VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY (VSSUT), ODISHA

Odd Mid Semester Examination for Academic Session 2024-25

COURSE NAME:**B.Tech** SEMESTER:**5th**

BRANCH NAME:**Information Technlogy**

SUBJECT NAME: **Design & Analysis of Algorithms**

FULL MARKS: **30** TIME: **90 Minutes**

Answer **All** Questions.

The figures in the right hand margin indicate Marks. *Symbols carry usual meaning.*

Q1. Answer all Questions. **[2 × 3]**

a) Write the peudocode to find the maximum element of an array and analyze its time complexity.

b) What are the different asymptotic notations used in asymptotic analysis.

c) Distinguish Greedy method and Dynamic Programming.

Q2. **[8]**

Explain Merge sort algorithm for n =8 elements: 24,12, 35, 23,45,34,20,48.
Derive the time complexity of Merge sort algorithm.
Is Merge Sort a) Stable Sort b) In-pace Sort Justify your answer.

OR

a) Write the recurrence for Strassen's Multiplication and solve it using any suitable method.

b) Solve the following recurrence relation using Recursion Tree method.
T(n)=2T(n/2) +1 for n> 1, T(n) =1 for n =1

$a = 2$
$b = 2$
$f(n) = 1$

Q3. **[8]**

Derive the time complexity if Bruteforce algorithm is applied to solve
a) LCS b) 0/1 knapsack problem.

Dynamic Programming is applied to find the LCS of A = RRSSRTTRTS and B=RTSRRSTST.

a) What is the length of LCS?
b) Using the algorithm find at least one LCS.
c) What is the optimal Substructure property in LCS.

$T(n) = n^{\log_b a}(\log n)$

$\frac{n^{\log_b a}}{n} = n^{-1}$

OR

The fractional and 0/1 knapsack methods were used to find an optimal solution to the knapsack instance of n=5 objects(**item 1 to 5**) and the capacity of knapsack **m=10**. The profits and weights of the objects are

$(P_1, P_2, P_3, P_4, P_5)$ = (10, 12,15,8,6)
$(W_1, W_2, W_3, W_4, W_5)$ = (2,3,5,4,1).

a) In which case: Greedy or Dynamic do you get maximum profit.
b) Which items were chosen in both the methods respectively?
c) What is the difference of Optimal Value you get?

$a = 2, b = 2, f(n) = 1$

$T(n) = 2T(\frac{n}{2})$

$1 = n^{\log_2 2}(\log n)$

$\frac{n}{1} = n^1$

$\frac{\log_2 2}{\frac{1}{1}} = \frac{\log(i+1)}{(i+1)}$

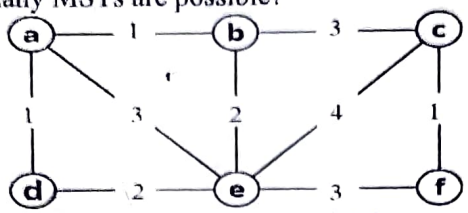
[8]

Q4.

For the graph given below answer the following questions:

a) What is length of MST?

b) How many MSTs are possible?



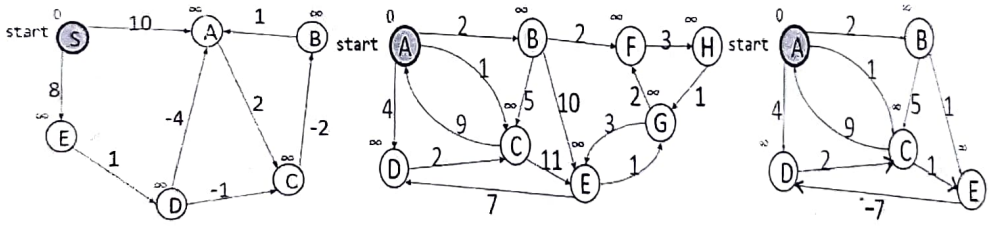
If Kruskal's algorithm is applied (using disjoint set operations) on the above graph and the edges are sorted as **ab, ad, cf, bc, de, ae, bc, ef, ce**.

c) How many times makeset, find and union operations will be called?

d) How many nodes with rank 1 are there in the final tree (formed after all the union operations)?

OR

Find the shortest path for the following graphs applying the most suitable algorithm from Dijkstra's and Bellman-ford algorithms. **Justify your selection of the algorithm.** If the shortest path is not well-defined none of the algorithms will be applied.



Graph-I Graph-II Graph-III