

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V • EXAMINATION – SUMMER • 2015

Subject code: 150703

Date: 11/5/2015

Subject Name: Design and Analysis of Algorithms

Time: 02.30pm-05.00pm

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 (a) Explain following terms with example. **06**

1. Set
2. Relation
3. Function

(b) Do as directed.

1. Calculate computation time for the statement t3 in following code fragment? **04**

```
for i = 1 to n
{
  for j = 1 to i
  {
    c = c + 1 ..... t3
  }
}
```

2. Prove that $T(n) = 1+2+3+...+n = \Theta(n^2)$. **04**

Q.2 (a) Write an algorithm for insertion sort. **03**

Analyze insertion sort algorithm for best case and worst case. **04**

(b) Define an amortized analysis. Briefly explain its different techniques. **04**

Carry out aggregate analysis for the problem of implementing a k-bit binary counter that counts upward from 0. **03**

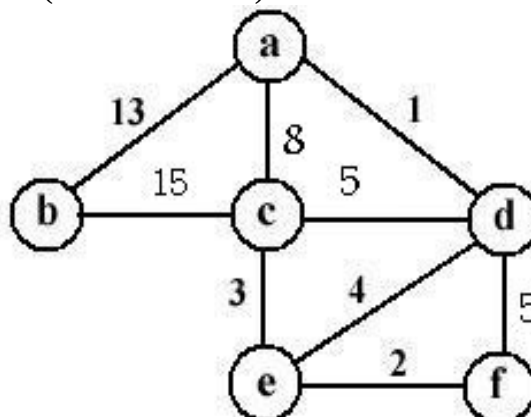
OR

(b) Analyze quick sort algorithm for best case, average case and worst case with example. **06**

In which case it performs similar to selection sort? **01**

Q.3 (a) Mention applications of minimum spanning tree. **02**

Generate minimum spanning tree from the following graph using Prim's algorithm. (Start at vertex a) **05**



(b) Discuss matrix multiplication problem using divide and conquer

technique. 07

OR

Q.3 (a) Following are the details of various jobs to be scheduled on multiple processors such that no two processes execute at the same on the same processor.

Jobs	J ₁	J ₂	J ₃	J ₄	J ₅	J ₆	J ₇
Start time	0	3	4	9	7	1	6
Finish time	2	7	7	11	10	5	8

Show schedule of these jobs on minimum number of processors using greedy approach. 03

Derive an algorithm for the same. 03

What is the time complexity of this algorithm? 01

- (b)** Answer the following questions. 03
- 1. What are the differences between greedy approach and dynamic programming? 04
 - 2. Explain class P and class NP.

Q.4 (a) Find an optimal solution to the knapsack instance $n=4$, $M=8$, $(P_1,P_2,P_3,P_4)=(3,5,6,10)$ and $(W_1,W_2,W_3,W_4)=(2,3,4,5)$ using backtracking. 04

Also draw the corresponding state space tree. 03

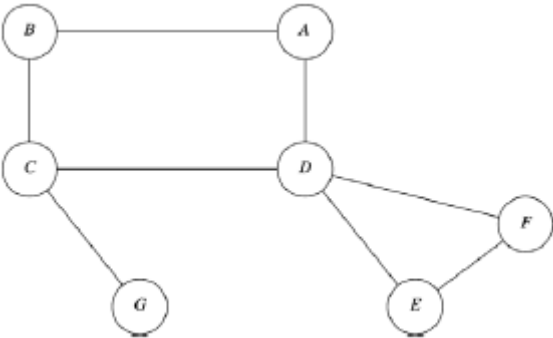
(b) What is finite automata? 02

Explain with example how finite automaton is used for string matching? 05

OR

Q.4 (a) Write an algorithm to find out the articulation points of an undirected graph. 03

Find out articulation points for the following graph. Consider vertex A as the starting point. 04



(b) Explain spurious hits in Rabin-Karp string matching algorithm with example. 02

Working modulo $q=13$, how many spurious hits does the Rabin-Karp matcher encounter in the text $T = 2359023141526739921$ when looking for the pattern $P = 31415$? 05

Q.5 (a) Generate equation for Matrix chain multiplication using Dynamic programming. 02

Find out minimum number of multiplications required for multiplying: $A[1 \times 5]$, $B[5 \times 4]$, $C[4 \times 3]$, $D[3 \times 2]$, and $E[2 \times 1]$. 04

Also give the optimal parenthesization of matrices. 01

(b) Discuss and derive an equation for solving the 0/1 Knapsack problem using dynamic programming method. Design and analyze the algorithm for the same. 07

OR

- Q.5 (a)** Discuss and derive the optimal substructure that can be used to solve the Longest Common Subsequence problem using dynamic programming. **03**
Find the longest common subsequence for the given two sequences of characters: P = (1,0,0,1,0,1,1,0,1,1,0,1); Q = (0,1,1,0). **04**
- (b)** Discuss Assembly Line Scheduling problem using dynamic programming with example. **07**
