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Following Paper ID and Roll No. to be filled in your Answer Book.

PAPER ID : 23218 Roll No.

B. Tech. Examination 2021-22

(Even Semester)

DESIGN & ANALYSIS OF ALGORITHMS

Time : Three Hours] *[Maximum Marks : 60*

Note :– Attempt all questions.

SECTION–A

1. Attempt all parts of the following : 8×1=8

(a) There are four algorithms A_1, A_2, A_3, A_4 to solve the given problem with the order log (n), n log (n), log (log (n)), n/log (n). Which is the best algorithm?

(b) As part of the maintenance work, you are entrusted with the work of rearranging the library books in a shelf in proper order, at the ends of each day. Name the algorithm which is best suited for this task.

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(c) Consider the matrix P, Q and R which are 10×20, 20×30 and 30×40 matrices respectively. What is the minimum number of multiplications required to multiply the three matrices?

(d) What is the time complexity of the brute force algorithm used to solve the knapsack problem?

(e) What ist he asymptotic runtime for traversing all nodes in a binary search tree with n nodes and printing them in order.

(f) What is the time complexity of the Floyd's algorithm to find all parts of shortest path of a graph G with vertices and E edges using dynamic programming method?

(g) Working modulo $q = 11$, how many spurious hits does the Robin-Karp matcher encounter in the text $T = 31415926$ when looking for the pattern $P = 26$.

(h) Is Halting-problem NP-complete?

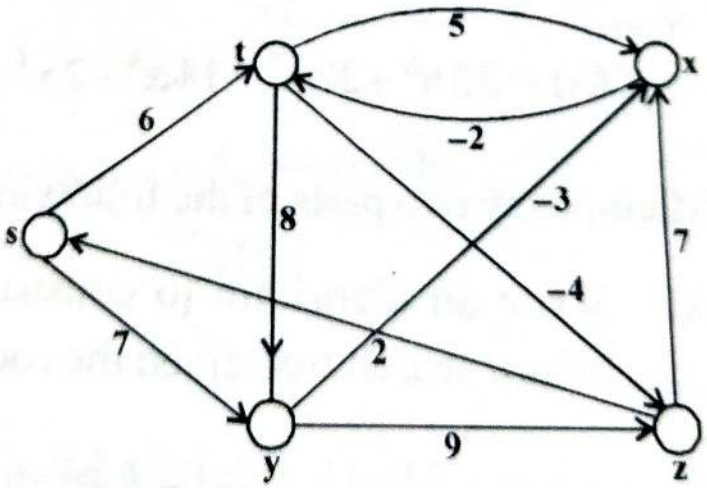
SECTION – B

2. Attempt any two parts of the following : 2×6=12

(a) Explain insertion in Red-Black tree. Show steps for inserting 1, 2, 3, 4, 5, 6, 7, 8 & 9 into an empty RB tree.

(b) What do you mean by greedy algorithm? Write greedy algorithm for Huffman code. Show that your algorithm has Greedy choice property.

(c) Define single source shortest path problem. Write an algorithm for single source shortest path and also apply the same on the following graph :



(d) Describe branch and bound technique. How it can be used to solve the TSP?

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SECTION – C

Note :– Attempt all questions from this section.

$10 \times 4 = 40$

3. Attempt any two parts of the following :

   (a) Derive a relation between degree and height of n keys B-tree. Insert the following information :

   F, S, Q, K, C, L, H, T, V, W, M, R, N, P, A, B, X, Y, D, Z, E

   into an empty B-tree with degree $t = 3$.

   (b) Explain the properties of a good algorithm with an example.

   (c) Derive a loose bound on the following equation :

$$f(x) = 35x^8 - 22x^7 + 14x^5 - 2x^4 - 4x^2 + x - 15$$

4. Attempt any two parts of the following :

   (a) Write an algorithm to construct the optimal binary search tree given the roots :

$$r(i, j),\ 0 \le i \le j \le n$$

   Also prove that this couldbe performed in time 0 (n).

(b) Let :

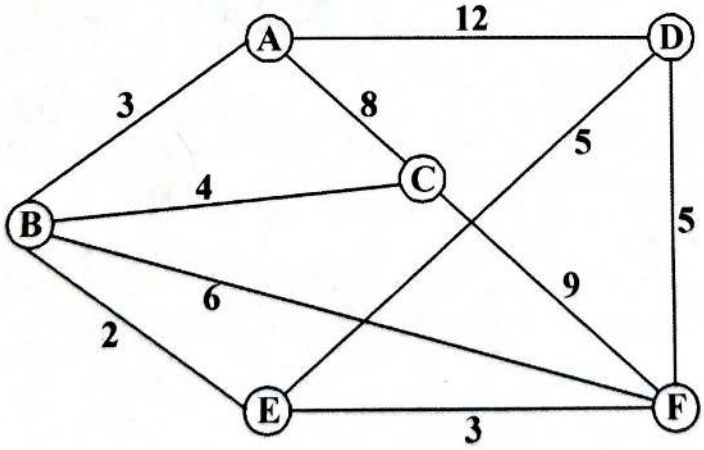
$$A = \left\{ \frac{i}{119}, \frac{m}{96}, \frac{c}{247}, \frac{g}{283}, \frac{h}{72}, \frac{f}{77}, \frac{k}{95}, \frac{j}{19} \right\}$$

be the letters and its frequency of distribution in a text file. Compute a suitable Huffman coding to compress the data effectively.

(c) Discuss four Queens' problem on a 4×4 chess board.

5. Attempt any two parts of the following :

(a) Discuss the Kruskal's algorithm and find the minimum cost spanning tree of the following graph :



(b) Write an algorithm to construct a minimum heap. Construct max heap from the following list :

(16, 14, 10, 8, 7, 9, 3, 2, 4, 1)

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(c) Write down the algorithms for BFS and DFS. Specify the running time of both algorithms.

6. Attempt any two parts of the following :

(a) Write Naive string matching algorithms. Explain notations used in the algorithms.

(b) Implement an algorithm for knapsack problem using NP-Hard approach.

(c) Suggest an approximation algorithm for TSP. Assume that the cost function satisfies the triangle inequality.

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