

**UNIVERSITY OF SWAZILAND
FINAL EXAMINATION, DEC 2012**

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 before you start answering any question.
 - (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.

SECTION-A

Q1 (a) (marks 10). Write equivalent single assignment statements corresponding to each of the following mathematical relations to find C,P,F,dy/dx and X. Use suitable identifiers.

$$1. C = \sqrt{\frac{x^2 + y^2 + 2xyz}{(x+y)^2}}$$

$$2. P = p_0 e^{-k(t_0 - t)} + \varepsilon$$

$$3. \frac{1}{F} = \frac{1}{F_1} + \frac{1}{F_2}$$

$$4. \frac{dy}{dx} = \frac{3\sin(x) + 2xy\cos(y)}{6xy}$$

$$5. X = \frac{\sin(a-b) + \cos(a-b)}{a-b}$$

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 = 3 , Y = 2 , A = -2, B = 3, C = 0;
int T1, T2;
bool On_Line;
enum colour {RED, GREEN, YELLOW, BLUE, WHITE};
colour shirt;
string name = "cs243"; string result;

On_Line = ((A * X + B * Y + C) == 0);
result = name + "+cs243" + "cs211";
shirt = YELLOW;
T1 = 2 * B / (3 - B % 3 - 1);
T2 = sqrt(X*X + Y*Y + B) + 1;

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

Q2 (marks 10 + 6). Write I.P.O., pseudo codes and complete programs to find and display the count of students and the average age of students in a class.

The program should read the ages of students in an array of integer numbers (in cms) from the keyboard interactively. The sentinel should be given as zero. Use appropriate interactive messages and output lay out on the screen. Declare a function sub program to find the average value. The formal argument list should include – count of students and the array.

Q3(a) (marks 6 + 6 + 6). Write Input, Process, Output, Pseudo codes and a complete well documented and indented program to read and display a linear array of records named – registration_data, implemented as an array of records. The student record has the following fields –

- a six digit student id number,
- a one character gender of the student,
- count of courses the student is registered and
- course codes of all the courses for which the student is registered.

Your program should display the above registration data in a good tabular lay out on a disk file followed by the summary information which includes the count of male and female students and average count of courses registered by a student in registration_data. Assume that the students are allowed to register for a maximum of six courses or less. The above data is read from a file- "F:\STDATA.TXT", each record in a line and each field is separated by a space character in a line. The sentinel in id field is 999999. Write at least four correct records of "F:\STDATA.TXT" including the sentinel.

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;  
float Tax, Salary;  
char Gender;  
double P [1000];
```

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). Exchange the values of N1 with N2 only when N3 and N4 are both negative or both positive.

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

There is no Tax if Salary is 36000 or less.
Tax is 10 % of Salary, if Salary is 65000 or less,
Tax is 20 % of Salary, if $65000 < \text{Salary} < 120000$ and
Tax is 30 % of Salary, if Salary is 120000 or above.

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

(iv). Display the count and all the values in array P which lie in $[1, 1000]$. Assume P has maximum 1000 values.

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

(vi). Display 'DESCENDING' only if $(N1 > N2 > N3 > N4)$,
'ASCENDING' only if $(N1 < N2 < N3 < N4)$ and
'NOT ORDERED' otherwise.

Q5 (marks 6 + 4 + 5). Information about the three lines is known as their slopes (m) and intercepts (c). It is required to find out the intersecting points of these lines, if they exist. The display should include the lines, coordinates of the points of intersection or a text message that lines do not intersect according to your own layout.

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

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_2012;

#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 << " Enter value number " << i << endl;
        cin >> ST;
        TEMPST = ST;        count = 0;        prod = 1;
        cout << "DATA  DIGIT COUNT  PRODUCT" << endl;
        cout << ST << endl;
        while (!(TEMPST == 0))
        {
            count++;
            Q = TEMPST / 10;
            digit = TEMPST - Q*10;
            prod = prod * digit;
            cout << setw(6) << TEMPST << setw(6) << digit
                << setw(6) << count << setw(6) << prod << endl;
            TEMPST = Q;
        }
    };
    return (0);
}
```

Assume that the data entered at run time is :

2345
1234
3456
4560
1111

OR

5671
6709
1001
2222
0000

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

(End of Examination Paper)