**Birla Institute of Technology & Science, Pilani**

**Work-Integrated Learning Programmes Division**

**Second Semester 2020-2019**

**M.Tech (DSE)**

**Mid-Semester Test (EC-2 Regular)-Solution**

Question-1 Solution

1. **1 mark for identifying the recurrence**

**1 mark for the solution (It is not mandatory for the student to use master theorem. Any method can be used. Check for the correctness)**

**Recurrence**

T(n)=T(n/2)+n/2 [Even if student assume it as T(n/2)+n,should be credited]

Solution using master theorem

a=1,b=2,f(n)=n/2,n log b a =n 0 =1

Case 3

Solution is Θ(f(n))= **Θ(n)**

1. 1 mark for the method

1 mark for the final answer. (If student writes it as O(n)-Should still be credited)

As the solution provided in (i), one fast robot can be found in **Θ(n) time.**

Now, in order to find all fast robots, we can just test the fast robot with all the others: for each pair of this type, knowing that at least one of the two is fast is enough to decide whether the other robot is fast or slow. This last stage takes n-1 more tests.

n + (n-1)= Θ(n).

Question-2

**Let S[i]=** number of days in a row preceding the present-day[inclusive],i, when the price of crude oil was not greater than the price on the present-day

We are interested in a day which has the crude oil price greater than current day’s price. We need to check the last price that is greater than current day’s price.

Input Output

|  |  |
| --- | --- |
| Day | Price |
| Day6 | 110 |
| Day5 | 150 |
| Day4 | 120 |
| Day3 | 35 |
| Day2 | 34 |
| Day1 | 40 |

|  |  |
| --- | --- |
| Day | S[i] |
| Day6 | 1 |
| Day5 | 5 |
| Day4 | 4 |
| Day3 | 2 |
| Day2 | 1 |
| Day1 | 1 |

We see that S[i] on day i can be easily computed if we know the closest day preceding i, such that the price on that day is greater than the price on the day i.If such a day exists, let’s call it g(i), otherwise, we define g(i) = 0. The No:of days is now computed as **S[i] = i – g(i).** To implement this logic, **we use a stack as an abstract data type to store the days i, g(i), g(g(i)),** and so on. When we go from day i-1 to i, we pop the days when the price of crude oil was less than or equal to price[i] and then push the value of day i back into the stack.

Question-3

The level order Traversal – 25,23,22,21,12,20,17,15,16,10,9,19,18,14,7,4,13,11.

The Post order Traversal – 4,13,15,11,16,21,10,9,12,23,19,18,20,14,7,17,22,25

Question-4

Singly Linked List is the best suitable Data structure based on all the above requirements. Each node in this DS uses only 2 space one to store its phone number and the other to store its classmates phone number. Hence space wise this is the best DS. The only disadvantage is if any student discontinues the course then reallocation of one phone number distributed to this student will have a O(n) complexity to search the student who had the phone number of the discontinuing student.

Question-5

1. We can model the problem using an undirected graph in which every edge represents one complaint and every vertex represent one name (one person)
2. Judge Jasti need to interview one person in each connect component of the complaint graph.

Question-6

1. Iterate through the graph and find a vertex with maximum degree. Runtime is O(|V|) to iterate through adjacency list keys and find the value (list) with the largest size() or O(|v|+|E|) for BFS or DFS
2. Run BFS or DFS from u and count the number of unique vertices visited runtime is O(|V|+|E|)

Question-7

|  |  |
| --- | --- |
| 0 |  |
| 1 | |  |  |  | | --- | --- | --- | | 53 | 88 | 8 | |
| 2 |  |
| 3 | |  |  | | --- | --- | | 79 | 59 | |
| 4 |  |
| 5 | 20 |
| 6 |  |
| 7 | 71 |
| 8 |  |
| 9 |  |

### The end of the test###