UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION, JULY 2013

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 one to five 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 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). (10 marks) Write equivalent single assignment statement corresponding to each of the following mathematical relations. Use suitable identifiers. Asume Z, p, X, D and F as of float type.

$$i. Z = \frac{12a\,b\,c}{(a-b)(c-s)}$$

$$ii. p = \sqrt{\frac{(5n-\beta)}{abc}}$$

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

$$iv. F = S(1+R/365)^N + \varepsilon$$

$$v. D^2 = (S-a)(S-2b)(S-3c)$$

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

```
const int  X = 3 ; Y = 2 ; R = 13;
int T1, T2, out;
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 ;
Holi_day =  (pred (mon) == succ (fri));
result = name + "+cs243" ;
T1 = 2 * X % (Y * 3) + 1;
T2 = sqrt(X*X + Y*Y - 4) + 1;

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

Q2 (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 and initials,
- stydy program and study year
- address of communication

Your program should read data interactively from KBD and write the admissions_data array information in a sequential text file. Use your own good layout. Write three records exactly that your program will be writing in the sequential text file.

Q3. (4 + 6 + 6 + 4 marks) Write a complete program which declares and tests a function to compute the value of factorial of a given integer, n (n! = 1.2.3 … n). If n is zero or negative, the factorial value should be one. The function name should be *factorial* of double type.

The main program should interactively read three non zero positive integers, n, r and p. It then computes and displays *ncr* and *rcp* using the function *factorial*. The *ncr* and *rcp* are defined as follows –

$$ncr = \frac{n!}{r!(n-r)!} \quad , \quad rcp = \frac{r!}{p!(r-p)!}$$

Write the exact user screen with suitable data set of your choice, when your program is executed.

SECTION-B

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

Q4. (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, I, J, Temp;
String name; float Height, Final_mark;
char Gender, Answer;
double P [500];
```

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

(i). Exchange the values of N1 and N2 only if values of N3 and N4 are distinct.

(ii). Display your age in years as a two digit integer, your height in cms as a floating number with one digit after decimal, your name as 15 characters and your Gender as a single character (M or F) as follows -

```
AGE = -- HEIGHT = ----.- NAME = --------------- GENDER = -
```

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

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

(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 500 values.

(vi). Display the smallest value in the array P. Assume P has 500 values.

Q5. (15 marks). Information about the xy-coordinates of centers of three circles and their radii are known. It is required to find the pairs of circles which touch each other.

All the information is to be given interactively from KBD. The Output should be displayed according your own lay out. But all the three circles should be displayed as three equations of circles.

Write the analysis (Input, Process and output), pseudo code 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_SUPL_Exam_JUL_2013;
#include <iostream>
#include <iomanip>
using namespace std;

int main()
{
  const int Size = 4;
  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++;
          Q = TEMPST / 10;
          digit = TEMPST - Q*10;
          sum   = sum + digit;
          cout << setw(6) << TEMPST << setw(6) << digit
               << setw(6) << count << setw(6) << sum
               << endl;
          TEMPST =  Q;
        };
    };
  return (0);
}
```

Assume that the data entered at run time is :

```
2345
1234
3456
4560
```

OR

```
5671
6709
1001
2222
```

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

(End of Examination Paper)