



PAPER ID

B. Tech.

Gueta

(SEM. V) (ODD SEM.) EXAMINATION, 2009-10
DESIGN & ANALYSIS OF ALGORITHMS

Time : 3 Hours]

[Total Marks : 100

Note : Attempt all questions:

1 Attempt any two of the following : **10×2=20**

(a) Let $f(n)$ and $g(n)$ be asymptotically positive functions. Prove or disprove each of the following conjectures :

(i) $f(n) = o(g(n))$ implies $g(n) = o(f(n))$

(ii) $f(n) + g(n) = \Theta(\min(f(n), g(n)))$.

(b) Show how to implement a first-in, first out queue with a priority queue. Show how to implement a stack with a priority queue.

(c) Let X be a random variable that is equal to the number of heads in two flip of a fair coin.

What is $E[X^2]$? What is $E^2[X]$?

2 Attempt any two of the following : **10×2=20**

(a) Give a recursive version of the Tree-Insert procedure.

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- (b) Argue that after executing RB-Delete-Fixup, the root of the tree must be black.
- (c) Write a recursive procedure OS-KEY-RANK (T, K) that takes as input an order statistic tree T and a key k and returns the rank of k in the dynamic set represented by T . Assume that the keys of T are distinct.

3 Attempt any two of the following : 10×2=20

- (a) Show how to reconstruct an LCS from the completed C table and the original sequence $X = \langle x_1, x_2, \dots, x_m \rangle$ and $Y = \langle y_1, y_2, \dots, y_n \rangle$ in $O(m+n)$ time without using the b table.
- (b) Generalize Huffman's algorithm to ternary codewords (i.e. codewords using the symbols 0, 1 and 2), and prove that it yields optimal ternary codes.
- (c) What is the total cost of executing n of the stack operations PUSH, POP and MULTITOP, assuming that the stack begins with S_0 objects and finishes with S_n objects ?

4 Attempt any two of the following : 10×2=20

- (a) Suppose that the graph $G = (V, E)$ is represented as an adjacency matrix. Give a simple implementation of Prim's algorithm so that it runs in $O(V^2)$ time for this case.
- (b) Give an efficient push-rebel algorithm to find a maximum matching in a bipartite graph. Analyze your algorithm.

- (c) Suppose we run Johnson's algorithm on a directed graph G with weight function w . Show that if G contains a 0-weight cycle c , then $\hat{w}(U, V) = 0$ for every edge (U, V) in c .

5 Attempt any two of the following : 10×2=20

- (a) Construct the string-matching automation for the pattern $P = aabab$ and illustrate its operation on the text string

$T = aabababababababab.$

- (b) Show that the subset-sum problem is solvable in polynomial time if the target value t is expressed in unary.
- (c) Write an efficient greedy algorithm that finds an optimal vertex cover for a tree in linear time.
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