UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 1, Examination in Engineering, July 2017

Module No: EE1102 **Module Name: Introduction to Programming**

[1 hour and 30 minutes]

[Answer all questions. Q1, Q2 and Q3 carry 5, 7 and 8 marks, respectively.]

Part I1

Q1. a) Consider the following code with a **if** statement.
`if(anualSalary >= 500000) anualTax = anualSalary*2.0/100;`

i. Explain the operating principle of **if** statement by using the above example. You may use a flowchart.

ii. Use **if−else if−else** statement, to calculate annual tax amount with respect to the data given in the following table.

	Annual Salary [Rs]	Tax Rate [%]
1	below or equal 499999	0
2	500000 - 699999	2
3	700000 - 999999	2.5
4	1000000 - 1299999	4
5	above or equal 1300000 -	7

[2 Marks]

b) Following loop calculates the sum of integers from 0 to 100.
`for(i = 0, sumIntg=0; i <= 100; ++i) sumIntg += i;`

i) Modify this loop to assign the sum of odd and sum of even numbers to variables sumOdd and sumEven, respectively. Both the calculation should occur simultaneously within the given loop.

ii) Write a **while** loop to calculate the sum of integers from 0 to 100.

[2 Marks]

c) How does the **switch** statement given by the following example work? Emphasize the role of **case**, **break** and **default**. You may use a flowchart in your explanation.

```
switch(option)
{ case 1: z = x + y; break;
  case 2: z = x − y; break;
  case 3: x++; z = x;
  case 4: x++; z = x; break
```

```
    default: z =0; break
  }
```
[1 Mark]

Q2. a) What are the advantages of using *functions* in a program? [1 Mark]

b) The definition of a function, for testing whether the input character c is a digit, is given below.

```
int isdigit (char c)
{  int status = 0;
   if(c<='9'&& c>='0') status=1;
   return status;
}
```

i. Write the definition of a function to test if the input character is a letter (capital or simple). Prototype of the function should be
int isletter (char c).

ii. Write the definition of a function that counts the number of letters in the input C-string in the form of an array. The function has the prototype
int nletters (char str [ ]).
The nLetters() should call the function isletter (). Please note that a C-string ends with the character '\0'.

[2 Marks]

c) Consider following program that displays the maximum value out of 3 user input integers a, b and c.

```
#include <stdio.h>

int maxVal(int, int, int);

int main(void)
{  int a, b, c, max;
   scanf("%d", &a);
   scanf("%d", &b);
   scanf("%d", &c);
   max=maxVal(a,b,c);
   printf("\nMaximum Value = %d", max);
   return 0;
}

int maxVal(int x, int y, int z)
{
  /*Complete the code*/
}
```

i. Complete the code of the function maxVal().

ii. Is it possible to name the variables a, b and c as x, y and z, respectively? Explain your answer.

iii. Convert the above program to find the maximum value out of 10 user input numbers. Assume that the array declared as
int num[10];
already contains the user input numbers. Use **while** or **for** loops where appropriate. Use the modified maxVal() function to find the maximum value within num[ ].

[4 Marks]

Q3. a) Consider the following program that defines a structure to hold x and y coordinates of a point in Cartesian plane. The function getPoint() obtains the x and y coordinates from the user.

```
#include <stdio.h>

struct SPOINT { double x; double y;};

struct SPOINT getPoint(void);

int main(void)
{  struct SPOINT a, b; /*declaration of points a and b*/
   double dAB; /*Distance between points a and b*/

   a = getPoint(); /* get user input */
   b = getPoint();

   dAB = distAB(a, b);
   printf("\nMaximum Value = %d", dAB);
   return 0;
}

struct SPOINT getPoint(void)
{ struct SPOINT p;
  scanf("%lf", &(p.x));
  scanf("%lf", &(p.y));
  return p;
}
```

i. Write the definition of the function distAB() which calculates the distance d between two points, where distance d between two points $A(x_1, y_1)$ and $B(x_2, y_2)$ is defined by
$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$

ii. Write advantages of using structures.

[2 Marks]

b) Assume the array defined as
char name[100];
contains a C-string which consists of only capital letters. Write a code fragment that would sort the content of name in the alphabetical order. [3 Marks]

c) Show how to do the following.

i. Declare a pointer ptr of type **int**.

ii. Declare a variable x of type **int**.

iii. Make the pointer ptr points to variable x.

iv. Assign the value 23 to the variable x by using the pointer ptr

[3 Marks]