(c) Explain Dijkstra algorithm to solve single source shortest path problem with suitable example. (CO4)

5. (a) Show the comparisons the native-string matcher makes for the pattern P = {10001} in the text T = {0000100010010} and also show the worst case time to rind the first occurrence of the pattern in the text is $O(n - m + 1)(m)$. (CO5)

(b) Define the following and relationship between them : (CO5)

(i) P and NP class

(ii) NP-complete class

(iii) KMP string matching algorithm

(c) Explain the following : (CO5)

(i) Hamiltonian Cycle

(ii) Fast Fourier Transform

(iii) Approximation Algorithms

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TMC–301

M. C. A. (THIRD SEMESTER) END SEMESTER EXAMINATION, Dec, 2022

DESIGN AND ANALYSIS OF ALGORITHM

Time : Three Hours

Maximum Marks : 100

Note : (i) All questions are compulsory.

(ii) Answer any *two* sub-questions among (a), (b) and (c) in each main question.

(iii) Total marks in each main question are twenty.

(iv) Each sub-question carries 10 marks.

1. (a) The recurrence $T(n) = 7T(n/3) + n^2$ describes the running time of an algorithm A. Another competing algorithm B has a running time of $S(n) = a S(n/9) + n^2$. What is the smallest value of 'a' such that A is a faster than B. (CO1)

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(b) Among Merge sort, Insertion sort and Quick sort which sorting technique is the best in worst case. Apply the best one among these algorithms to sort the list E, X, A, M, P, L, E in alphabetic order. (CO1)

(c) What do you understand by stable and unstable sorting ? Sort the following sequence : {25, 57, 48, 36, 12, 91, 86, 32} using heap sort. (CO1)

2. (a) Define Red-Black tree and its properties. Discuss the various cases for insertion of key in red-black tree for given sequence of key in an empty red-black tree :{15, 13, 12, 16, 19, 23, 5, 8}. (CO2)

(b) 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, G, I. Into an empty B-tree with degree t = 3. (CO2)

(c) Explain properties of Binomial Heap. Write an algorithm for union of two Binomial Heaps and write its time complexity. (CO2)

3. (a) What is Knapsack problem ? Solve Fractional knapsack problem using greedy programming for the following four items with their weights w = {3, 5, 9, 5) and values P = {45, 30, 45, 10} with knapsack capacity is 16. (CO3)

(b) What is N queens' problem ? Draw a state space tree for 4 queens problem using (CO3)

(c) Discuss the dynamic problem solution for longest common sequence (LCS) problem. Write an algorithm to compute LCS of two given strings. (CO3)

4. (a) Define spanning tree. Write Kruskal's algorithm for finding minimum cost spanning tree. Describe how Kruskal's algorithm is different from Prim's algorithm for finding minimum cost spanning tree. (CO4)

(b) Give Floyd War shall algorithm to find the shortest path for all pairs of vertices in a graph. Give the complexity of the algorithm and also explain with example. (CO4)