UNIVERSITY OF SWAZILAND
FINAL EXAMINATION NOVEMBER / DECEMBER, 2015 (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). Programs should be well documented and indented in C++.

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

SECTION-A

Q1(a). (10 marks). Write equivalent single assignment statements corresponding to each of the following mathematical relations to find numerical values of S, P, R, *root1* and the derivative *dy/dx*. Use suitable identifiers.

1. $S = \dfrac{a^2 - b^2}{(3a + 4b)(a^2 - 2bc)}$

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

3. $\dfrac{1}{R} = \dfrac{1}{R1} + \dfrac{1}{R2}$

4. $root1 = \sqrt{\dfrac{-b + (b^2 - 4ac)}{2a}}$

5. $\dfrac{dy}{dx} = \dfrac{\sin(\theta)}{\cos(\theta + \sin(\theta))}$

Q1(b). (10 marks). 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 = 4 , Y = 4 , A = 2, B = 7, R = 4;
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 +  "Rose" + "+DLAMINI";
today = sun;
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). (6 + 4 + 10 marks). 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 result should be $\overline{X}$ only when n is greater than zero, and it should zero, otherwise. Write IPO and Pseudo codes of your function subprogram.

Now write a complete calling program to test your above sub subprogram. The calling program should read the required data interactively, call the function subprogram and displays all the test data and results produced in a good layout.

Q2(b). (5 + 5 marks). 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.

Q3. (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 right once so that, the value of N1 goes to N2, N2 goes to N3, N3 goes to N4, N4 goes to N1 (i.e. values of   N1 → N2 → N3 → N4 → N1).

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

Tax is 30 % of Salary, if Salary more than 80000 or more,
Tax is 20 % of Salary, if 60000 < Salary < 80000 ,
Tax is 10 % of Salary, if Salary > 36000 , but is less than or equal to 60000.
There is no Tax if Salary is 36000 or less.

(iii). Using a switch statement, display 'MALE', if Answer is 'M' or 'm'.
Display 'FEMALE' if Answer is 'F' or 'f'.
Display 'INCORRECT ANSWER' otherwise.

(iv). Display all the values in array P which are smaller than zero. Assume P has 1000 values. Also display the count of nonnegative values in array P.

(v). Display the largest value in array P. Assume P has 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).
'RANDOM' otherwise.

Q4. (marks 6 + 4 + 5). Information about a line is known by the values of its slope (M) and intercept (C). Now assume that the information about two Lines, say L1 and L2 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 on L1 or
Pi lies on L2 or
Pi lies on both L1 and L2.

Each line is displayed as -   Y = M X + C
Each point is displayed as –   (X, Y).

Write the IPO, pseudo codes and programs to solve the above problem. Include suitable comments and proper indentations in your program.

HINT: A point lies on a line if the point satisfies the equation of the line.

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

```cpp
// Program CS243_Exam_Dec_2015;

#include <iostream>
#include <iomanip>
using namespace std;

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

  for (i = 1; i < Size; i++)
    {
       cout << i << " Enter value number " << endl;
       cin >> ST;
       cout << ST << endl;
       TEMPST = ST;      count  = 0;        prod  = 1;
       cout << "DATA   DIGIT COUNT   PRODUCT" << endl;

       while (!(TEMPST == 0))
         {
           count++;
           digit = TEMPST % 10;
           prod = prod * digit;
           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 :

1324
2070
3332
4812

         OR

4301
7721
1011
2223

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

(End of Examination Paper)