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SG.

I hereby pledge on my honor that I will strictly adhere to academic integrity codes and the work done on this examination is solely my own and I will not receive / give any help from / to anybody or source during this examination.

1)

```
public static void insertionSort (LinkedList<E> list){
    for (int j=1; j< list.size(); j++){
        E current=list.get(j);
        int i=j-1;
        while (i>=0){
            if (list.get(i).compareTo(current)>0){
                E temp= list.get(i+1);
                list.set(i+1, list.get(i));
                list.set(i, temp);
                i--;
            }
        }
    }
}
```

In the worst case of insertion sort, the algorithm will take $O(n^2)$ time, because in inner and outer loop we increment or decrement numbers by 1. If we were divide / multiply by 2, it would contain logn in the time complexity. Also I moved comparing current and i'th index outside of loop condition and inside of loop that to even comparing won't be give a number bigger than 0, while condition always be executed if i is bigger or equals 0.

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2)

To compare the shortest path we can use Djaviat's solution. In that solution if graph is dense graph we can use adjacency matrix, if it is a sparse graph we can use adjacency list for a better running time.

Adjacency matrix	AdjacencyList
$\Theta(n^2)$	$\Theta(m)$
↳ square of number of vertices.	↳ number of edges (without priority queue)

To implement it, we can use a better solution than Djaviat's solution. If we use a priority queue (it can be a heap), because of tree traversal rules, it will take to compare as $O(\log n)$ and because we are going to do for every vertex it'll take $O(n \log n)$. (for adjacency list)

For adjacency matrix, we can use it dense graph and will take $O(n^2)$

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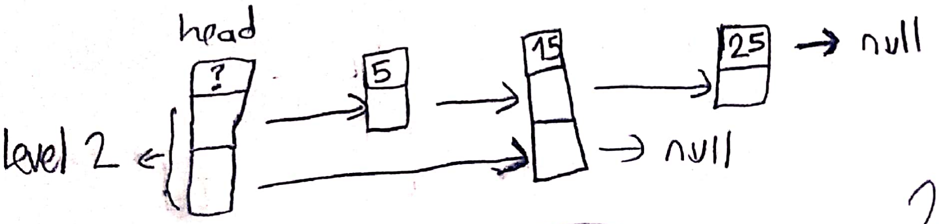
3)

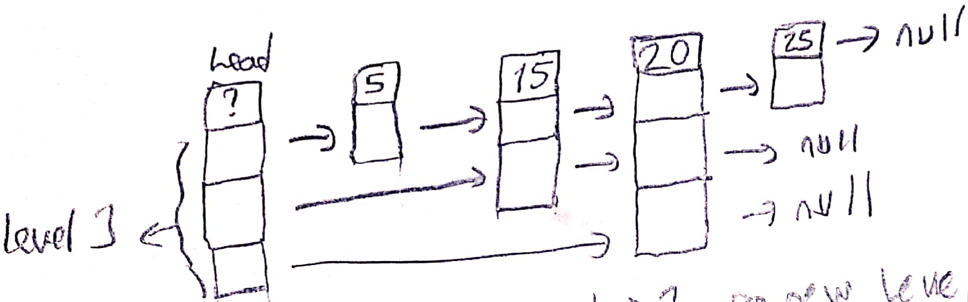
a) If we say that skip list level is $= n$, then the rule is for maximum elements is $\boxed{2^n - 1}$

The reason it become exponential Maximum size is because skip list insertions are logaritmic. For example %50 of elements will be in first level, and %25 of elements will be in second level and it goes like that by dividing by 2.



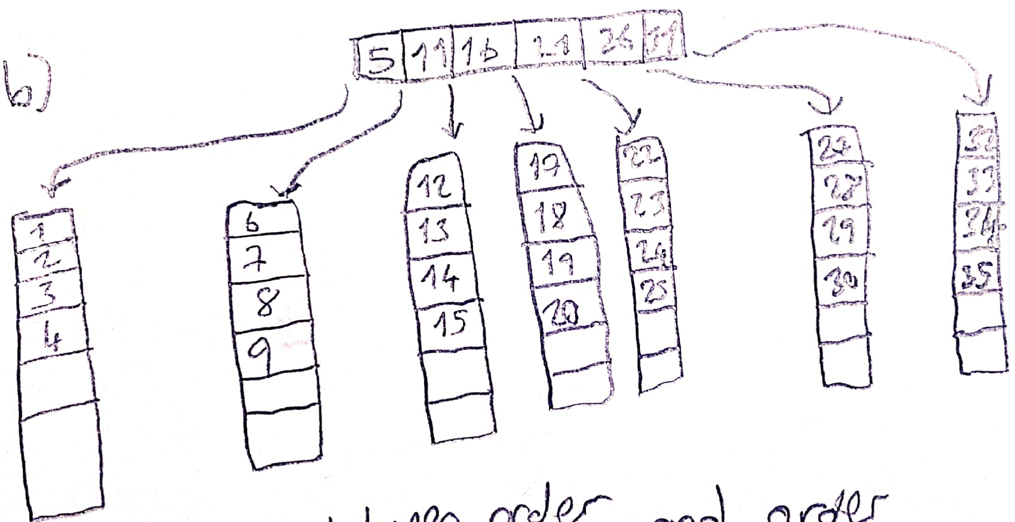
$2^2 - 1 = 3$ max elements

Adding 20



4 > 3 so new level created and new element inserted.

b)



Order → number of children.
order holding data + 1

Should be between $\frac{order}{2}$ and order → 7

$\lceil \frac{7}{2} \rceil = 4$

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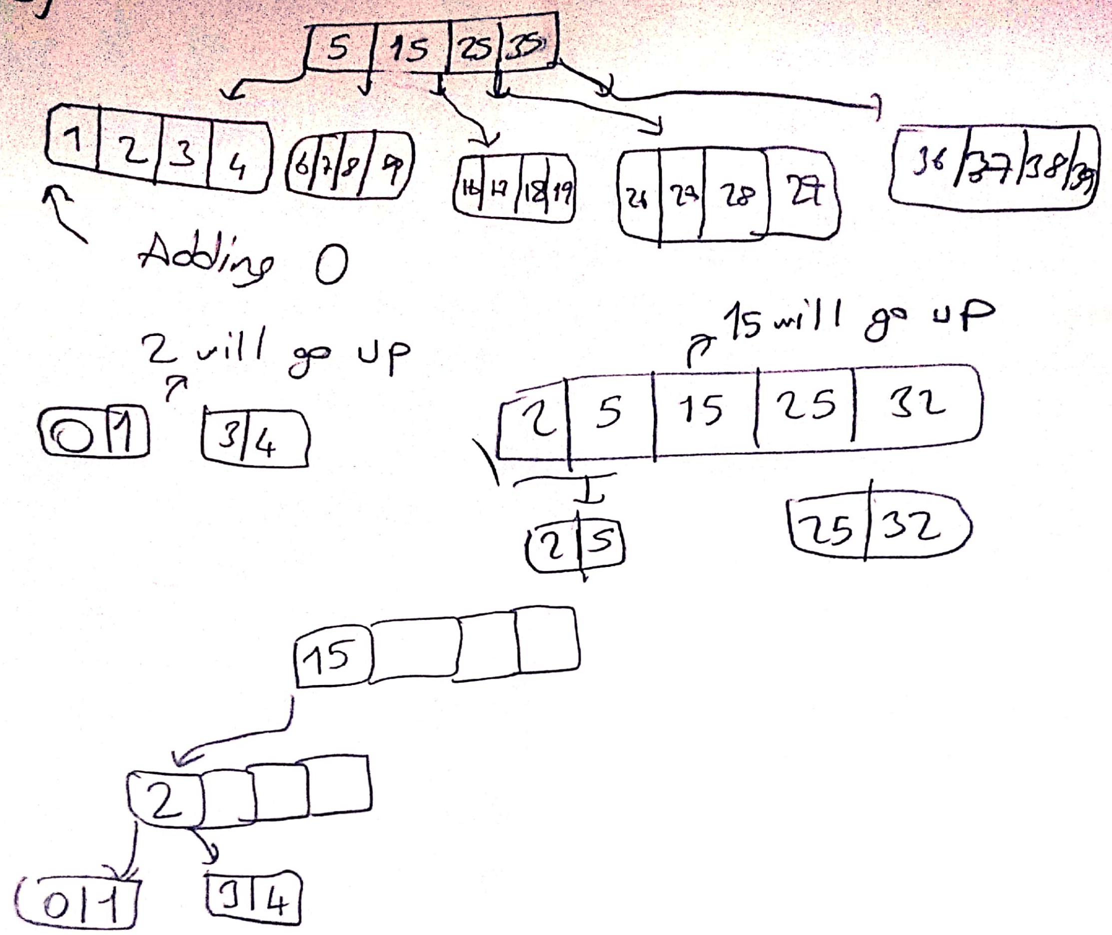
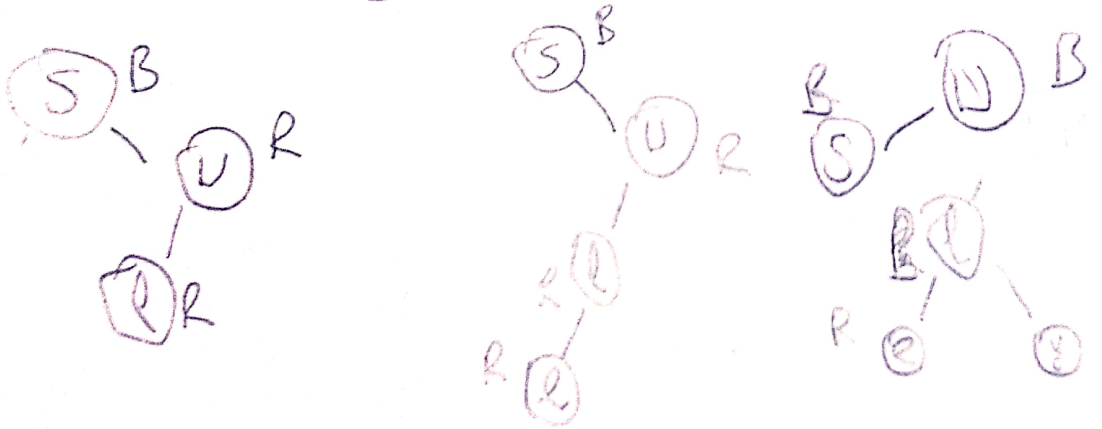
c)



d) S u l e y m



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4)

In my implementation I represent vertices with integers because edgeIterator takes source parameter as integer and source is our beginning vertex.

```
public class SuleymanGraph implements Graph {

    MyHashSet <Edge> allEdges;

    public SuleymanClass (int size){
        Edge dummyVal = new Edge (-1,-1);
        allEdges = new MyHashSet<Edges>();
        for(int i=0; i<size; i++) allEdges.put(dummyVal);
    }
    Private static class MyHashSet extends HashSet <E>{
        @override
        public int hashCode (){
            return 31 * this.size() * this.size();
            // 31 is a prime number
            // so using this number with quadratic
            // probing helps us for prevent collisions.
        }
        @override
        public boolean equals (MyHashSet other){
            return hashCode() == other.hashCode();
        }
    }
    Iterator <Edge> edgeIterator (int source){

        return new Iterator<Edges> (){
            @override
            public Edge next(){
                boolean returnNextFlag = false;
                for (Edge temp: allEdges){
                    if(returnNextFlag == true)
                        return temp;
                    if (temp.getSource() == source)
                        returnNextFlag=true;
                }
            }
        }
```

	Final	Final
1	Runtime	0
1	Iter 1 + move	0
1	Iter 2 + move	0
1	Replace (remove+insert)	0
1	1	0
2	2BFS + queue	3
2	distance value handling	0
2	Run time	3
2	2	6
3	3.a	--
3	initial(3)	3
3	Final(2)	2
3	# of elements(3)	3
3	3.b	--
3	Root(3)	
3	Leaves(3)	
3	# of elements(2)	2
3	Sort (-1)	
3	3.c	--
3	Root(2)	2
3	Insert(3)	2
3	# of elements(3)	3
3	Sort(-1)	
3	3.d	--
3	True(8)	
3	Each mistake(-2)	
3	3.e	--
3	Where(3)	
3	Why one(5)	
3	**3**	17
4	Edge representation	0
4	HashSetGraph Declerations	3
4	Constructor	1
4	edgeIterator	0
4	Iter Declerations	
4	Constructor	
4	next	0
4	Edge Declerations	
4	Constructor	
4	hashCode	0
4	equals	1
4	4	5
	Format	
	F Total	28