



COMSATS UNIVERSITY ISLAMABAD
DEPARTMENT OF COMPUTER SCIENCE
Mid Term Examination, Spring 2022

Class/Section: - BSCS - 5A/B
Subject: - Design and Analysis of Algorithm
Instructor: - Tanveer Ahmed Siddiqui

Marks: - 25
Time: - 90 minutes
Dated: - May 14, 2022

Question # 01: ----- CLO-1 ----- Marks = 2.5+2.5

a) Devise a rule of inference for verification of partial correctness of statements of the form:

if condition 1 then

S_1

else if condition 2 then

S_2

...

else

S_n

where $S_1, S_2, \dots, S_n$ are blocks.

b) Use above rule of inference to verify the following program segment is correct with respect to the initial assertion T and the final assertion $y = 2$.

if $x < 0$ then

$y := -2|x|/x$

else if $x > 0$ then

$y := 2|x|/x$

else if $x = 0$ then

$y := 2$

Question # 02: ----- CLO-2 ----- Marks = 3+5+5

a) Compute the **time complexity** of the following program segment written in C++. Express your answer (**time complexity**) using most appropriate notation among O , Ω and Θ .

```
void func(int n){  
    if (n <= 1) return;   
    int i, j;  
    for( i = 1 ; i <= n; i++)  
        for(j = 1 ; j <= n; j++){  
            cout<< " Mid Term Exam 2022";  
            break;  
        }  
}
```

b) Set up a recurrence relation for the following function's basic operation count and solve it.

```
function multiply(y, z)      2
    comment return the product yz
1.  if z = 0 then return(0) else  n
2.  if z is odd                n
3.  then return(multiply(2y, [z/2]) + y)  n+1
4.  else return(multiply(2y, [z/2]))      log n
```

c) Solve the following recurrence relation using master theorem

$$T(n) = 2T \sqrt{n} + \log n.$$

Question # 03: ----- CLO-3 ----- Marks = 7

A robot can take steps of 1 meter or 2 meters. Design a recursive algorithm $walk(n)$ that compute the number of ways the robot can walk n meters. (Order is taken into account so that the 4 meter walk 1, 2, 1 is considered distinct from the 4 meter walk 1, 1, 2)