UNIVERSITY OF SWAZILAND
FINAL EXAMINATION NOVEMBER / DECEMBER, 2014 (SEM-I)

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 notations 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.

Q1 (a) (marks 10). Write equivalent single assignment statements corresponding to each of the following mathematical relations to find numerical values of S, P, F, *root2* and the derivative *dy/dx*. Use suitable identifiers.

1. $S = \dfrac{(a+b)(a-b)}{3ab^3(a-2bc)}$

2. $P = \sqrt{\dfrac{(2-3\alpha)(3-2\beta)}{(1-6\alpha\beta)}}$

3. $\dfrac{1}{F} = \dfrac{1}{F1} + \dfrac{1}{F2}$

4. $root2 = \sqrt{\dfrac{-b-(b^2-4ac)}{2a}}$

5. $\dfrac{dy}{dx} = \dfrac{3ax^2 + 3by^2}{3abxy}$

Q1 (b) (marks 10). Find the values of left hand side identifiers in the following assignment statements. Assume that the following declarations are already given. What will be the exact display on the screen when the following program segment is executed?

```
const int X = 5 , Y = 5 , A = 2, B = 1, R = 5;
int T1, T2;
bool On_Circle;
enum day {sun,mon,tue,wed,thu,fri,sat};
day today;
string name = "DLAMINI"; string result;

On_Circle = ((X-A)*(X+A)+(Y-B)*(Y+B)) != (R*R);
result = name +  "BRENDA" + "+DLAMINI";
today = sat;
T1 = (X+A)/2 + (Y+B)/2;
T2 = sqrt(X*X + Y*Y - B) + A + R;

cout << " On_Line = " << On_Circle <<endl
     << " result =  " << result << endl
     << " T1      = " << T1 << endl
     << " T2      = " << T2 << endl
     << " shirt   = " << today << endl;
```

Q2 (a) (marks 6 + 4 + 10). A complete robust function subprogram to compute the value of average of a given array of floating numbers is to be developed as follows –

$$\overline{X} = \frac{\sum_{i=0}^{n-1} X_i}{n}$$

Your function subprogram should get the values of *n* and an array of floating numbers *X* as formal arguments. The return result should be $\overline{X}$ only when n is greater than zero, and it should be the value of n, otherwise.

Write Input, Process, Output and Pseudo codes of the calling program and the function sub subprogram in C++. The calling program should read the required data interactively, call the function subprogram and displays the test data and results produced in a good layout.

Q2(b) (marks 5+5). Write the exact output produced by your programs of Q2(a) when they are executed for

n = 5 and X array as -   *8.0, 12.0, 11.0, 9.0 and 10.0* and
n = 0 and X array has no floating values.

SECTION-B

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

Q4 (marks 25). Assume that reading is from the keyboard and display is on the screen and the following declarations are already given -

```
int  N1, N2, N3, N4, I, J, Temp, P[1000];
float Tax, Salary;
char Answer;
```

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

(i). Circulate left once so that, the value of N1 goes to N4, N2 goes to N1, N3 goes to N2, N4 goes to N3 (i.e. N4 ◄—N1◄—N2◄— N3 ◄—N4 .

(ii). Compute Tax according to the following rules –

Tax is 30 % of Salary, if Salary more than 120000 or more,
Tax is 20 % of Salary, if 80000 < Salary < 120000,
Tax is 10 % of Salary, if Salary is less than or equal to 80000.
There is no Tax if Salary is 36000 or less.

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

(iv). Display the count and all the values in array P which are larger than zero. Assume P has maximum 1000 values.

(v). Display the smallest value in array P. Assume P has maximum 1000 values.

(vi). Assuming P has 1000 values, display
'DESCENDING' only if ($P_i \geq P_{i+1}$ for all possible i),
'ASCENDING' only if ($P_i < P_{i+1}$ for all possible i).

Q5 (marks 6 + 4 + 5). Information about a circle is known as the coordinates of its center (CX, CY) and its radius CR. Now assume that the information about two circles, say C1 and C2 are given and similarly information about three points, say P1, P2 and P3 are given. It is required to find out -

if any point   Pi lies in C1 or
                Pi lies in C2 or
                Pi lies in both C1 and C2.

Each circle is displayed as - $(X - CX)^2 + (Y - CY)^2 = CR^2$
Each point is displayed as –   (CX, CY).

Write the Input, Process and output, pseudo codes and programs in C++ to solve the above problem. Include suitable comments and proper indentations in your program.

HINT: A point lies in a circle if the distance between the point and circle center is less than or equal to its radius

Q6 (marks 10). Read the following C++ program very carefully and write the **exact** display produced on screen when the program is executed.

```
// Program CS243_Exam_Dec_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 << i << " Enter value number " << endl;
      cin >> ST;
      cout << ST << endl;
      TEMPST = ST;        count  = 0;        sum  = 0;
      cout << "DATA   DIGIT COUNT   SUM" << endl;

      while (!(TEMPST == 0))
        {
          count++;
          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;
}
```

Assume that the data entered at run time is :

```
1234
2076
3333
4187
```

                    OR
```
4321
7719
1001
2222
```

Give the exact display for either of the above input data sets.

(End of Examination Paper)