



Course: Data Structures Lab  
 Program: BS(CS), BS(DS), BS(SE)  
 Duration: 2.5 Hours + 10 minutes  
 Paper Date: 25-Jan-2022  
 Section: All  
 Exam: Final

Course Code: CL2001  
 Semester: Spring 2021  
 Total Marks: 10  
 Weight: 40%  
 Page(s): 2  
 Roll No:

**Instruction/Notes:**

- Understanding the question statement is a part of your exam; so do not ask for any clarifications. In case of any ambiguity, make suitable assumption.
- Submission path is \\cactus\Xeon\Fall 2021\Data Structures Lab\Final's Submission (Submit your code in your respective section).
- Submission in Google Classroom in your respective section is also required.
- Submit only 1 cpp file for each question.
- For submission you will rename your cpp files with your roll number in the format **20L-9876\_Q1** and then submit it on both cactus and google classroom.
- We will check your code for plagiarism. If plagiarism is found, it will result in F grade in lab.
- Cell phones, Smart watches, Sharing of USBs or any helping code is **not allowed**.

**Note: Write suitable main for each question. Comments and Indentation hold marks as well.**

**Question 1:**

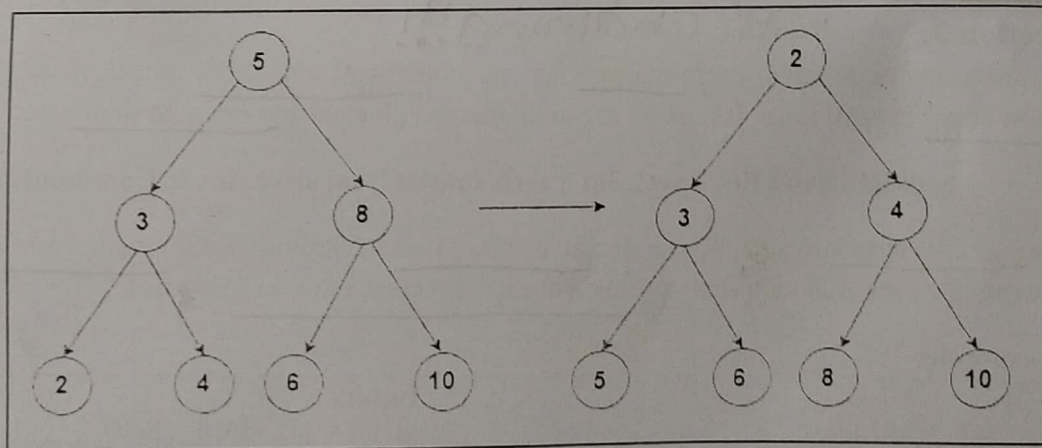
**(Marks 30)**

Given a complete binary search tree in form of an array, efficiently convert it into a min-heap. Your solution should not exceed  $O(n)$  time complexity.

`void bstToMinHeap(int * arr, int size);`

**For Example:**

The solution should convert the BST on the left, into the binary tree on the right which satisfies the structural and heap-ordering property of min-heap.



Input: [5, 3, 8, 2, 4, 6, 10]

Output: [2, 3, 4, 5, 6, 8, 10]



## Question 2:

(Marks 40)

Suppose there is a circle. There are  $n$  petrol pump on that circle. Every petrol pump is represented as a set having 2 pieces of information:

- 1) The amount of petrol that every petrol pump has.
- 2) Distance from that petrol pump to the next petrol pump.

(amount, distance)

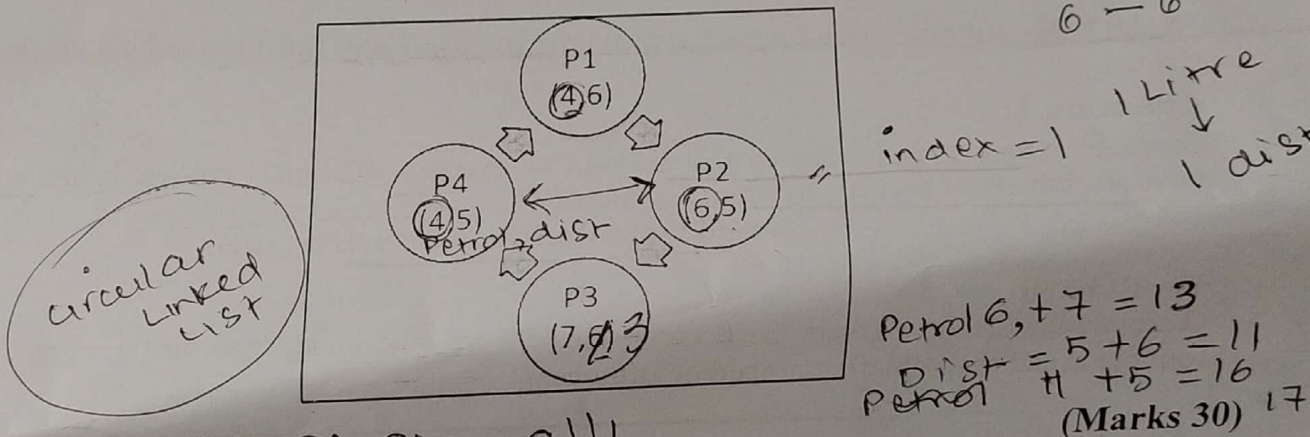
Using the most suitable data structure, calculate the first point from where a truck will be able to complete the circle (The truck will stop at each petrol pump and it has infinite capacity). Expected time complexity is  $O(n)$ . Assume for 1-litre petrol, the truck can go 1 unit of distance.

**int CompleteTour();**

Input is given in Q2.txt file. The first line has total number of petrol pumps, all the proceeding lines have amount of petrol and distance to next petrol pump for every petrol pump.

**For example:**

Let there be 4 petrol pumps with amount of petrol and distance to next petrol pump value pairs as {4, 6}, {6, 5}, {7, 3} and {4, 5}. The first point from where the truck can make a circular tour is 2nd petrol pump. Output should be "start = 1" (index of 2nd petrol pump).



## Question 3: With Chaining!!!

Given two sets represented by two arrays having  $n$  elements altogether, check if the given two sets are disjoint or not in  $O(n)$  time? It may be assumed that the given arrays have no duplicates.

**bool IsDisjoint (int \* set1, int \* set2, int size1, int size2, int & CommonElement)**

Whatever data structure you choose, decide its size yourself. Provide reasoning in form of comments. You can write any other function that your data chosen structure requires to work.

**For example:**

**Input:**

set1[] = {12, 34, 11, 9, 3}

set2[] = {2, 1, 3, 5}

**Output:**

Not Disjoint. 3 is common in two sets.

**Input:**

set1[] = {12, 34, 11, 9, 3}

set2[] = {7, 2, 1, 5}

**Output:**

Yes, Disjoint. There is no common element in two sets.