



DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF TECHNOLOGY
FIRST SESSIONAL

SUBJECT: (IT 509) Design And Analysis of Algorithm

Examination : B.TECH Semester - V	Seat No. :	
Date : 03/08/2018	Day : Friday	
Time : 11:45 – 01:00	Max. Marks : 36	

INSTRUCTIONS:

1. Figures to the right indicate maximum marks for that question.
2. The symbols used carry their usual meanings.
3. Assume any necessary data but giving proper justifications.
4. Be precise, clear and to the point in answering the questions. Unnecessary elaborations will not fetch more marks.

Q.1 Do as directed.

[12]

- (a) Consider the following function. Find the asymptotic complexity in Big 'Oh' (O). [2]

```
F(n){
    int Count = 0;
    for(int i=n; i>0; i/=2)
        for(int j=0; j< i; j++)
            Count++;
}
```

- (b) Briefly discuss any four characteristics of good algorithm. [2]

- (c) Design the recurrence relation for the following code snippet and solve it using any method: [2]

```
Sessional_1(a, n){
    if(1 == n)
        return a;
    m = n/2;
    return Sessional_1(a, m) * Sessional_1(a, n-m);
}
```

- (d) After applying few passes of quick sort on some given array, we got the following output: [2]
1, 10, 5, 8, 25, 44, 55, 30, 70. How many pivot elements are there in this output? [Brief justification required.]

- (e) Solve the following recurrence relations using master theorem, [Hint: Use change of variable for mathematical convenient.] [2]

$$T(n) = T(\sqrt{n}) + \log_2 n$$

- (f) Arrange the following functions in increasing order of complexity: [2]

$$F_1(n) = n^{0.999999} \log n, \quad F_2(n) = 100000n, \quad F_3(n) = 1.000001^n, \quad F_4(n) = n^2.$$

Q.2 Attempt Any TWO of (Among (a), (b) and (c)) the following questions.

[12]

- (a) (i) Define an Algorithm and discuss various characteristics of an algorithm. [4]

(ii) Discuss the life cycle of an algorithm in brief. [2]

- (b) (i) List down the necessary steps in brief, how to analyze the problem. [2]

(ii) Discuss generalized algorithm (template) for divide and conquer and write its recurrence. [4]

- (d) Consider the variation of the Merge Sort algorithm that splits the input into three sets of equal sizes (almost) let's call it 3-way merge sort. Write down the algorithm for 3-ary merge sort and analyze its complexity. Is normal 2-way merge sort is preferable over 3-ary merge sort? Yes/No with brief justification. [6]

Q.3 (a) Solve the recurrence equation given below using backward substitution method, [6]
[Hint: Assume, $n=2k$]

$$T(n) = \begin{cases} T(n-2) + n^2 & ; \text{if } n > 2 \\ 1 & ; \text{if } n = 0 \end{cases}$$

- (b) Analyze the time complexity of Quicksort algorithm's Best case, Average case, and Worst case [6]
in detail. It is possible to eliminate worst case always if we use random element as pivot in Quicksort? Yes/No with proper justification.

OR

- Q.3** (a) Assuming that the partitioning in Quicksort produces a uniform 9 to 1 (9:1) proportional split, [6]
analyze the time complexity of the quick sort with recursion-tree method. Is this partitioning closer to the worst-case or best-case? Reason your answer.

- (b) Write the MIN-MAX algorithm using Divide and Conquer paradigm. Derive the recurrence [6]
equation and find the asymptotic complexity.