



COMSATS University Islamabad
Islamabad Campus
Department of Computer Science
Design and Analysis of Algorithm

Quiz 4

CLO-3: Prove correctness of an algorithm using loop invariant and induction.

Time: 15 minutes

Registration #: _____

Class: _____

Total Marks: 10

Name: _____

Section: _____

Question:

a) State the **Loop Invariant**, $I(n)$ of the following algorithm.

Algorithm Decimal_to_Binary(n)

//Input: n , a positive integer

//Output: b , an array of bits, the bin representation of n , starting with the least significant bits

```
1.  $t \leftarrow n$ 
2.  $k \leftarrow 0$ 
3. while( $t > 0$ ) do
4.    $k \leftarrow k + 1$ 
5.    $b[k] \leftarrow t \bmod 2$ 
6.    $t \leftarrow \lfloor t/2 \rfloor$ 
end
```

b) Establish the **correctness** of the above algorithm using loop invariant that you define in part (a). Show all steps i.e., **initialization**, **maintenance** and **termination**.

ANSWER IN THIS BOX

a)) Loop Invariant: Marks = 3

b) Correctness:
i) Initialization Marks = 2

ii) Maintenance Marks = 4

iii) Termination Marks = 1