53 (IT 501) DAAL

2013

(December)

DESIGN AND ANALYSIS OF ALGORITHM

Paper : IT 501

Full Marks : 100

Pass Marks : 30

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **Q. No. 1** and **any four** questions from rest.*

1. *(a)* What is the loop invariant for Quick sort ? 2

(b) How Strassen has reduced the running time of matrix multiplication algorithm ? 2

(c) Write *one* practical application of Optimal Binary Search Tree problem. 1

(d) "If one NP-Complete problem can be solved in polynomial time, all NP-Complete problems can be solved in polynomial time." Whether the statement is true *or* false ? Justify your answer. 1+2=3

(e) Why do we need an algorithm ? 2

(f) What will happen if Dynamic Programming is applied to sorting ? What are the two characteristics that a problem must satisfy for Dynamic Programming to apply ? 3+2=5

(g) If time complexity of Insertion Sort is said to be $\theta(n^2)$, what is n ? 1

(h) Give *one* example of a NP-Complete problem. 2

(i) Define comparison sort. 2

2. (a) Prove that lower bound for any comparison sort algorithm is 5

$$\Omega(n \lg n).$$

(b) What is asymptotic analysis of algorithm ? Say, $f(n) = 2^n$. For this function find lower bound, upper bound and tight bound. 2+9=11

(c) Which algorithm is more efficient in terms of space, Merge Sort or Quick Sort ? Why ? 1+3=4

3. What is running time of an algorithm ? Write the Insertion Sort algorithm and analyse the algorithm to determine worst case and best case running time. 2+2+8+8=20

4. (a) Explain the difference between Dynamic programmming and Greedy approach. 5

(b) Write an algorithm to find a particular element in Binary Search Tree. 5

(c) Write Prism's algorithm for minimum cost spanning tree. Also write the loop invariant of the algorithm. 5+5=10

5. (a) Define P, NP and NPC problems. Explain the concept of Reducibility. 2+2+2+4=10

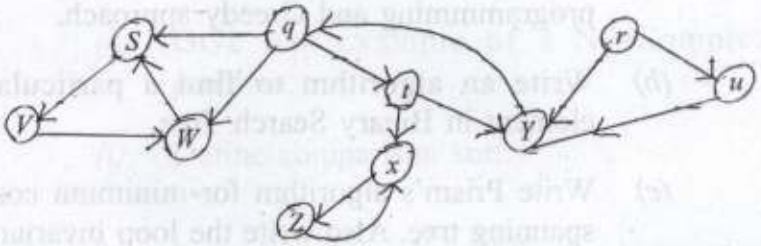
(b) Explain Backtracking technique with an example. 10

6. Determine the cost and structure of an Optimal Binary Search tree for a set of $n = 7$ keys with the following probabilities : 20

i	0	1	2	3	4	5	6	7
p_i		0.04	0.06	0.08	0.02	0.10	0.12	0.14
q_i	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05

7. *(a)* Compare BFS and DFS. 5

(b) Show how DFS works on the graph of figure below. Show the discovery and finishing time of each vertex, and show the classification of each edge. 10



(c) What is AND-OR graph ? Describe with a diagram. 5