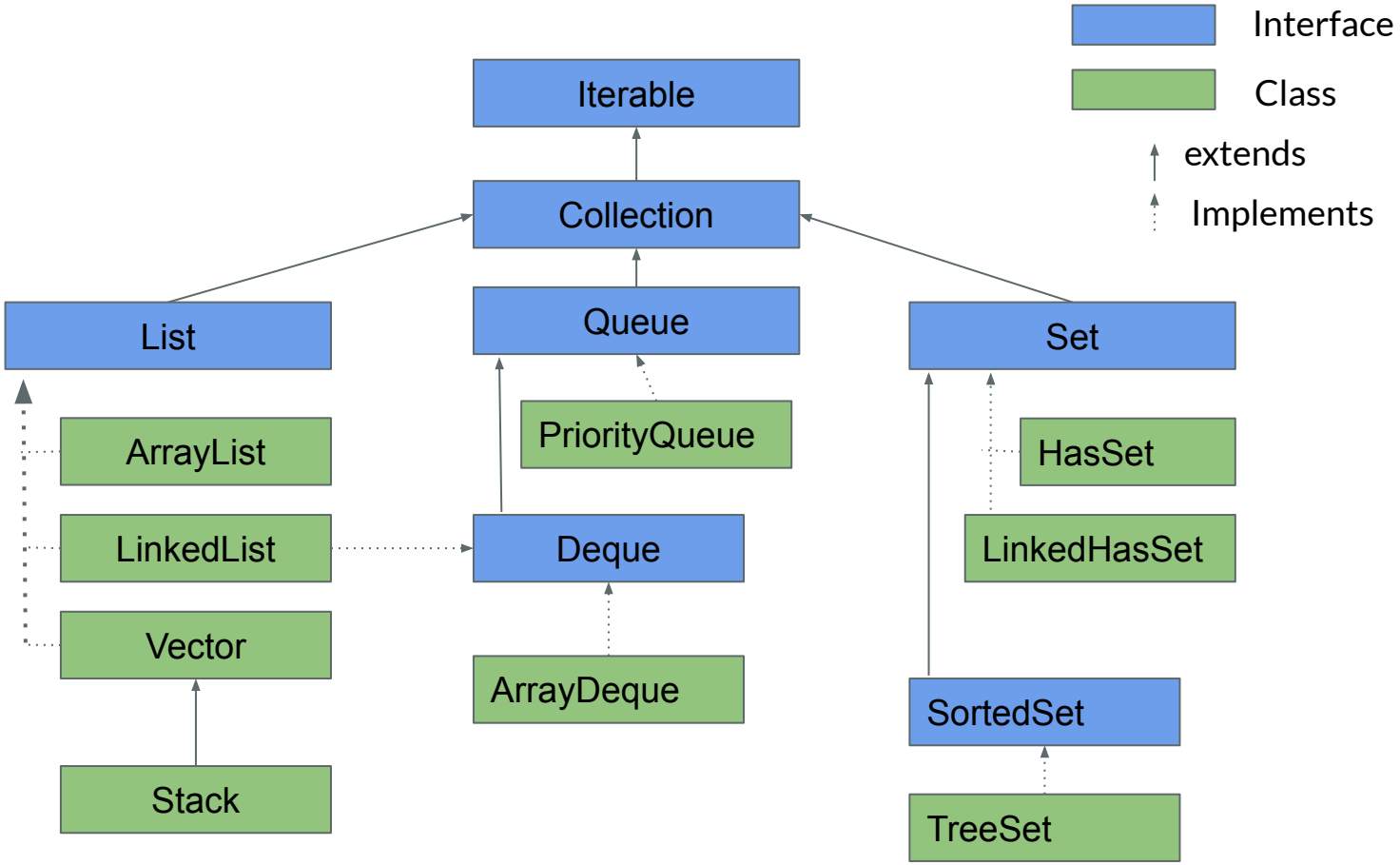
Collections

Dhvani Undhad

Collection framework

- The JAVA collection framework is a collection of Interfaces and classes of helps in storing and processing the data efficiently.
- This framework has several useful classes which have lots of useful functions which makes a program easy to code.
- Basically we can think of a collections is a framework that provides an architecture to store and manipulate the group of object.
- Java collection means a single unit of objects.
- It represent a set of Interfaces and classes.

Hierarchy of Collection Framework



Collection - List

- A List is an ordered collection.
- May contains duplicate elements.
- Elements can be inserted or accessed by their position (Index based)in the list.
- List interface is implemented by the classes ArrayList, LinkedList, Vector and Stack.

To instantiate the List Interface:

```
List <data-type> list1= new ArrayList();
List <data-type> list2 = new LinkedList();
List <data-type> list3 = new Vector();
List <data-type> list4 = new Stack();
```

ArrayList

- The ArrayList implements the List Interface.
- It uses a Dynamic array to store duplicate element of different data types.
- The ArrayList maintains the insertion order and is non-synchronized.
- The elements stored in ArrayList can be randomly accessed.

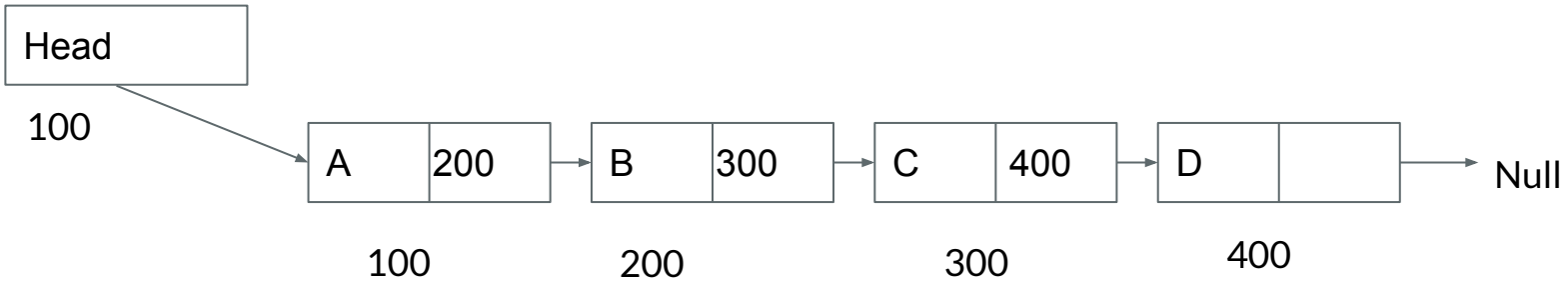
For Example:

```
class Collection1{
public static void main(String args[]){
ArrayList<String> list=new ArrayList<String>();//Creating arraylist
list.add("Dhvani");//Adding object in arraylist
list.add("Meena");
list.add("Manasvi");
list.add("Vineet");
//Traversing list through Iterator
Iterator itr=list.iterator();
while(itr.hasNext()){
System.out.println(itr.next());
}
}
}
```

Output: Dhvani
Meena
Manasvi
Vineet

LinkedList

- LinkedList implements the collection Interface.
- There are two types of LinkedList : 1) Singly LinkedList 2) Doubly LinkedList
- It uses a doubly LinkedList to store an elements internally.
- It can store duplicate elements.
- It maintains the insertion order and is not synchronized.
- Manipulation is fast and easy in LinkedList because no shifting is required.



For Example:

```
public class LinkedList1 {

    public static void main(String args[])
    {
        LinkedList<String> ll = new LinkedList<>();

        ll.add("Dhvani");
        ll.add("Undhad");
        ll.add(1, "Lalitbhai");

        System.out.println(ll);
    }
}
```

Output:
[Dhvani, Lalitbhai, Undhad]

Collection - Set

- A set is an interface and extends collection which do not contains duplicate elements.
- We can store at least one Null value in Set except TreeSet.
- There are three main implementation of Set:

1) HashSet: Stores it's elements in Hash table and does not maintains order.

2) TreeSet : Stores elements based on their values.

3) LinkedHasSet : Maintains orders of it's elements in which they were inserted into Set.

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HashSet

Methods in HashSet:

- **boolean add(Element e)**: It adds the element e to the list.
- **void clear()**: It removes all the elements from the list.
- **Object clone()**: This method returns a shallow copy of the HashSet.
- **boolean contains(Object o)**: It checks whether the specified Object o is present in the list or not. If the object has been found it returns true else false.
- **boolean isEmpty()**: Returns true if there is no element present in the Set.
- **int size()**: It gives the number of elements of a Set.
- **boolean(Object o)**: It removes the specified Object o from the Set.

Set can be instantiated as:

```
1. Set<data-type> s1 = new HashSet<data-type>();
2. Set<data-type> s2 = new LinkedHashSet<data-type>();
3. Set<data-type> s3 = new TreeSet<data-type>();
```

For Example:

```
1.  public class CollectionTest{
2.  public static void main(String args[]){
3.  Set<String> set=new HashSet<String>(); //Creating HashSet and adding duplicate elements
4.  set.add("Dhvani");
5.  set.add("Vijay");
6.  set.add("Dhvani");
7.  Iterator<String> itr=set.iterator();  //Traversing elements
8.  while(itr.hasNext()){
9.  System.out.println(itr.next());
10. }
11. }
12. }
```

Output: Vijay
Dhvani

TreeSet

- It’s same as HashSet except it’s sorts it’s elements in the ascending order while HashSet doesn’t.
- It allows null element.

For Example:

```
1.  TreeSet<String> al=new TreeSet<String>();
2.    al.add("Zayad");
3.    al.add("Shrutil");
4.    al.add("Coby");
5.    //Traversing elements
6.    Iterator<String> itr=al.iterator();
7.    while(itr.hasNext()){
8.     System.out.println(itr.next());
9.    }
```

Output:

Coby
Shruti
Zayad

LinkedHashSet

- It contains only unique elements only like HashSet.
- Maintains the insertion order and is non synchronized.
- It allows Null elements.

For Example:

```
LinkedHashSet<String> set=new LinkedHashSet<String>(); //Creating HashSet and adding duplicate elements
1.  set.add("Dhvani");
2.  set.add("Vijay");
3.  set.add("Dhvani");
4.  set.add(Null);
5.  Iterator<String> itr=set.iterator();  //Traversing elements
6.  while(itr.hasNext()){
7.  System.out.println(itr.next());
8.  }
```

Output:

Dhvani
Vijay
Dhvani
Null

Collection - Map

- A map contains values on the basis of key. For example Key and Value pair.
- A map contains unique Key.
- A map can not be traversed like ArrayList and HashSet through Iterator, so you need to convert it into Set using KeySet() and entrySet() method.

Class	Description
HashMap	**HashMap is the implementation of Map, but it doesn't maintain any order.**
LinkedHashMap	**LinkedHasMap is implementation of Map. It inherits HashMap class. It maintains insertion order.**
TreeMap	**TreeMap is the implementation of Map and SortedMap. It maintains ascending order.**

HashMap

For Example:

```
HashMap<Integer, String> hmap = new HashMap<Integer, String>();

        hmap.put(12, "Company");
        hmap.put(2, "Managers");
        hmap.put(7, "Customers");
        hmap.put(49, "Employee");
        hmap.put(3, "Headquarters");

        //Converting HashMap into Set.
        Set set = hmap.entrySet();
        Iterator iterator = set.iterator();

        while(iterator.hasNext()) {
            Map.Entry mapData = (Map.Entry) iterator.next();
            System.out.println("Key: " + mapData.getKey() + " ,Value: " + mapData.getValue());
        }
```

Output:

Key: 49 ,Value: Employee
Key: 2 ,Value: Managers
Key: 3 ,Value: Headquarters
Key: 7 ,Value: Customers
Key: 12 ,Value: Company

Hashtable

- HashMap allows one null key and any number of null values, but Hashtable doesn't allow null keys and null values.
- It will gives you an NullPointerException.

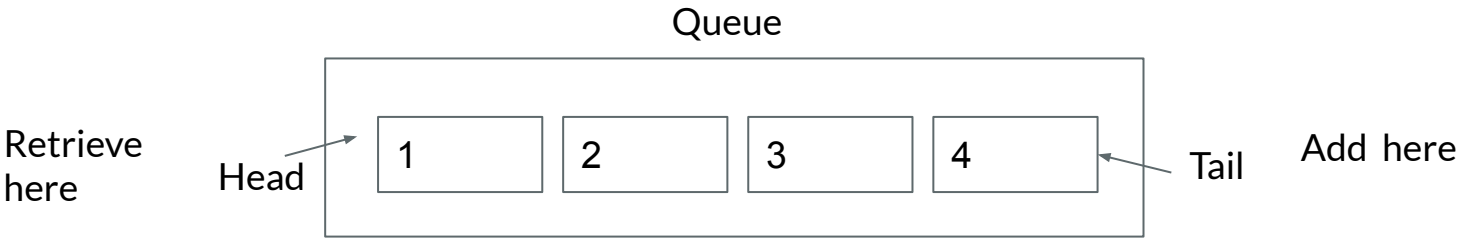
For example:

```
Hashtable<String , Integer> table = new Hashtable<>();
        //Hashtable does not allow null Key or values and throws Null Pointer during execution
        try {
                table.put(null, 5);
                table.put("Dhvani", 6);
                table.put("Neha", null);
        }
        catch(NullPointerException e){
                System.out.println("Hashtable does not allow null key or values");
        }
        System.out.println("Hashtable: "+table.get("Neha"));
```

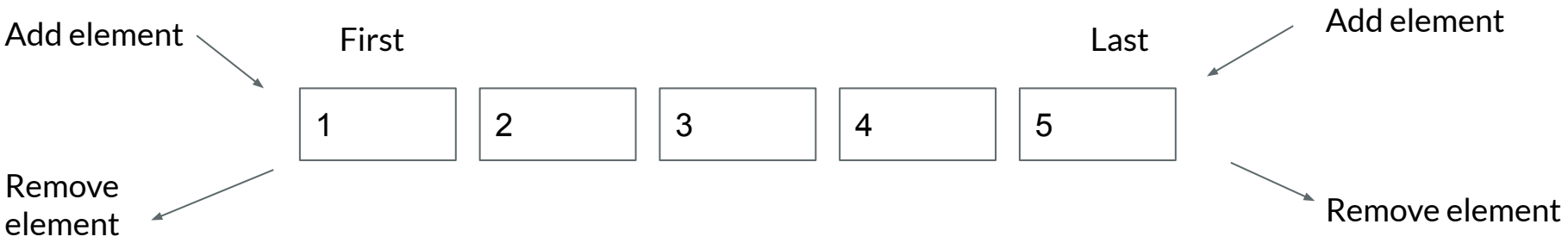
Output:
Hashtable does not allow null key or values
Hashtable: null

Collection - Queue and Deque

- Queue is an Interface in java which extends Collection Interface.
- It is an ordered list and in Queue elements retrieved as FIFO (First In First Out) orders.



- Where as Deque Interface is subtype of Queue Interface and it is double- ended Queue.
- Deque uses LIFO(Last In First Out) or Stack Data Structure.
- It supports addition or removal of elements from both the sides.



Comparable Interface

- In JAVA it is easy to sort Arrays and list of objects that implements the Comparable interface.
- However if you want to sort the object of custom class, then you need to implement Comparable interface in our custom class.

This interface has only one method:

```
public abstract int compareTo(T obj)
```

- Since this method is abstract you have to implement this method into class.

Let’s say object of Employee class is (empId, empName, empAge) and we want to sort the objects by empAge.

```
public int compareTo(Employee e){

    if(this.empAge==e.empAge)

        return 0;

    else if(this.empAge>e.empAge)

        return 1;

    else

        return -1;

}
```

Comparator Interface

- By using Comparable we can not sort multiple data member at once, ther by Comparator interface comes in the picture.
- Comparator used to order the objects of user defined classes.
- A comparator object is capable of comparing two objects of two different classes.

This interface has only one method:

```
public int compare(Object obj1, Object obj2):
```

- We can create as many as comparator in separate class and then we can call the Collections.sort method on one or more comparator by creating object of that class:

```
//Sorting arraylist al by Employee Age

Collections.sort(al, new EmpAgeComparator());

//Sorting arraylist al by Employee Name

Collections.sort(al, new EmpNameComparator());
```