UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION, JULY 2014

Title of Paper   : STRUCTURED PROGRAMMING - I

Course number : CS243

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, Root₁, R and the derivative. 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. $$\frac{dy}{dx} = \frac{\alpha Sin(\alpha) + 2\alpha\beta Cos(\beta)}{3\alpha\beta}$$

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 = 2 , R = 5;
int T1, T2;
bool out, Holi_day;
enum day { sun, mon, tue, wed, thu, fri, sat };
string name = "supl_cs243"; string result;

out =  (3 * X  +  2 * Y  +  R) == 0 ;
Holi_day =  ( mon == fri );
result = name + "+2014" ;
T1 = 2 * X % (Y * 3) + 10;
T2 = sqrt(X*X + Y*Y - 4) + 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 well documented and indented program to interactively read in a linear array of records named – admissions_data, implemented as an array of records. The student record has the following information in appropriate fields –

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

Your program should read data interactively from KBD into the array, admission_data and write the array information in a sequential text file, one record in a line, each field separated by a 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 reads complete data in admisssions_data array from the file, you have created in Q2(a).

After reading the admissions_data array, your program now interactively reads an Id of a student and calls the SEARCH subprogram, which searches the admissions_data array for this Id information.

Include a complete subprogram SEARCH, that displays all the record information of a certain student whose Id number is provided as an argument. It should display an appropriate error message if the given Id number 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, BIG, I, J, Temp;
char  Answer, grade;
double P [100], Final_mark;
```

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 largest of N1, N2, N3 and N4 by the following actions in sequence –

- Put the larger of N1 and N2 in BIG.
- Put the larger of BIG and N3 in BIG.
- Put the larger of BIG and N4 in BIG.
- Display BIG.

(ii). Using a switch statement, display "YES", if THE Answer is 'Y' or 'y'. Display "NO" if Answer is 'N' or 'n'. Display "ANSWER ENTRY IS INCORRECT" otherwise.

(iii). Display all the values in array P which are nonnegative. Assume P has 100 values.

(iv). Display the smallest 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. $P_i \leq P_{i+1}$ for all possible i). Assume P has 100 values.

(vi). Compute letter grade from Final_mark according to UNISWA rules.

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

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 :
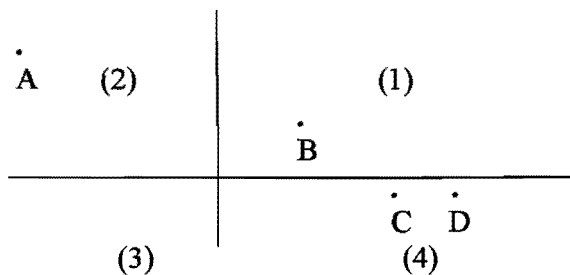
The point A is in quadrant number 2, the points C and D are in quadrant number 4 and B is in quadrant number 1.The count of points in quadrant numbers 1 to 4 are 1, 1, 0 and 2 respectively.

Write Input, Process and output, pseudo code (declarations and action steps). Assume that x-y coordinates of a point are two integers and that no point lies on any axis.

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

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```cpp
// Program CS243_SUPL_Exam_JUL_2014;
#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;
          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 :

7328
2314
4356
4650
                OR
6571
6079
1111
2222

(End of Examination Paper)