Summer 2022
CSE221
Assignment 2
Marks: 80
Deadline: Sep 1, 2022

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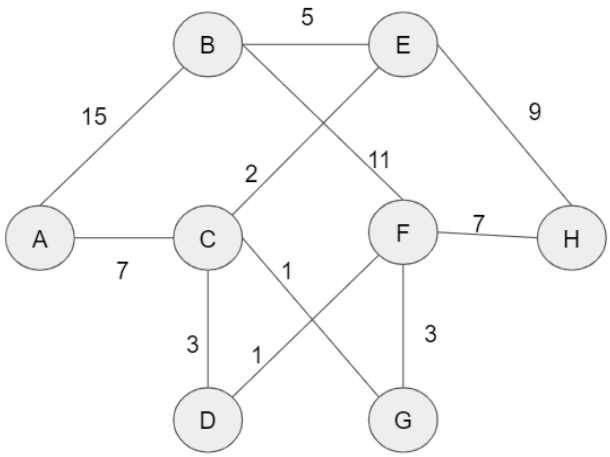
1. **A list of nodes, List = [80, 60, 50, 65, 80, 90, 75, 70] is given. [5+5=10 marks]**
    a. **Construct max-heap using the nodes from the list showing proper steps and find out the time complexity of the entire operation.**
    b. **Operate heap sort on the constructed heap of part a and show the sorted array/list showing proper steps and find out the time complexity of the entire operation.**

2. **Find out the minimum cost spanning tree with its cost from the given graph using the following algorithms. You have to show necessary steps in the simulations. [5+5+2.5+2.5=15 marks]**



    a. **Prim's Algorithm. Consider vertex A as the source. Explain the time complexity.**
    b. **Kruskal's Algorithm. Explain the time complexity.**
    c. **Are both trees and their costs same? Explain the answer.**
    d. **In which scenario Kruskal's Algorithm can perform better than Prim's Algorithm. Explain the answer.**

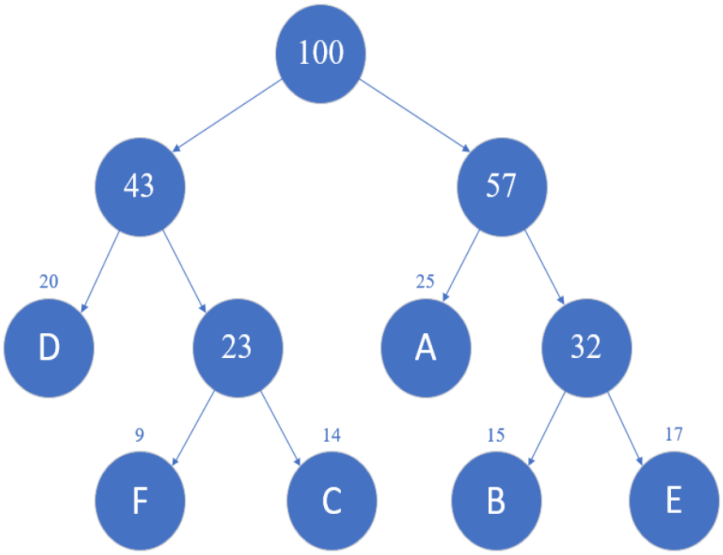
3. **A message is given below,**

It's coming home.

[12+2+1=15 marks]

   a. **Encode the message using Huffman Encoding. Construct Huffman Tree, generate the codeword for each character, show the encoded message and count the total number of bits required to store the message.**
   b. **Explain why huffman encoding is better than ascii codes.**
   c. **What is the time complexity of Huffman Encoding?**

4. **Do the following operations using the Huffman Tree given below. [5+5=10 marks]**



   a. **Decode 10110110011001110101010 using Huffman Decoding.**
   b. **Show the frequencies and number of bits for each string.**

5. **You have won a voucher from Agora super shop. According to the terms of voucher you are given a shopping cart which can contain a maximum capacity of 10 kg. You can take any products from the given list as much as you can until the cart gets filled. Your motive is to acquire maximum benefit. [8+2=10 marks]**

Product	Weight	Price
Rice	5	150
Wheat	4	48
Oil	5	250
Sugar	2	80
Salt	1	5

Solve the problem using Fractional Knapsack. Explain the time complexity. Explain why Fractional Knapsack is a greedy approach.

6. **Find out the longest common subsequence of abcbda and bdcaba showing necessary steps. What is the time complexity of the algorithm? [9+1=10 marks]**

7. **You are about to sell some of your pre-owned electronic devices. To do this, you have contacted a shop and they provided you information about the resale values of every particular device. Now you have decided to go there with the devices carrying in a bag which has the capacity of 9 kg. You will definitely put those devices in the bag which will generate the maximum resale value. [8+2=10 marks]**

Product	Weight	Price
Iphone	2	20
Tablet	2	10
Android phone	2	12
Laptop	6	25
Speaker	3	9

   a. **Solve the problem using 0/1 Knapsack. Explain the time complexity.**
   b. **Explain why 0/1 Knapsack is dynamic programming.**