

**Part I Answer any 10 of the following - 2 marks each, total 20 marks**

1. Asymptotic analysis is the approximation of ..... of an algorithm.
2. The worst case complexity of Linear search is .....
3. Breadth First Search uses a ..... data structure to keep track of visited nodes
4. Tower of Hanoi is a complex age-old puzzle solvable by using the ..... data structure
5. BST Searches on an average complete in .....
6. AVL Trees and Red-Black Trees are examples of .....
7. Use the ..... notation to signify knowledge of lower and upper bounds of running time of an algorithm
8. Worst Case time complexity for Quick Sort has been found to be .....
9. Selection sort and Insertion sort use no auxiliary memory in addition to the input array and hence they are called .....
10. To get a best case time complexity of  $O(1)$  for Insert, Delete and Search operations, use a .....
11. A k-stream merge sort algorithm that sorts RAM size chunks of data at a time is an example of .....
12. Kruskal's algorithm is used to find the ..... of a Graph

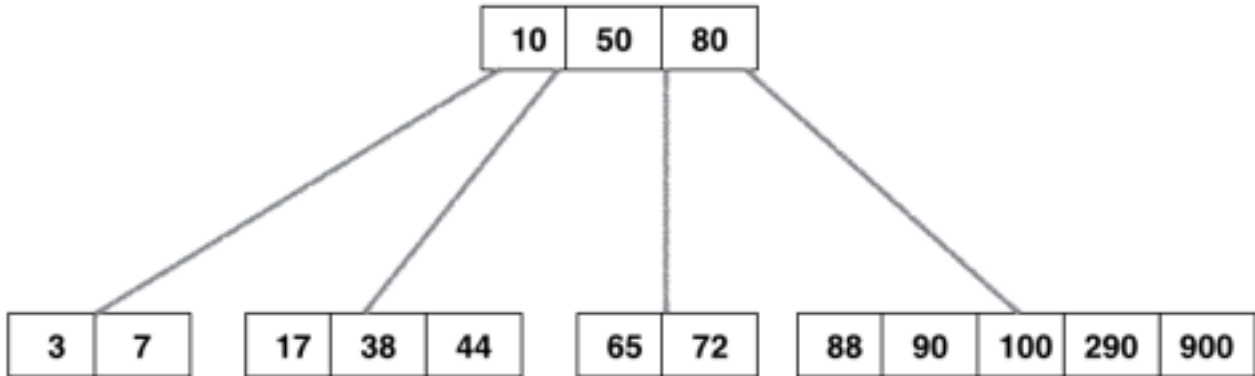
**Part II Answer the following - 5 marks each, total 40 marks**

13. Define the following data structures using C Structs for nodes and illustrate each using diagrams. In each case label relevant nodes using standard convention. **Total 10 marks**
  - a. AVL Tree with the values 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
  - b. Red Black Trees with the values 5, 8, 12, 17, 20, 28, 33
14. Identify the sorting method represented by the for loop below to sort the following number array: 4, 8, 2, 5, 7, 1, 9, 6, 3. Show the steps and the intermediate arrays.

```
void .....Sort(int arr[], int n) {
    int i, key, j;
    for (i = 1; i < n; i++)
    {
        key = arr[i];
        j = i-1;
        while (j >= 0 && arr[j] > key)
        {
            arr[j+1] = arr[j];
            j = j-1;
        }
        arr[j+1] = key;
    }
}
```

}

15. Given the following illustration, identify the data structure and write the corresponding C Struct.



16. Do the following: **5 marks each, total 20 marks**

- a. List the properties of Graphs
- b. List the properties of B trees
- c. List and/or illustrate the steps for the following algorithms. Write down the step in pseudocode wherever necessary. You may use the graph in Q.7 to illustrate your answer. **Total 10 marks**
  - I. Depth-First-Search in a Graph
  - II. Breadth-First-Search in a Graph.

**Part III Do the following: 10 marks each, total 40 marks**

17. Given the following input array 4, 8, 2, 5, 7, 1, 9, 6, 3, show the steps needed to perform:

1. Heap Sort. Illustrate with intermediate heaps for each step of the heap sort
2. Quick Sort. Show i, j and Pivot values for each step. You may choose either the Lomuto or Hoare methods.

18. Do the following: **total 10 marks**

1. Use a numerical Hash function to convert the following keys into corresponding array indices: 1, 4, 2, 12, 17, 19, 27, 34, 49, 23
2. Illustrate with the use of
  - a. Chaining to overcome the first two collisions
  - b. linear probing to overcome the next two collisions.

Duration: 3 hrs, Total Marks 100

19. Trace Kruskal's or Prim's algorithm for the weighted graph below.

- 10 marks

