

1- 3 important characteristics of skip list.

Answer ; (page 442)

Search and update require linear time

Fast Searching of Sorted Chain

Provide alternative to BST (binary search trees) and related tree structures.

Balancing can be expensive.

Relatively recent data structure: Bill Pugh proposed it in 1990

2- Drawback of using array to store BST.

Answer:- (Page 21)

The drawback of using is the limitations that array being of fixed size can only store a fixed number of elements.

Therefore, no more elements can be stored after the size of the array is reached.

3-examples of hashing.

Answer:- repeat

4-c++ code to add node in doubly link list.

Answer ; (page 40)

```
class Node {
public:
int get() { return object; }; // returns the value of the element
void set(int object) { this->object = object; }; // set the value of the element
Node* getNext() { return nextNode; }; // get the address of the next node
void setNext(Node* nextNode) // set the address of the next node
{ this->nextNode = nextNode; };
Node* getPrev() { return prevNode; }; // get the address of the prev node
void setPrev(Node* prevNode) // set the address of the prev node
{ this->prevNode = prevNode; };
private:
int object; // it stores the actual value of the element
Node* nextNode; // this points to the next node
Node* prevNode; // this points to the previous node
};
```

5-What you conclude from the running time analysis of disjoint sets.

Answer (page 405)

We conclude that:

- ❖ union is clearly a constant time operation
- ❖ Running time of find(i) is proportional to the height of the tree containing node i.
- ❖ This can be proportional to n in the worst case (but not always).
- ❖ Goal: Modify union to ensure that heights stay small

6-explain how heap sort work.

Answer:- repeat

7-what is c++ template.

Answer:- (page 75)

A template is a function or class that is written with a generic data type. when a programmer uses this function or class the generic data type is replaced with the data type needed to be used in the template function or in the template class. We only give the data type of our choice while calling a template function or creating an object of the template class. The compiler automatically creates a version of that function or class with that specified data type.

8-explain and write the code for union and find operation of parent array in disjoint sets.

Answer:- (page 399)

Find (i)

This loop is used to find the parent of an element or the name of the set that contains that element.

```
// traverse to the root (-1)
for(j=i; parent[j] >= 0; j=parent[j])
    ;
return j;
```

Union (i, j)

Now let's see the code for the function of union. Here we pass two elements to the function union. The union finds the roots of i and j. If i and j are disjoint sets, it will merge them. Following is the code of this function.

```
root_i = find(i);
root_j = find(j);
if (root_i != root_j)
    parent[root_j] = root_i;
```

In the code, we see that at first it finds the root of tree in which i exists by the find(i) method and similarly finds the root of the set containing j by find(j). Then there is a check in if statement to see whether these sets (roots) are same or not. If these are not the same, it merges them in such a fashion that the root i is set as the parent of root j. Thus, in the array where the value of root j exists, the value of root i becomes there.

Question No: 41 (Marks: 2)

Convert the given infix form to postfix form.

$A+B/C-D^E-F$

Answer:- (Page 66)

$AB+C/D-EF - ^$

Question No: 42 (Marks: 2)

How we can implement Table ADT using Linked List

Answer:- repeat

Question No: 43 (Marks: 2)

If we allow assignment to constants what will happen?

Answer:- repeat

Question No: 44 (Marks: 2)

How heap sort works to sort a set of data.

Answer:- repeat

Question No: 46 (Marks: 3)

Give your comment on the statement that heap uses least memory in array representation of binary trees. Justify your answer in either case.

Answer: - repeat

Question No: 47 (Marks: 3)

How we can use concept of equivalence relations to generate a Maze.

Answer: - repeat

Question No: 48 (Marks: 3)

"For smaller lists, linear insertion sort performs well, but for larger lists, quick sort is suitable to apply." Justify why?

Answer: - repeat

Question No: 49 (Marks: 5)

6 9 5 0 4 1 7 3 2

Show the first five merging steps for Merge sort on this array.

Answer:- repeat (Also see the same solution above)

Question No: 50 (Marks: 5)

What is Disjoint Sets? Explain with an example.

Answer:- (Page 388)

Disjoint sets - Two sets are disjoint if they have no elements in common.

Example:- Suppose there are many people around you. How can we separate those who are related to each other in this gathering?

We make groups of people who are related to each other. The people in one group will say that they are related to each other. Similarly we can have many groups. So every group will say that they are related to each other with family relationship and there is no group that is related to any other group. The people in the group will say that there is not a single person in the other group who is related to them.

Question No: 51 (Marks: 5)

Write the code of the percolateDown() function and also comment it.

Answer:- (page 369)

```
template <class eType>
void Heap<eType>::percolateDown( int hole )
{
int child;
eType tmp = array[ hole ];
for( ; hole * 2 <= currentSize; hole = child )
{
child = hole * 2;
if( child != currentSize && array[child+1] < array[ child ] )
child++; // right child is smaller
if( array[ child ] < tmp )
array[ hole ] = array[ child ];
else break;
}
array[ hole ] = tmp;
}
```

Question No: 52 (Marks: 5)

Here is an array with exactly 15 elements:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15.

Suppose that we are doing a binary search for an element. Indicate any elements that will be found by examining two or fewer numbers from the array.

Answer:- repeat

Question No:1

How we can implement Table ADT using Linked List (marks 2)

Answer: - repeat

Question No:2

which three basic operations are performed on AVL trees (mark 3)

Answer:- (page 457)

- ❖ Insert
- ❖ Delete
- ❖ search

Question No:3

write down the c++ code to implement insertion sort algorithm (5)

Answer: - repeat

Question No:4

Give the name of three Divide and Conquer algorithms. (marks 3)

Answer: - repeat

Question No:5

Here is an array of ten integers:

5 3 8 9 1 7 0 2 6 4

Draw this array after the FIRST iteration of the large loop in an insertion sort (sorting from smallest to largest). This iteration has shifted at least one item in the array! (marks 3)

Answer: - repeat

Question No: 1

For smaller list linear insertion sort is perform well but for large list Quick sort suitable to apply/justify why?????????

Answer:-

Since for smaller lists number of comparisons and interchange (if needed) decreases radically in insertion sort than quick sort. For larger lists, opposite occurs in both sorting techniques.

Question No: 2

Here is a array of exactly 15 elements

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Suppose that we are doing a binary search for an elemnt .Indicate any element that will be found by examining two or fewer number from the array (5 mrks)

Answer:- repeat

Question No: 3

Write the applications of heap.

Answer:- (page 84)

The stack and heap are used in function calls. When we allocate memory dynamically in our programs, it is allocated from the heap. The use of priority queue with the help of heap is a major application. The priority queue is itself a major data structure, much-used in operating systems. Similarly priority queue data structure is used in network devices especially in routers. Heap data structure is also employed in sorting algorithms.

Question No: 4

Write down the c++ code for selection sort (5 marks)

Answer: - repeat

Question No: 5

Write the application of binary search tree

Answer: - (page 369)

The searching and sorting operations are very common in computer science with the help of binary search tree.

Question No: 6

Write the about disjoint set?

Answer: - repeat

Question No: 7

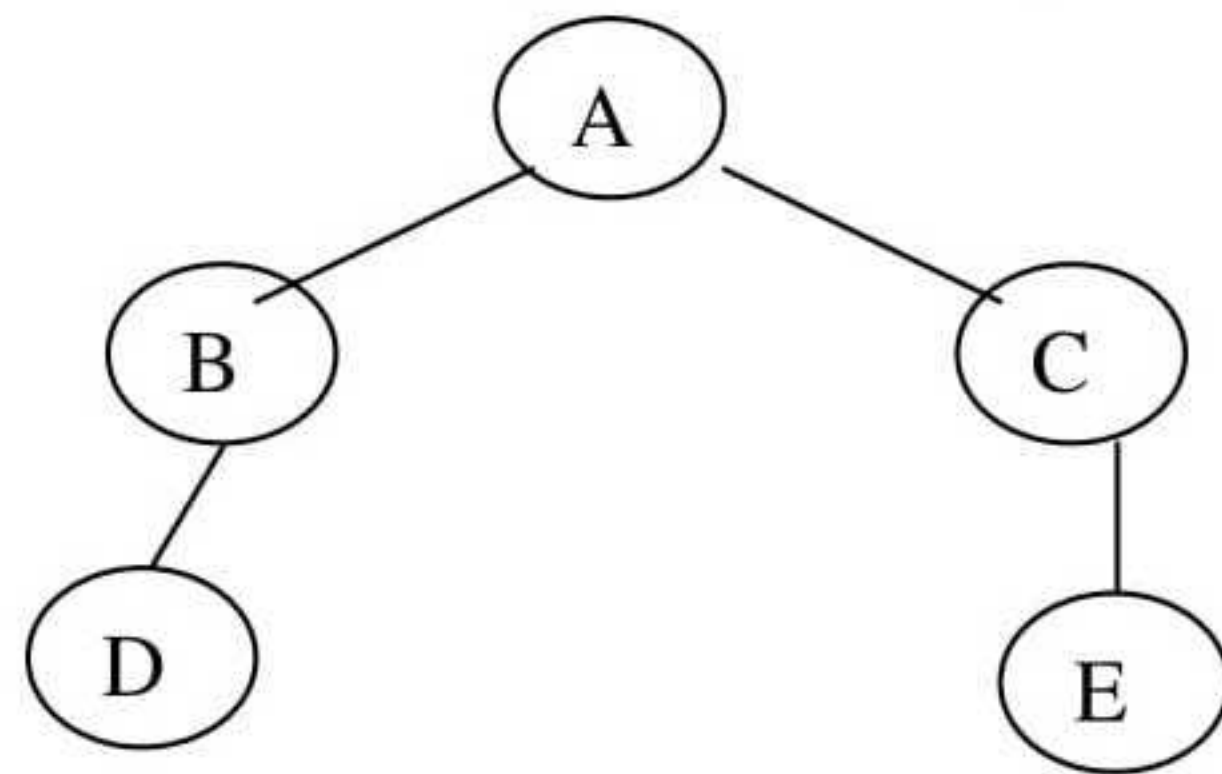
Heapify the elements of the following array (reading from left to right) into a Min Heap and show that Min Heap contents in the form of array as shown below,

original array	6	5	3	9	1	2	10	8	-
----------------	---	---	---	---	---	---	----	---	---

Answer: - repeat

Question No: 8

Represent the following binary tree in array



Answer: - repeat

Question No: 1

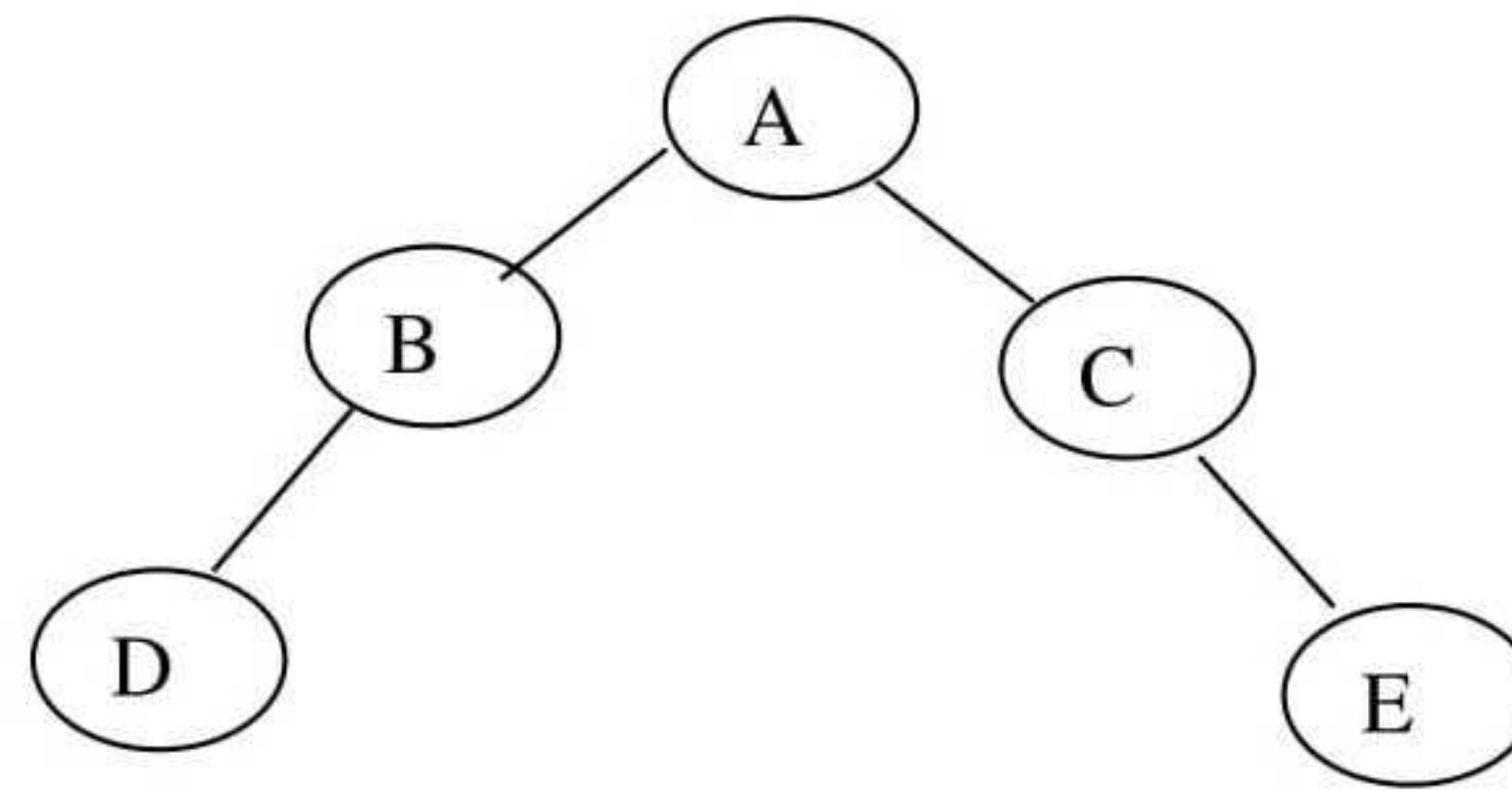
Write the any two operation of linked list that perform their function in one step. 2Marks

Answer: - (page 38)

- ❖ Add
- ❖ Remove
- ❖ Find

Question No: 2

Represent the following binary tree in array. 2Marks



Answer: - repeat

Question No: 3

Write different type of hashing. 2 Marks

Answer: - [Click here for detail](#)

Data structures that employ hashing methods to store keys (and information possibly associated to it) are denoted as **hashing types**.

Question No: 4

Give the table name that we can on table abstract data type. 3mark

Question No: 5

Explain the process of Deletion in a Min-Heap 3 Marks

Answer: - repeat

Question No: 6

What is skip list? 3 Marks

Answer: - repeat

Question No: 7

What we can conclude from the running time array of disjoint set. 5 Marks

Answer: - repeat

Question No: 8

77, 33,44,11,88,22,66,55 sort the following array using insertion algorithm. 5 Marks

Answer: - See the same solution above

Question No: 9

What is disjoint set? 5 Marks

Answer: - repeat

Question No: 10

Suppose we have the following representation for a complete Binary Search Tree, tell the Left and Right child nodes and Parent node of the node D (Marks: 5)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	...
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	...

Answer: - repeat

1. Give one example of Hashing. (2)

Answer: - repeat

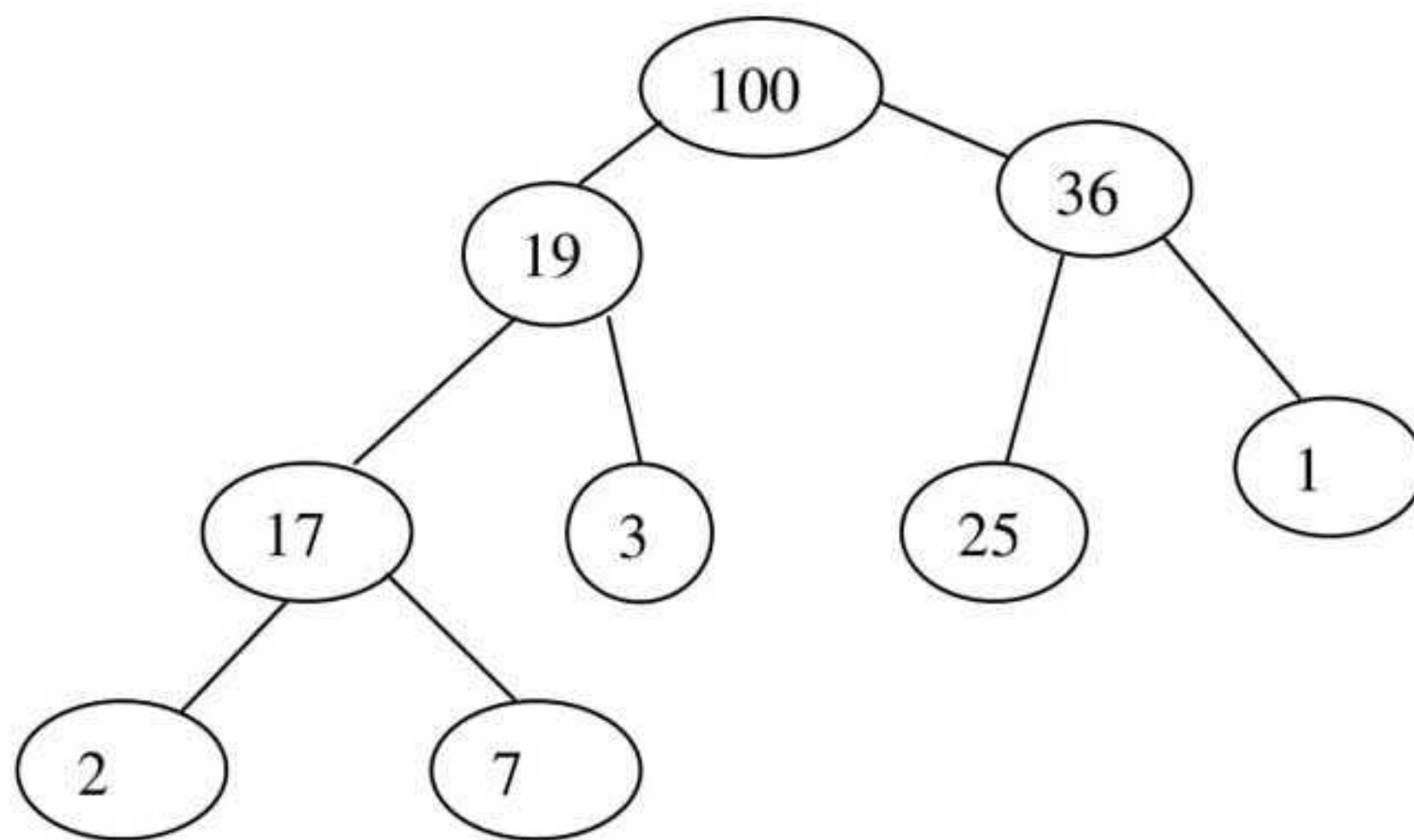
2. Give the operation names that we can perform on Table abstract data type. (2)

Answer: - repeat

3. Define Linked List in your own words. (2)

Answer: - repeat

4. Convert this tree representation of a heap into the corresponding array representation. (2)



Answer: - repeat

5. Here is an array of ten integers:

5 3 8 9 1 7 2 6 4

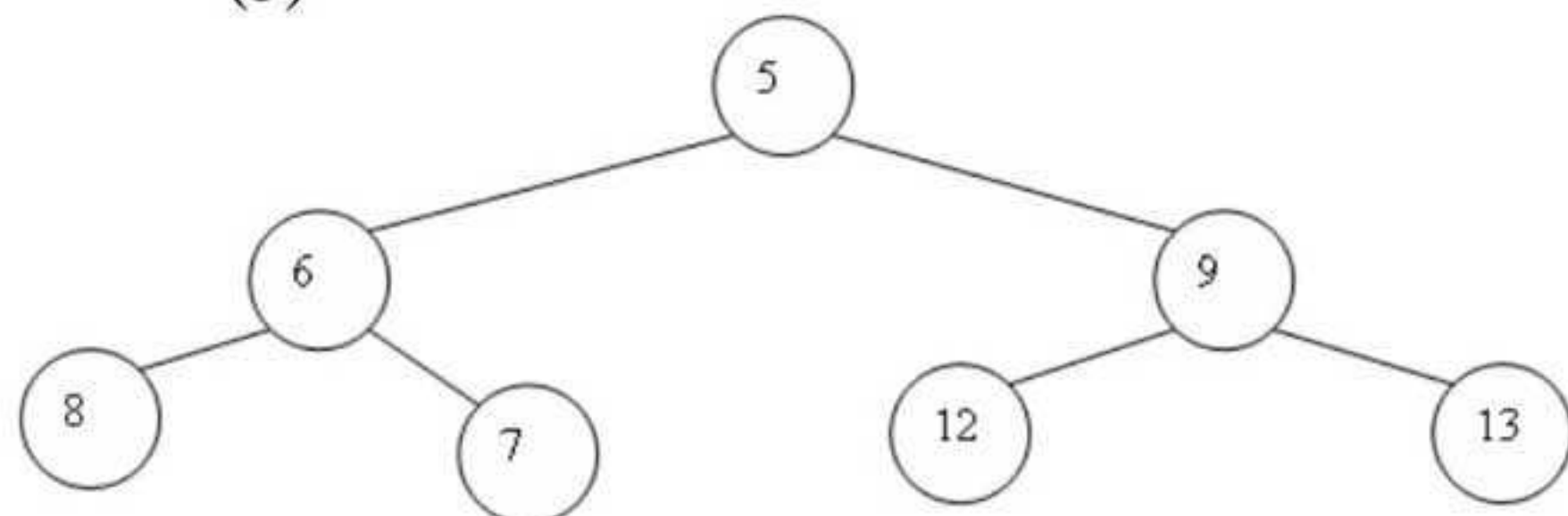
Draw this array after the FIRST iteration of the large loop in an insertion sort (Sorting from smallest to largest). This iteration has shifted at least one item in the array. (3)

Answer:- repeat

6. Which implementation of disjoint set is better with respect space and why? (3)

Answer: - repeat

7. Consider the following Min Heap apply operation delMin on it and show resultant Heap. (3)



Answer: - repeat

8. Which is Dynamic Equivalence Problem with an example? (5)

Answer: - (page 395)

We are using sets to store the elements. For this purpose, it is essential to remember which element belongs to which set. We know that the elements in a set are unique and a tree is used to represent a set. Each element in a tree has the same root, so the root can be used to name the set. The item (number) in the root will be unique as the set has unique values of items. We use this root as the name of set for our convenience. Otherwise, we can use any name of our choice. So the element in the root (the number) is used as the name of the set. The *find* operation will return this name. Due to the presence of many sets, there will be a collection of trees. In this collection, each tree will be representing one set. If there are ten elements, we will have ten sets initially. Thus there will be ten trees at the beginning. In general, we have N elements and initially there will be N trees. Each tree will have one element. Thus there will be N trees of one node. Now here comes a definition for this collection of trees, which states that a collection of trees is called a *forest*.

The trees used for the sets are not necessarily binary trees. That means it is necessary that each node should have a maximum of two children nodes. Here a n may have more than two children nodes.

To execute the union operation in two sets, we merge the two trees of these sets in such a manner that the root of one tree points to the root of other. So there will be one root, resulting in the merger of the trees.

In the find operation, when we call *find* (x), it helps us to know which set this x belongs to. Internally, we find this x in a tree in the *forest*. When this x is found in a tree the *find* returns the number at root node (the name of the set) of that tree.

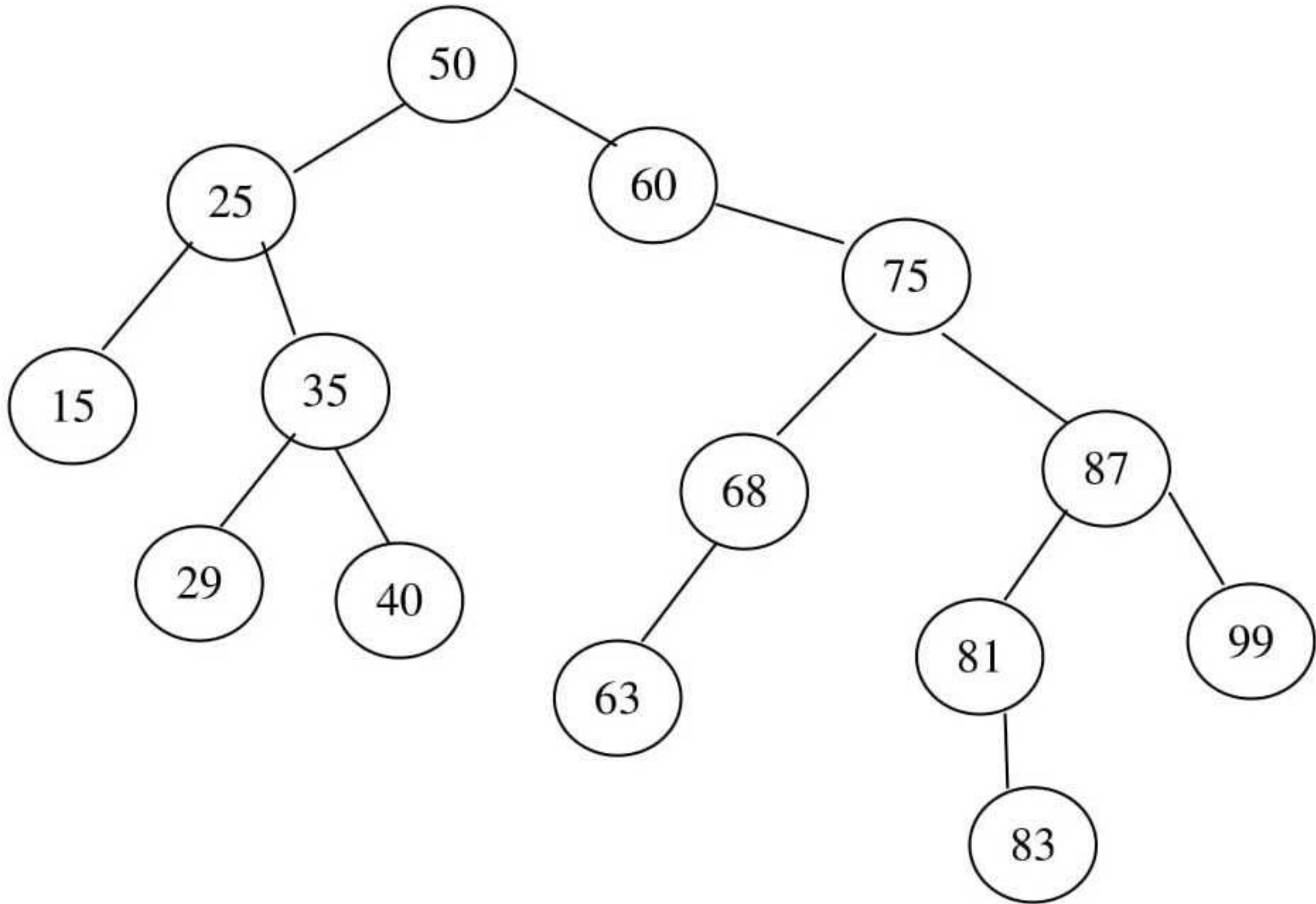
9. Here is an array of ten integers

5 3 8 9 1 7 0 2 6 4

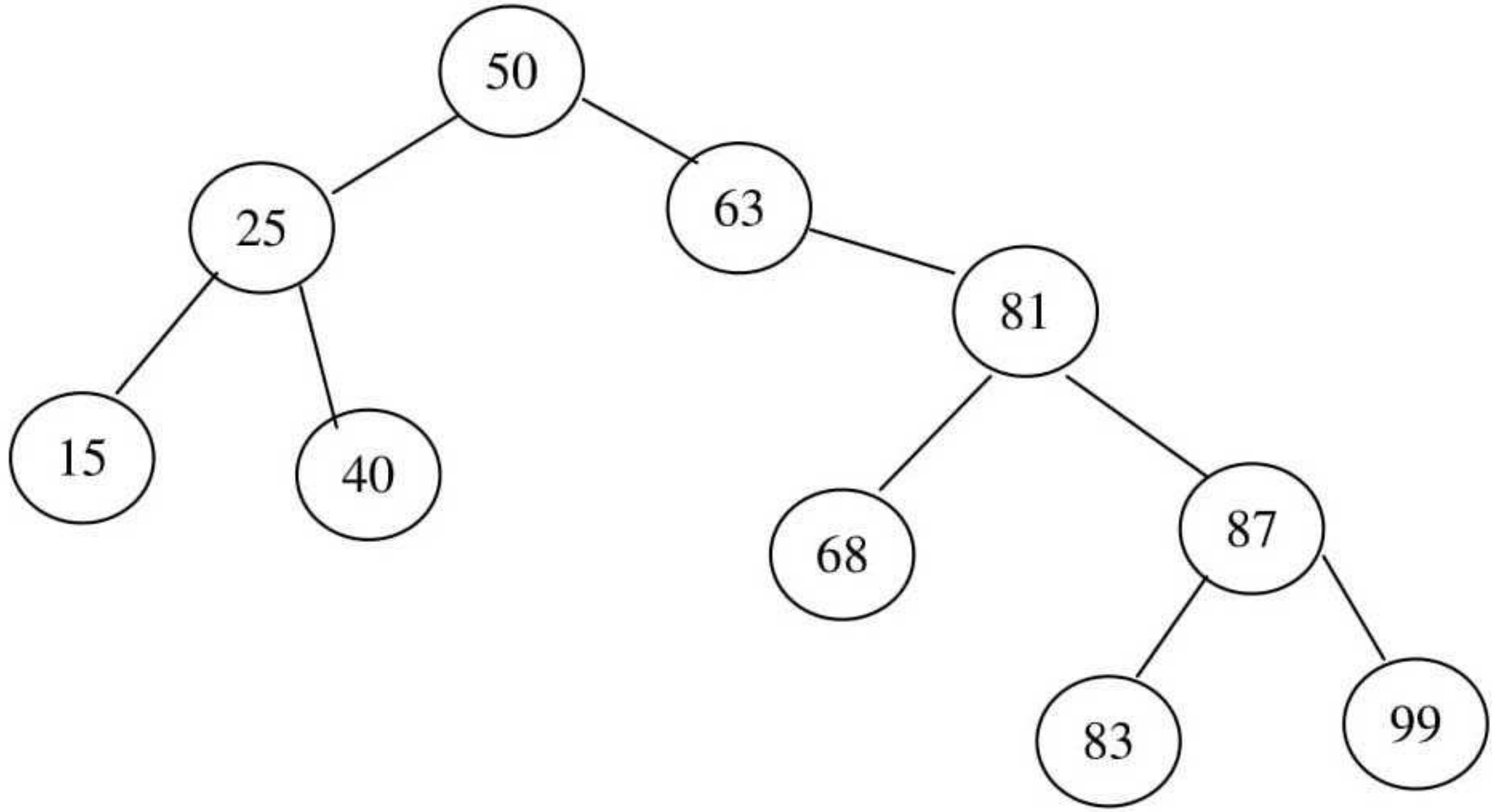
Sort the array by using selection sort algorithm and show content of array after each step. (5)

Answer: - repeat

10. Consider the following Binary tree and Delete the key 29, 35, 75 and 60 only. Show the resultant tree after deleting these keys. (5)



Answer:-



11. Suppose we have the following representation for a complete Binary Search Tree, tell the Left and Right child nodes and Parent node of the Node D

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	...
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	...

Answer: - repeat

1) For a perfect binary tree of height 5, what will be the sum of heights of nodes? 2marks

Answer: - repeat

2) Properties of equivalence class.

Answer: - repeat

3) Two ways for the implementation of Queue data structure.

Answer: - (Page 89, 91)

1. Implementation of queue using linked list
2. Implementation of queue using Array.

4) Worst case of selection sort

Answer: - [Click here for detail](#)

The worst case occurs if the array is already sorted in descending order. Nonetheless, the time require by selection sort algorithm is not very sensitive to the original order of the array to be sorted.

6) “is a sibling of” set of all human beings is equivalence relation or not? Explain.

Answer: (Page 387)

Yes it is an equivalence relation

First rule is reflexive i.e. for all element $x \in S$, $x R x$. Suppose that x is Haris so $Haris R Haris$. This is true because everyone is related to each other. Second is Symmetry: for all elements x and y , $x R y$ if and only if $y R x$. Suppose that y is Saad. According to the rule, $Haris R Saad$ if and only if $Saad R Haris$. If two persons are related, the relationship is symmetric i.e. if I am cousin of someone so is he. Therefore if Haris is brother of Saad, then Saad is certainly the brother of Haris. The family relationship is symmetric. This is not the symmetric in terms of respect but in terms of relationship. The transitivity is: ‘for all elements x , y and z . If $x R y$ and $y R z$, then $x R z$ ’. Suppose x is Haris, y is Saad and z is Ahmed. If Haris “is related to” Saad, Saad “is related to” Ahmed. We can deduce that Haris “is related to” Ahmed. This is also true in relationships. If you are cousin of someone, the cousin of that person is also related to you. He may not be your first cousin but is related to you.

7) Linked memory

(Answer: Page 18)

Linked memory is a memory in which the various cells of memory are not located continuously. In this process, each cell of the memory not only contains the value of the element but also the information where the next element of the list is residing in the memory. It is not necessary that the next element is at the next location in the memory. It may be anywhere in the memory. We have to keep a track of it.

Thus, in this way, the first element must explicitly have the information about the location of the second element.

Similarly, the second element must know where the third element is located and the third should know the position of the fourth element and so on

8) 3 5 9 8 1 7 0 2 6 4 , draw after the 1st iteration of large loop in a selection sort (smallest to largest)

Answer: - repeat

9) Union commands 1, 2, 3, 4, 5 union(4,2),union(3,1),union(5,4) 5 marks

Answer: - repeat

10) Code for removing an element from a linked list data structure if it is implementation by using linked memory methods.

Answer: Page 34

```
void remove() {  
if( currentNode != NULL && currentNode != headNode) {  
lastCurrentNode->setNext(currentNode->getNext());  
delete currentNode;  
currentNode = lastCurrentNode->getNext();  
size--;  
}  
};
```