

# C.U.SHAH UNIVERSITY

## Winter Examination-2015

**Subject Name: Design and Analysis of Algorithms**

**Subject Code: 4TE05DAA1**

**Branch: B.Tech (CE,IT)**

**Semester: 5      Date:7/12/2015      Time: 2:30 To 5:30      Marks: 70**

**Instructions:**

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

**Q-1      Attempt the following questions:**

**[14]**

- a) Define Algorithm.
- b) Which of the following is not  $O(n^2)$ ?  
 i).  $n + 10000n$       ii).  $n^{1.9999}$       iii).  $10^5n + 2^6n$       iv).  $n^3/\sqrt{n}$
- c) The number of comparisons done by sequential search is .....  
 i)  $(N/2)+1$       ii)  $(N+1)/2$       iii)  $(N-1)/2$       iv)  $(N+2)/2$
- d) Two main measures for the efficiency of an algorithm are  
 i). Processor and memory  
 ii). Complexity and capacity  
 iii). Time and space  
 iv). Data and space
- e) The quick sort algorithm exploit \_\_\_\_\_ design technique  
 i). Greedy      ii). Dynamic programming  
 iii). Divide and Conquer      iv). Backtracking
- f) A list of  $n$  strings, each of length  $n$ , is sorted into lexicographic order using the merge-sort algorithm. The worst case running time of this computation is  
 i).  $O(n \log n)$   
 ii).  $O(n^2 \log n)$   
 iii).  $O(n^2 + \log n)$   
 iv).  $O(n^2)$
- g) Let  $f(n)$  and  $g(n)$  be two asymptotically positive functions. Prove or disprove the  $2^{2n} = O(2^n)$  (using the basic definition of  $O$ ,  $\Omega$  and  $\Theta$ ).
- h)  ${}^7C_5 = ?$  (Hint: Binomial Co-efficient)
- i) The Knapsack problem belongs to the domain of \_\_\_\_\_ problems.  
 i) Optimization      ii) NP Complete      iii) Linear Solution      iv) Sorting
- j) Consider the following function f:  

```

int f(int n)
{
  int s = 0;
  while(n > 1)
  {

```



```

n = n/2;
s++;
}
return s;
}

```

What is the asymptotic complexity in terms of  $n$ ? (Pick the smallest correct answer)

- i).  $O(n \log n)$
  - ii).  $O(n)$
  - iii).  $O(\log n)$
  - iv).  $O(n^2)$
- k) Define Asymptotic notation.
- l) Can Master Theorem be applied to the recurrence of  $T(n) = 4T(n/2) + n^2 \lg n$ ? Why and why not? Give an asymptotic upper bound of the recurrence?
- m) List the characteristics of algorithm.
- n) Which of the following sorting methods would be most suitable for sorting a list which is almost sorted?
- i). Merge Sort
  - ii). Insertion Sort
  - iii). Selection Sort
  - iv). Quick Sort

### Attempt any four questions from Q-2 to Q-8

#### Q-2 Attempt all questions

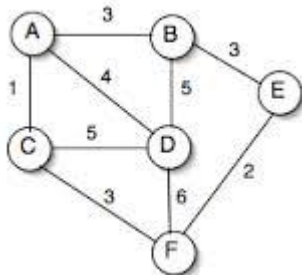
- (a) Using recurrence tree method solve the following recurrences: [07]
- (i)  $T(n) = T(n/3) + T(2n/3) + O(n)$
  - (ii)  $T(n) = 3T(n/4) + cn^2$
- (b) Solve the following recurrences: [07]
- (i)  $T(n) = 3T(n/4) + n \lg n$
  - (ii)  $T(n) = T(n-1) + n$

#### Q-3 Attempt all questions

- (a) Explain the single source shortest path algorithm. (Hint: Dijkstra's Algorithm) [07]
- (b) What do you mean by amortized analysis? Explain the techniques used in amortized analysis. [07]

#### Q-4 Attempt all questions

- (a) Explain the merge sort algorithm with an example. [04]
- (b) Generate the minimum spanning tree for the given graph using Kruskal's algorithm. [07]  
Also explain the algorithm.



- (c) Given 10 activities along with their start and finish time as  $S = \langle A_1, A_2, A_3, A_4, A_5, A_6, A_7, A_8, A_9, A_{10} \rangle$  [03]



$S_i = \langle 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 \rangle$

$F_i = \langle 5, 3, 4, 6, 7, 8, 11, 10, 12, 13 \rangle$

Compute a schedule where the largest numbers of activities take place.

**Q-5**

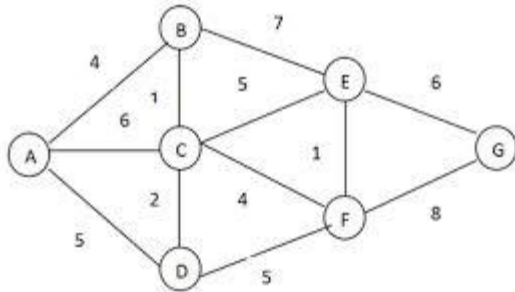
**Attempt all questions**

(a) Find an optimal solution for the knapsack Instances  $n=7$ ,  $M=15$ , [07]

$(P_1, P_2, \dots, P_7) = (10, 5, 15, 7, 6, 18, 3)$  and  $(W_1, W_2, \dots, W_7) = (2, 3, 5, 7, 1, 4, 1)$

(b) Write Prim's algorithm for minimum spanning tree. Generate the minimum [04]

spanning tree for the given graph.



(c) Write down an algorithm for insertion sort. [03]

**Q-6**

**Attempt all questions**

(a) Consider five items along their respective weights and values [07]

$W = \langle 5, 10, 20, 30, 40 \rangle$  and  $V = \langle 30, 20, 100, 90, 160 \rangle$ . The capacity of Knapsack  $M=60$ .

Find the solution to the fractional Knapsack problem.

(b) Find an optimal parenthesization of a matrix-chain product whose sequence of [07]

dimensions is  $\langle 4, 10, 3, 12, 20, 7 \rangle$ .

**Q-7**

**Attempt all questions**

(a) Explain KMP string matching algorithm. For the text  $T = xyxyxyxyxyxyxyxyxyxyxyxyxy$  [07]

and pattern  $P = xyxyxyxyxy$  find the value of function  $\pi$ .

(b) What is the difference between Greedy algorithms and Dynamic Programming? [07]

Find out the longest common subsequences from the two given sequence of characters:

$S_1 = \langle A, B, C, D, B, C, D, C, D, D \rangle$

$S_2 = \langle B, C, D, C, D \rangle$

**Q-8**

**Attempt all questions**

(a) What do you mean by P, NP, NP-complete and NP-Hard problems? [04]

(b) Explain the Rabin-Karp string matching algorithm with an example. [04]

(c) What is backtracking? Explain N-queen problem. Also give the solution for the 8-Queen [06]  
problem.

