Reg No.:_____ Name:_____

1422TCS100052402

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

M.Tech Degree S2 (R, S) / S2 (WP) (R) Examination May 2024 (2022 Scheme)

Discipline: COMPUTER SCIENCE 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 Illustrate graphically the various asymptotic notations with example. (5)

2 Explain how disjoint set data structure is used to find connected components on an undirected graph.. (5)

3 Consider the bipartite graph G (LUR, E) where L = {1, 2, 3, 4, 5} and R = {A, B, C, D, E} with edges E = {(1, A), (1, B), (2, B), (2, C), (3, D), (4, E), (5, E)}. Find the maximum bipartite matching of this graph. (5)

4 Apply Miller Rabin algorithm to test whether the number 341 is prime or not. (5)

5 Demonstrate the approximation algorithm for the subset-sum problem. (5)

PART B

Answer any 5 questions. Each question carries 7 marks

6 (a) Given a text T = "abcxabcdabcdabcy" and a pattern P = "abcdabcy", use the Knuth-Morris-Pratt algorithm to find all occurrences of P within T. (4)

(b) Compute the amortized cost of incrementing a binary counter using potential method. (3)

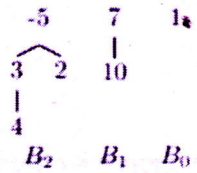
7 (a) Apply the Rabin-Karp algorithm to search for the pattern "ABC" in the text "ABCDABCDEABC" using a prime base q = 101. (4)

(b) Explain aggregate method of amortized analysis with a suitable example. (3)

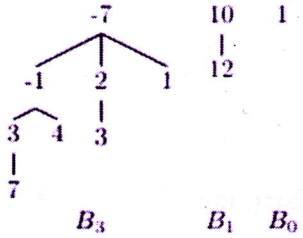
8 (a) Analyse the time complexity of decrease-key operation in Fibonacci heap. (3)

(b) Illustrate merge operation on the binomial heaps H_1 and H_2 shown in the figure. (4)

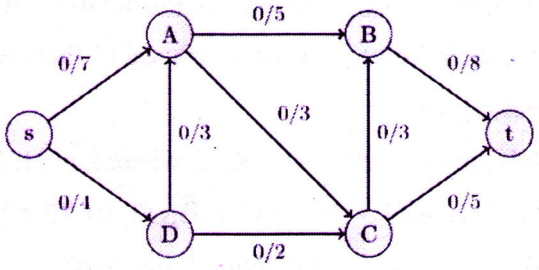
Binomial heap H_1



Binomial heap H_2



9 Describe Ford Fulkerson algorithm and find the maximum flow for the flow network shown below (edge labels are of the form flow/capacity). (7)



10 (a) State and prove Fermat's theorem. (3)

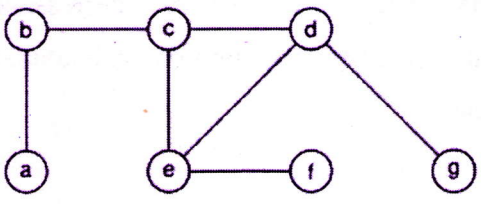
(b) Analyse randomized quicksort and derive its running time. (4)

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

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \quad B = \begin{pmatrix} 9 & 8 & 7 \\ 6 & 5 & 4 \\ 3 & 2 & 1 \end{pmatrix} \quad C = \begin{pmatrix} 30 & 24 & 18 \\ 84 & 69 & 54 \\ 138 & 114 & 90 \end{pmatrix}$$

12 (a) Explain the approximation algorithm for traveling salesperson problem. (4)

(b) Compare the optimal vertex cover and the approximate vertex cover produced by Greedy based approximation algorithm, for the undirected graph G = (V, E) shown below: (3)



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