0795 Computer Science 3

CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

JUNE 2020 **ADVANCED LEVEL**

Subject Title	**Computer Science**
Paper No.	**Paper 3 – Practical Work**
Subject Code No.	**0795**

Two Hours

Carry out ALL the tasks given. For your guidance, the approximate mark for each part of a task is indicated in brackets.

Great importance is attached to the accuracy, layout and labelling of drawings and computer generated outputs.

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

Write algorithms in the answer booklet provided. Also record in your answer booklet any information requested or that you believe would make it easier to understand how you carried out tasks or answered questions.

You are expected to print out a single copy of relevant fragments of your program at different times. ***Please notify the instructor of any required printout that was not done!***

When an imperative programming language is required to write program code, either **Standard [ISO]** Pascal or the **[ANSI] C or C11** programming languages may be used.

If need be, supervisors will assist you in recording details of intermediate work carried out on the computer.

Do not write on the first page of your answer booklet. It is reserved for administrative purposes.

Where information is provided as soft copy, notify the instructors if it is not found in your machine or has not been made available to you.

Turn Over

Task 1

The Cameroon Ministry of Transport has an agency that stores information about vehicles and their owners. Each vehicle is registered with this agency and must be insured before it can be driven. Details of the vehicles, owners and insurance policies are stored in a relational database using the following three relations:

Vehicle(RegistrationNumber, OwnerID, Manufacturer, Model, Colour, EngineSize, DateRegistered)

Owner(OwnerID, Title, Name, Surname, HouseNumber, Street, Town, Postcode)

Insurance(PolicyNumber, RegistrationNumber, DateStarted, PolicyType, ExcessAmount)

In this system, the following restrictions apply to some attributes:

- RegistrationNumber: a mixture of exactly 7 letters and numbers, eg; MA11FXB.
- EngineSize: a whole number representing the capacity of the engine, eg; 1597.
- PolicyType: The type of insurance policy. It is either 'Comprehensive' or 'Third Party.
- ExcessAmount: a monetary value, eg, 100.

(i) In your answer booklet use the Data Definition Language (DDL) of SQL to create the Insurance, Owner and Vehicle relational tables. Identify the primary key for each. **(3, 3, 3 marks)**

(ii) The owner of the vehicle with registration number DF24JUT repainted his car to pink. Write an SQL statement to update the Vehicle table so that it reflects this change. **(2 marks)**

(iii) A police officer checks out some details about the car with registration number AB72XHC and its owner. Write an SQL query to obtain the Model and Colour of the car, and the Name and Surname of the car's owner. **(3 marks)**

The database is to be extended to store information about vehicle safety certificates. Vehicles do a yearly roadworthiness test. A vehicle that passes the test is issued a roadworthiness certificate that has a unique certificate number and is valid for 12 months from the date the certificate is issued. The certificate also has the name of the garage that issued it. A database is used to hold the details of certificates as well as the record of all certificates ever issued to each vehicle. For a particular vehicle, the record includes its current certificate together with all certificates issued to it in the past.

(iv) Using the SQL DDL create a table that holds information about safety certificates. **(3 marks)**

(v) Implement a relational database for the tables in (i) and (iv) above using DBMS of your choice. **(4 marks)**

(vi) Implement the relationship graph between entities in (v) above and print a copy. **(4 marks)**

Task 2-Council data

The local council in your area has decided to record information about all its inhabitants. It started this activity by recording the names of all the people in the council area. You have been contracted to propose a computer application to carry out this task.

Bert	Jeff	Gary	Neba	Chang	Olga	Nora	Mary	Vera	Rani	Neil	Jill	Cain	Lara	Bart

Table 1.

Instructions: *In your answer booklet clearly write down which of the C or Pascal programming language you will use throughout the following programming exercise. The algorithms given in the Figures are in a pseudocode based on C and Pascal and where ← is for assignment and // starts a comment.*

```
procedure selectionSort (Array)
   for i ← 1 to sizeOfArray – 1
   //set current element as minimum
      integer min ← i
      //check the element to be minimum
      for j ← i+1 to sizeOfArray do
         if Array[j] < Array[min] then
            min ← j
         endIf

         // swap the minimum element
         // with the current element
         tmp ← a[i]
         a[i] ← a[min]
         a[min] ← tmp
      endFor
   endFor
endProcedure
```

Figure 1: Selection Sort Algorithm

```
Boolean found ← false;          // global variable
integer position ← 1;           // global variable

procedure bin_search_rec (Array, name, min, max)
      integer bottom ← min;     integer top ← max;

   if (min <= max) then
      mid ← (min+ max) div 2; // integer division
      if Array[mid] = name then  // mark item as
         found ← true            // found and store
         position ← mid          // its position.
      else if Array[mid] < name then // in righ half of range
         bin_search_rec (Array, name, mid+1, top)
      else          // in left half of range.
         bin_search_rec (Array, name, bottom, mid-1)
      endif
   endif
endProcedure

procedure bin_search (Array, name, min, max)
   bin_search_rec (Array, name, min, max)
   if found = false then print "Name not found"
   else print Array[position]  // print the value found
endProcedure
```

(i). In your answer booklet give a declaration, in your chosen programming language (PL), of an array data structure which is immediately initialised to values as given in Table 1. The size of the array is the same as the number of inhabitants in the council. **(2 mark)**

(ii). Using your favourite editor, implement a PL function (or procedure) called **doDisplay** that takes as arguments an array and its size, as defined in (i), and then displays the names of council inhabitants. **(3 marks)**

(iii). Using the algorithm for selection sort in Figure 1, give a PL procedure or function called **select_sort** that sorts the content of the array in (ii) in alphabetical order. Add a main program unit (if need be) and call the subroutines **doDisplay** and **select_sort** from it. **(4 marks)**

(iv). Using the data in Table 1, make sure your program in (iii) works. Screen-capture and save a copy of your output as **printout 2a**, then print it. **(2 marks)**

(v). Save your program code as **task 2a** and print a copy of it. **(1 mark)**

(vi). Using the algorithm for a recursive binary search in Figure 2, give a PL procedure called **bin_search** that takes an array, a **name** to search, and the bounds **min** and **max** of the search range within the array. It then calls the recursive procedure **bin_search_rec** with matching arguments. The procedure **bin_search** then prints the given name if found. Otherwise, the message **"Name not found"** is printed. [*Note: In Figure 2, variables* **found** *and* **position** *are global.*] **(4 marks)**

(vii). Modify your main program in (iii) so that it calls the **select_sort** procedure, then prompts for a name that it uses to call procedure **bin_search** with. **(4 marks)**

(viii). Save your program code as **task 2b**. Print a copy of it. Also screen-capture a copy of your output as **printout 2b**, then print it. **(2 marks)**

(ix). Run your program from (vii) but enter a name that is not found in the array of names. Screen-capture and save your output as **printout 2c**, then print it. **(1 mark)**

(x). Use your outputs from (viii) and (ix) to justify whether or not the program implemented is correct. **(2 marks)**