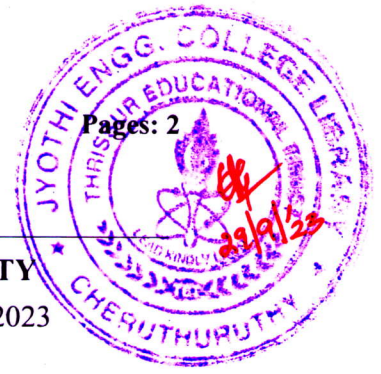Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Second Semester M.Tech Degree Regular Examination June 2023

Discipline: COMPUTERS CIENCE AND ENGINEERING

Course Code &Name: 222TCS100 ADVANCED DATA STRUCTURES AND ALGORITHMS

Max. Marks: 60   Duration: 2.5 Hours

PART A

Answer all questions. Each question carries 5 marks   Marks

1 Derive the asymptotic bound for the recurrences.

    a. $T(n)=6T(n/3) + n$ (2.5)

    b. $T(n)=4T(n/2) + n^2$ (2.5)

2 Prove that the amortized cost of Fibonacci Heap Union operation is equal to its actual cost.   (5)

3 Find the maximum bipartite matching of the graph G (LUR, E), where L={a,b,c,d,e}, R={w,x,y,z} and E={(a,w), (b,w), (c,x), (b,y), (c,y), (c,z), (d,y), (e,y)}   (5)

4 Apply Miller Rabin algorithm to test whether 127 is prime or not.   (5)

5 Design an approximation algorithm to find the vertex cover of a graph. Derive the approximation ratio α, of the algorithm.   (5)

PART B

Answer any 5 questions. Each question carries 7 marks

6 a. Derive the amortized cost of stack operation including multi-pop in a sequence of **m** operations which contains **n** push operations.   (4)

    b. Apply RABIN-KARP algorithm to search for the pattern P= "25" in text T=" 23893547". where q=64.   (3)

7 (a). Construct a Binomial heap using the numbers 10,4,9,15,22,30.   (3)

    (b). Demonstrate the difference in the procedure of DECREASE-KEY operation in Fibonacci heap and Binomial heap.   (4)

8   a. Define Binomial Tree. What is the number of binomial trees in a binomial heap with **n** nodes? Justify your answer.   (4)

    b. Show that the amortized time of an operation is $O(n)$ if no heuristics is applied while performing union operation on a disjoint set implemented using linked list.   (3)

9   a. Consider a flow network with source s and sink t. Prove that $f(s,V) = f(V,t)$.   (2)

    b. Demonstrate FORD- FULKERSON method on a graph to find the maximum flow.   (5)

10   (a) Differentiate Monte Carlo and Las Vegas algorithms with suitable examples.   (4)

    (b) Derive the expected running time of randomized Quick sort algorithm.   (3)

11   Verify the correctness of the matrix multiplication, AB=C where,   (7)

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 5 & 6 & 7 \\ 9 & 10 & 11 \end{bmatrix} \quad B = \begin{bmatrix} 5 & 6 & 7 \\ 8 & 9 & 10 \\ 11 & 12 & 13 \end{bmatrix} \quad C = \begin{bmatrix} 54 & 60 & 66 \\ 158 & 168 & 186 \\ 246 & 132 & 306 \end{bmatrix}$$

12   (a). Demonstrate the approximation algorithm to find the minimum cost tour (TSP) on graph.   (5)

    (b). Compare the cost of the algorithm to the optimal cost.   (2)

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