Total number of printed pages – 8

MCA

PCS 3001

Third Semester Examination – 2006

ANALYSIS AND DESIGN OF ALGORITHM

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (a) Define max-flow problem as optimization problem.

   (b) Solve the recurrence relation

   $T(N) = 4T(N/3)+N$, for $N \geq 2$ with $T(1) = 1$, when N is a power of two.

P.T.O.

(c) What do you mean by connected component of a directed graph ?

(d) Explain why we expect the average case for mergesort to be almost the same as the worst case.

(e) What is the lower bound for finding both the maximum and minimum key in an array containing *n* keys ? Briefly describe a strategy that yields this lower bound for any *n*.

(f) Describe an **optimal** method for finding the two largest keys in an array. How many comparisons are done in the worst case ?

(g) What are the general characteristic of divide and conquer algorithm ?

(h) How the forward and backward approach differs under dynamic programming paradigm ?

(i) Explain the role of data structure in computing amortized complexity.

(j) Define P, NP and NP-complete problems with examples. Which of the problem family seeks the help of approximation algorithm for finding a solution ?

2. (a) Describe the method of divide and conquer that used to design Algorithms. State the control Abstraction for Divide-and-Conquer. Solve the general recurrence form of complexity T(n) with a=5, b=4, and $f(n) = cn^2$; for some constant c

$$T(n) = \begin{cases} T(1) & n=1 \\ aT(n/b) + f(n) & n>1 \end{cases}$$ 5

(b) Discuss the problem model of a multi-stage graph. State an algorithm to find a minimum-cost path from source to shrink using forward approach using ***dynamic programming*** paradigm. 5

(b) boosting up the priority of a process in multilevel queues without feed back

(c) gradually increasing the priority of jobs that wait in the system for a long time to recover from indefinite blocking

(d) letting jobs reside in memory for a certain amount of time so that the number of pages required can be estimated accurately.

(viii) Bit vector or bit-map is used in connection with disk space management in order to

(a) keep track of the allocated space when contiguous allocation method is used

(b) specify the bad sectors on the disk

(c) optimize the disk space occupied by files when indexed allocation method is used

(d) keep track of the free space in the disk.

(ix) Imposing a linear order on all resource types and letting processes request resources in increasing order is an example of

(a) Deadlock avoidance

(b) Deadlock prevention using hold and wait

(c) recovery

(d) Prevention using breaking circular wait.

(x) Dirty bit helps in

(a) Cleaning the RAM

(b) Improving the memory speed

(c) Dirts the page table

(d) None of the above

(iv) Find out the shortest path from A to E using DFS.

(v) What are the time complexity and space complexity of Bellman-Ford algorithm on different representation of graph ?

2×5

6. (a) Which process determines the amount of work done by Kruskal's algorithm ? How much work is done in the worst case? Explain. In Kruskal's method for finding a minimum spanning tree, how does the algorithm know when the addition of an edge will generate a cycle ? 5

(b) Discuss the mechanism of Branch and bound algorithm as *"all state space search method"*. Considering Traveling Sales Man (TSP) problem, explain the application of ***Least cost Branch and***

bound search and FIFO branch and Bound search to found an optimal solution. 5

7. (a) Write an algorithm that takes any 3 elements $a(i)$, $a(j)$, and $a(k)$ of an array and rearranges them in the array so that $a(i) \leq a(j) \leq a(k)$. Analyze the time complexity of your algorithm. 5

(b) State the different constraints to be satisfied while solving a problem using backtracking. Discuss how BACK-TRACKING is used to solve ? Explain the role of constraints in 0/1 knapsack problem. 5

8. (a) What is the time complexity of the QUICK SORT ALGORITHM, if the pivot is chosen from the center of the list rather than from one end ?

(b) Consider an undirected graph with V vertices and E weighted edges. How would you (simply!) modify the Floyd-Warshall algorithm to require $O(V^2)$ memory ?

(c) In the backtracking formulation of the 8-queens problem, what are the explicit and implicit constraints ?

(d) Solve for T(n) :

$T(N) = \ddot{o}n\ T(\ddot{o}N) + N$, for $N \geq 2$ with $T(1) = 1$.

2.5×4