

Assignment 01

Design and Analysis of Algorithms

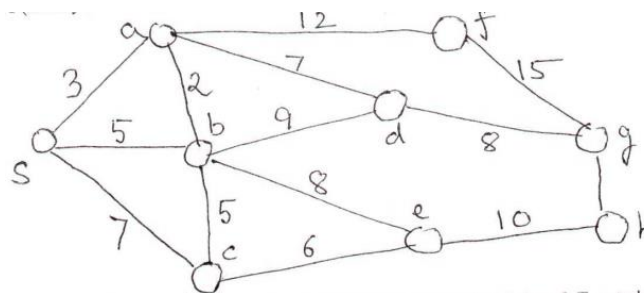
Last date of submission: 13/11/2022

Marks: Based on viva performance (Max 15)

1. Write a program for 3-way merge sort and illustrate its working to sort: 283, 305, 527, 749, 961, 169, 196, 325, 356.
2. Write a program for identification of the second ranked item among the set of n integers using the quick Select.
3. Write a program to multiplication of two large integers using divide and conquer technique (Assume input size in power of two).
4. You are given a sorted array $A[1 \dots n]$ of integers that has been rotated right k positions, but k is unknown. Examine the following examples.
 - [36, 41, 7, 18, 29, 31] is sorted array that has been rotated $k=2$ positions
 - [29, 31, 36, 41, 7, 18] is sorted array that has been rotated $k=4$ positions

Write an efficient program, with suitable justifications, to determine k from the given array.

5. You are given n dates in the $dd-mm-yyyy$ format. Write an efficient program that takes $O(n)$ time to sort the dates chronologically (from earlier dates to later dates).
6. Write a program for the execution of Prim's minimum spanning tree algorithm on the following graph with the node s as source. In particular, show that the d and P arrays (π array in Cormen's book) at each step.



7. Consider set of n tasks, with task i having start time s_i and end time f_i . Two tasks i and j are said to be compatible if $s_i > f_j$ or $s_j > f_i$. The task at any point in time, so two tasks are not compatible can not be schedule on the same machine. The goal is to schedule

all tasks using as few machines as possible. Write an efficient program to solve the above problem.

8. Consider two sorted arrays A and B with m and n integers respectively. Assume that all integers are distinct. Design an $O(\log n + \log m)$ time divide and conquer algorithm to find K_{th} smallest element all values in A and B. (Hint: Start with considering the middle elements of A and B. Where can the k -th smallest element lie.)
9. $A = \{a_1, a_2, \dots, a_{2n}\}$ is a (unsorted) set of $2n$ items. Weight of each item $a_i \in A$ is w_i . It is known that for each a_i belongs to A, there exists some item $a_j \in A$ such that $w_i + w_j = c$, where c is a given constant. The items in A have to be divided among n friends so that all carry two items each and share equal weight. Suggest an algorithm for this and also write a program.