)
- (b) How many chips will be required to obtain a memory of capacity, 16 K bytes. (3 marks)
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