UNIVERSITY OF SWAZILAND
RE-SIT / SUPPLEMENTARY EXAMINATION, JULY, 2017

Title of Paper   :   STRUCTURED PROGRAMMING - I /
                           COMPUTER PROGRAMMING - I

Course number : CS243 / CSC112

Time allowed   : Three (3) hours.

Instructions   : (1) Read all the questions in Section-A and Section-B from
                    Page 1 to Page 5
             (2) Answer all questions in Section-A. Choose options
                    as given in questions of Section-B.

             (3) Maximum mark is 100.

             (4) Use correct notation and show all your work on the script.

             (5) All programs should be well documented and indented.

This paper should not be opened until the invigilator has granted permission.

SECTION-A

Q1 (a) (marks 10). Write equivalent single assignment statement corresponding to each of the following mathematical relations to find S, p, Root$_1$, R and the derivative, $dy/d\alpha$. Use suitable identifiers.

1. $$S = \frac{(a+b)(b-c)}{3a^2b^2}$$

2. $$p = \sqrt{\frac{(2\alpha - 3\beta)}{\sin^2 \alpha - \cos^2 \beta}}$$

3. $$Root_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

4. $$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

5. $$\frac{dy}{d\alpha} = \frac{\alpha Sin(\alpha) + 2\alpha\beta Cos(\beta)}{3\alpha\beta}$$

Q1 (b). (10 marks) Find the values of left hand side identifiers of the following assignment statements. Assume that the following declarations are already given. Show your work and write the exact display produced.

```
const int   X = 3 ,  Y = -5 ,  R = 1;
int T1,  T2;
bool out,  Holi_day;

string name = "supl / resit cs243112-"; string result;

out =   (3 * X  +  2 * Y  +  R)  == 0 ;
Holi_day =  !( X + 2 == -Y  );
result = name + "+2017" ;
T1 = (2 * X) % (-Y * 3) + 10;
T2 = sqrt(X*X + Y) + R;

cout << " Out     = " << out <<endl
     << " result  = " << result << endl
     << " T1      = " << T1 << endl
     << " T2      = " << T2 << endl
     << " Holiday = " << Holi_day << endl;
```

Q2(a) (marks 6 + 4). Write a complete independent program to declare an array of records named – ADMISSIONS_DATA, implemented as an array of records. The program should read the data interactively in the array, ADMISSIONS_DATA and write the array onto a text file. The student record has the following information in appropriate fields –

- six digit student id number,
- student's surname,
- year of study
- program of study,

Your program should write the array in a text data file ("F:\DATAFILE.TXT") sequentially, one record in a line and each field separated by at least one space..

Write three records exactly that your program will be writing in the sequential text file.

Q2(b) (marks 4 + 6 + 10) . Write a separate main program that

(i). reads complete data in ADMISSSIONS_DATA array from the file ("F:\DATAFILE.TXT"), created in Q2(a) above.

(ii). Interactively reads an Id of a student, say in KEYID and calls the SEARCH function.

(iii). SEARCH function searches the ADMISSIONS_DATA array and displays on the screen all the information of this KEYID student in a good layout of your choice. If the search fails, i.e. this KEYID student is not in the array, an appropriate search fail message should be displayed.

Include a complete SEARCH function, that displays all the record information of a certain student whose Id is KEYID, given as an argument. It should display an appropriate error message if the argument is not in the ADMISSIONS_DATA array.

SECTION-B

NOTE: Select options in this section as given with the questions.

Q3. (25 marks) Assume that reading is from the KBD and display is on the screen and following declarations are already given -

```
int   Age, N1, N2, N3, N4, SMALLEST, I, J, Temp;
char  Answer, grade;
double P [100], Final_mark;string NAME, REVNAME;
```

Write only executable statements in C++ with proper syntax (not a complete program) to perform **any five** of the following tasks independently.

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(i). Display the smallest of N1, N2, N3 and N4 by the following actions in sequence –

    1. Put N1 in SMALLEST.
    2. Put the larger of SMALLEST and N2 in SMALLEST.
    3. Put the larger of SMALLEST and N3 in SMALLEST.
    4. Put the larger of SMALLEST and N4 in SMALLEST.
    5. Display SMALLEST.

(ii). Using a switch statement, display "OUT", if the Answer is 'T' or 't'. Display "IN" if Answer is 'I' or 'i'. Display empty line, otherwise.

(iii). Display all the values in array P which are in the range [1, 100]. Assume P has 100 values.

(iv). Display the largest value in array P. Assume P has 100 values.

(v). Display "CORRECTLY ORDERED IN ASCENDING ORDER" if all the values in array P are in ascending order (i.e. $P_i \le P_{i+1}$ for all possible i). Assume P has 100 values.

(vi). Compute the reverse of NAME in REVNAME.

Q4 (marks 6 + 4 + 5). Information about the xy-coordinates of several points is known. It is required to find out and display the quadrant number in which each point lies. Also the display should include the count of points lying in each quadrant. The sentinel point lies on one or both the axis.

All the information is to be given interactively from the keyboard, The xy-coordinates of points are to be displayed along with the quadrant number on the screen according to your own layout. For example, points A, B, C and D are shown in the following figure :
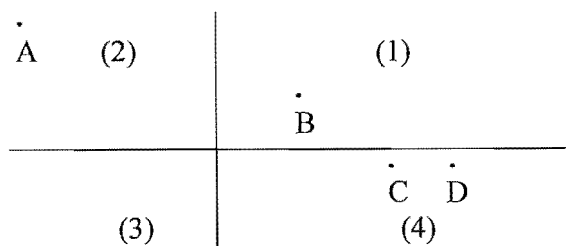
The point A is in quadrant number 2, the points C and D are in quadrant number 4 and B is in quadrant number 1.The count of points in quadrant numbers 1 to 4 are 1, 1, 0 and 2 respectively.

Write IPO and pseudo code for the above problem. Write your own test data and corresponding results produced by your pseudo code.

Q5 (marks 10). Read the following C++ program very carefully and write the **exact** display produced on screen when the program is executed.

```cpp
// Program CS243_SUPL_Exam_JUL_2016;
#include <iostream>
#include <iomanip>
using namespace std;

int main()
{
   const int Size = 5;
   int  ST, TEMPST, Q, i, j, digit, count, sum;

   for (i = 1; i < Size; i++)
     {
        cout << " Enter value number " << i << endl;
        cin >> ST;
        TEMPST = ST;   count  = 0;            sum   = 0;
        cout << "DATA    DIGIT COUNT    SUM" << endl;
        cout << ST << endl;
        while ((TEMPST > 0))
          {
            count = count +1;
            digit = TEMPST % 10;
            sum   = sum + digit + count;
            cout << setw(6) << TEMPST << setw(6) << digit
                 << setw(6) << count << setw(6) << sum
                 << endl;
            TEMPST =  TEMPST / 10 ;
          };
     };
   return (0);
}
```

Give the exact display for either of the following data entered at run time :

```
7348
2314
4386
4110
```

(End of Examination Paper)