What is Collection ?

Ans – if we want represent individual group of single entity we use collection

In general   
Collection interface considered as root interface of collection framework

9 Key features

1. Collection(v1.2)
2. List(1.2)
3. Set
4. SortedSet
5. NavigableSet
6. Queue
7. Map
8. SortedMap
9. NavigableMap

There is no concrete class which is implement Collection directly .

Concreteclas – that class which have all implemented method it is not have abstract method.

* Difference between Collection and Collections

1. Collection is a interface
2. Collections is a utility class present java.util package to define several utility method for Collection object Ex Sorting, Searching etc.

List interface (v1.2)

* Implemented class of List interface
* Array List(1.2)
* LinkedList(v1.2)
* Vector (v1.0)
* Stack(v1.0)
* Vector and Stack class are also called legacy class because which came into 1.0 version
* ArrayList and LinkedList and Vector Classes implement List interface
* Stack extends Vector class

Note : In 1.2 version vector and stack class are updated to implement List interface

It is the child interface of collection

If we want represent a group of individual object as single entity where

* Duplicates are allowed
* Insertion order must be preserved then we should go for List.

Set Interface (v1.2) :

* it is the child interface of Collection.
* if we want represent individual group of single entity we use collection
* duplicate are not allowed
* insertion order not preserved

Implement Class

* HashSet(v1.2)
* LinkedHashSet(v1.4)

SortedSet ((I) v1.2)

* It is the child interface of set
* duplicate are not allowed
* all object should be inserted in some sorting order

NavigableSet interface (v1.6)

* it is the child interface of SortedSet interface
* it contains several method for navigation purpose

TreeSet (v1.2) is a class which implement NavigableSet interface and SortedSet interface

Queue interface (v1.5)

* it is the child of collection
* if we want represent a group of individual objects prior to processing the we should go for queue
* usually queue follow FIFO order but based on our requirement we can implement our own priority order also Ex: before sending a mail all mail id’s we have to store in some data structure I which order we added mail id’s In the same order only mail should be delivered for this requirement it is the best choice.
* Implemented classes
* Priority Queue(c)
* BlockingQueue(i)

Priority BlockingQueue(c)

LinkedBlockingQueue(c)

Note: Priority BlockingQueue, LinkedBlockingQueue are classes implements BlockingQueue.

All the above interfaces (Collection, List, SortedSet, Navigable and Queue) meant for representing a group of individual objects

Map(v1.2): If we want to represent a group of object as key value pairs then we should go for Map

* Map is not a child interface of Collection
* If we if we want represent a group of individual objects key value pairs then we should go for map

Ex:

|  |  |
| --- | --- |
| **Key** | **Value** |
| 102 | Amir |
| 103 | Ayan |
| 104 | Shahid |
| 105 | Anil |

* Both key and value objects only
* Duplicate keys are not allowed but values can be duplicated

Implementation classes of Map

* HashMap(v1.2)

LinkedHashMap (v1.4)

* WeakHashMap(v1.2)
* IdentityHashMap(v1.4)

Dictionary (Abstract class) (v1.0) these are also legacy classes

* Dictionary(AC)
* Hashtable
* Properties

**SortedMap**:

* It is the child interface of map
* If we want to represent a group of key value pair according to some sorting order of Key’s
* In SortedMap Sorting should be based on key but not based on value

**NavigableMap**:

* It is the child interface of map
* It defines several methods for navigation purposes
* TreeMap is the only Class which implement NavigableMap

**Cursor:**

If you want get object one by one from collection we use Cursors Concept

* Enumeration

Limitation of Enumeration:

* + - We can apply Enumeration concept only for legacy class
    - and it is not a universal curser
    - by using enumeration we can get only read access
    - we can’t perform remove operation
    - to overcome above limitation we should go for iterator
    - Method’s 1 hasnextelement() 2 nextelement()
* Iterator
  + - We can apply iterator concept for any collection object
    - It is universal cursor
    - By using iterator we can perform both read and remove operation’s
    - Method’s 1. Boolean hasNext() 2 Object next() 3 void remove()
    - Limitation
    - By using Enumeretion and iterator we can towards forward
    - Only we can’t move backward
    - These are single directional cursor
    - By using iterator we can perform only read and remove opreation
    - And we can’t perform replacement of additional new object
    - To overcome above limitation we should go for list iterator
* List Iterator
  + list iterator we can move either forward direction or to the backward direction and hence it is bidirectional cursor
* we can perform replacement and addition of new objects
* it’s a child interface of Iterator and hence all method available in Iterator by default available in listiterator
* list iterator defines the following nine methods

1. Boolean hasNext()
2. Object next()
3. Int nextIndex()
4. Boolean hasPrevious()
5. Object previous()
6. Int previousIndex()
7. Void remove()
8. Void add(Object o)
9. Void set(Object o)

**Utility Class:**

* Collections
* Arrays

**Sorting:**

If you want default natural sorting Sorting:

* Comparable interface

If you want customize sorting

* Comparator interface
* Collection: if you want represent ……
* Collection interface defines most common method which are applicable for any collection object these method are inside in Collection
* Add();
* addAll()
* remove() ->
* in Collection remove method match object value then remove object
* whereas List remove method considered as index

Ex: remove(5);

* + Collection will match value if found then remove
  + List find index if found then remove
* removeAll()
* clear()
* retainAll()
* contain()
* containAll()
* isEmpty()
* size()
* toArray() return object array
* iterator() return iterator object

Note: there is no concrete class which implements collection interface directly

**List interface:**

* If we want represent a group of individual object as single entity where
* Duplicates are allowed
* Insertion order must be preserved then we should go for List.
* Histroginus object are allowed on all collection except (TreeSet , TreeMap)
* Histroginus means different type of object
* Underline data structure is resizable array or growable array

**ArrayList Constructor**

* Default initials capacity of 10(not confirmed there is no method to check capacity)
* Assign manual size new ArrayList( int intialcapacity)
* Create an equalent ArrayList object it is use to convert another object to List ex: treestet to ArrayList . List t = new ArrayList(Collection c)
* New Capacity = (Current Capacity \*3/2 +1)

Methods to be practice:

* Add() :on 4th index of object in 2 object collection
* Get()
* Remove() from unadded index ;
* Listiterator()

Usually we can use collections to hold and transfer objects from one location to another location {container} to provide support for this requirement every collection class by default implements serielizable and clonable interfaces

* ArrayList and vector classes implements random-access interfaces also so that any random element we access with same speed

**Random-access** **interface**: present in java.util package and it does not contain methods it’s a marker interface. Where required ability will be provided by jvm.

**Difference between ArrayList and vector**

|  |  |
| --- | --- |
| it is non synchronized | every method is synchronized |
| Multiple thread can access no thread safety | Thread safe |
| It’s fast | It’s slow |
| 1.2v it’s not legacy | 1.0 it’s legacy |

**Difference between ArrayList and LinkedList**

|  |  |
| --- | --- |
| **Arraylist is best choice for retrieval operation** | **Best choice in insert or delete data in middle** |
| **Worst choice in insert or delete data in middle** | **Worst choice for retrieval operation** |
| **Arraylist stored elements in consecutive memory location and retrieval will become easy** | **Linkedlist is not store elements in consecutive memory location retrieval operation become difficult** |
| **ArrayList underline data structure is follow Array concept** | **LinkedList underline data structure is follow double-link-list concept** |

* How to get synchronized object of ArrayList.
* By default is non synchronized but we can get synchronized version of ArrayList object by using syncronizedList() of collections class

List list = new ArrayList();

List synList = Collections.syncronizedList()

Similar we can get synchronized version of set and map object by using these method

* Collections.syncronizedSet()
* Collections.syncronizedMap()

**LinkedList**:

* The underline data structure is doublelink list
* Insertion order is preserved
* Duplicate objects are allowed
* Hitrogionius object allow
* Null insertion is possible
* Linked list impl serielizable and clonable interface but not randow access interface
* Linked is the best choice if our frequent operation is insertion an deletion in the middile

LinkedList Constructor

* LinkedList l = new LinkedList() ……Empty LinkedList create
* LimkedList l = new LinkedList(Collection)…given collection convert to LinkedList

LinkedList class specific methods

Usually we can link list to develop stack and queues to provide support for this requirement linklist defines the following specific methods

* Void addFirst(Object o)
* Void addLast(Object o)
* Object getFirst()
* Object getLast()
* Object removeFirst()
* ObjectremoveLast()

Vector class:

* Underline data structure is resizable array and growable array
* Insertion order is preserved
* Duplicates are allowed
* Hystroginus object are allowed
* Null insertion is allowed
* Serielizable and clonable and random-access interface
* Every method is present in vector is synchronized and hence victor object is thread safe

**Constructor**:

1. Vector v = new Vector()

create empty object with initials capacity 10 once vector reaches max capacity then a new vector object will be created with new capacity = current capacity\*2

1. Vector v = new Vector(int initial-capacity)

Creates an empty vector object with specified initials capacity

1. Vector v = new Vector(int initials-capacity, int incremental-capacity)
2. Vector v = new Vector(Collection)

Vector Method is big

* addelement()
* removeelement()

**Stack**:

It is the child class of vector

It is the specially design the class for last in first-out(LIFO)

How many Method are available:

Push() add object

Pop() return top of the object last inserted

Peek() return top of the stack not rewmove

Empty() to check epty stack

Search(Object v) it will return (offset) if found else -1

Offset – index of element from the top of the stack index and offset are difference

Offset index

[1] C [ 2]

[2] B [1]

[3] A [ 0]

**Set**: child interface of collection set does not have any new method only available collection method set is use

Implements class

* Hashset(1.2)
  + LinkedHashSet(1.4)
* SortedSet( i v1.2)
  + NavigableSet(i v1.6)
  + TreeSet(1.2)
* **HashSet**
* Underline data structure hash table
* Duplicate objects are not allowed
* Insertion order is not preserved
* It is based on hash code of object
* Null insertion allowed(only once)
* Hystrogionious object allowed
* Impments serielizable and clonable but not random access
* Hashset is the best choice if our frequent opretion is search opreatio

**Note**: in HashSet duplicate are not allowed if we are trying to insert duplicate the we won’t get and compile time or runtime any error add simply returns false

**Constructor**

* HashSet l = new HashSet()

Creates an emty hashset object with default initials capacity 16

Default fill ratio .75

* HashSet h = new HashSet(int initials capacity)
* HashSet h = new HashSet(int initials capacity,double fillRatio)
* HashSet h = new HashSet(Collection c)

Fill Ratio – after filling .75 ratio a new hashset object will be created

Load-factor – after filling how much a new hashset object will be created

LinkedHashSet:

* It is the class of hashset
* It is exactly same as hashset including constructor and method

Difference

|  |  |
| --- | --- |
| HashSet(v1.2) | LinkedHashSet(v1.4) |
| Underline DataStructure is hashTable | Underline data structure is combination of Linkedlist and HashTable |
| Insertion order is not preserved | Insertion order is preserved |
| Duplicate not allowed | Duplicate not allowed also |
|  | It is use to develop cache based application where duplicate are not allowed and insertion order should be preserved |

**SortedSet(i):**

* Sorted is the child interface of set
* If we want represent a group of individual objects according to some sorting order without duplicate then we should go for SortedSet.

Methods

* First()
* Last()
* headset(Object o) : less then object
* tailSet(Object o) : >= object
* subSet(Object obj1,Object obj2)>=obj1 and <obj2
* Comparator();

**TreeSet(c):**

* Underline data structure is balance tree
* Duplicate is not allow
* Insertion order not preserved
* Hydrogenous objects are not allowed otherwise runtime exception classcastexception
* Null insertion is allowed only once
* All objects will be inserted based on some sorting order it may default natural sorting order or customized sorting order
* Null pointer check if there is only one null object it will allow else not working till 1.6 after 1.6 it will no allowing

**Constructor**:

* TreeSet t = new TreeSet(); - insertion data in default natural sorting orde
* TreeSet t = new TreeSet(Comparator c) creates empty comparator object where will be inserted in customize sorting specified comparator object
* TreeSet t = new TreeSet(Collection c)
* TreeSet t = new TreeSet(SortedSet s)

**Important Note :**

* if we are depending on default natural order compulsory object should be homogeneous and comparable otherwise throw CCE(Class Cass Exception)
* and object is set to be comparable if only if corresponding class implement comparable
* String and all wrapper classes are implements comparable
* Stringbuffer class does not impl comparable
* If you compare with null value nullpointer exception will be throw

**Comparable(i)**

* It is available in java.lang package and it contains only one method compareTo()
* When we default nature sorting order we go for comparable and if want
* Customize sorting order we will go for comarator
* Return –value if obj1 has to come before obj2
* Return +veobj1 has to come after obj2
* Return 0 if obj1 and obj2 are equal
* It contain only one method compareTo()
* **Comparator** :
* It is available in jata.util package and it defines two methods
* compare()
* equels();
* Return –value if obj1 has to come before obj2
* Return +veobj1 has to come after obj2
* Return 0 if obj1 and obj2 are equal
* Whenever we are implementing comparator compulsory we should provide only for compare method
* And we are not required implementation for equals method because it is already available to our class from inheritance ob object class

**Map**:

* Map is not a child interface of collection
* If we want to represent a group of object as key value pairs we should go for map
* Both keys and values are objects only
* Duplicate keys are not allowed but values can be duplicated
* Each key value pair is called Entry hence
* map is considered as Entry objects

Map(v1.2 i)

* + HashedMap(1.2)
    - LinkedHashMap(1.4)
* IdentityHashMap(1.4)
* WeakHashMap(1.2)
* SortedMap(1.2)
  + NavigableMap(1.6 i)
    - TreeMap(1.2)
* HashTable(1.0)
  + Properties(1.0)
* Map interface methods
  + If the is already present then old value will be replaced with new value and returns old value
  + Object put(Object key ,Object value)
  + Void putAll(Map m)
  + Object get(object key)
  + Object remove(Object key)
  + Boolean containsKey(Object key)
  + Boolean containsValue(Object key)
  + Boolean isEmpty()
  + Int size
  + Void clear()

Map is a group of key value pair each key value pair is call an entry

Hence map is considered as a collection of entry objects without adjusting map object there is no chance of existing entry object hence entry interface is define insight map interface.

Interface Map

{

Interface Entry

{

Object getKey()

Object getValue()

Object setValue(Object name)

}

}

* **HashMap:**
* Underline data structure is hashtable
* Hashcode of key
* Insertion order is not preserved its based on hashcode of key’s
* Duplicate key are not allowed
* Null key is allow for one only
* Initials capacity 16
* Fil ratio 0.75

Difference

|  |  |
| --- | --- |
| HashMap | HashTable |
| Methods not synchronized | Methods are synchronized |
| Not thread safe | Thread safe |
| Performance fast | Performance low |
| Null key or value are allowed | Null key or value not allowed(nullpointerException) |

**LinkedHashMap:**

* It is the child class of hash-map
* It is exactly as hash-map(including methods and constructor) except the following defferences

|  |  |
| --- | --- |
| **HashMap(1.2)** | **LinkedHashMap(1.4)** |
| Underline data structure is hash-Table | Underline data structure combination of (LinkedList and HashTable(hybrid data structure) |
| Insertion order is preserved and it’s based on hash-code of keys | Insertion order is preserved |
|  |  |
|  |  |

Note : LinkedHashSet and LinkedHashMap are commonly use to develop cache based application’s

**SortedMap**:

* It’s the child interface of map
* If we want to represent a group of key value pairs some sorting order of keys then we should go for sorted map
* Sorting is based on the key but not based on value

**Methods** :

* Object Firstkey();
* Object lastkey()
* SortepMap headMap(Object Key) <
* SortepMap tailMap(Object Key) >=
* SortepMap subMap(Object Key1,Object key2)>= to <
* Comparator comparator()

TreeMap:

* It is the implemented class of sortedmap
* Underline data structure is red black tree
* Insertion order is not preserved it’s based on some sorting order of keys
* Duplicate keys are not allowed but value can be duplicated
* If we are depanding default natueal sorting order then key’s should be homogyneous and comparable otherwise we’ll get Runtime Exception classcastexception
* If we are defining our sorting by comparator then keys need not be homogeneous and comparable we can take hytrogenous non comparable objects also.
* Null is not allowed onwards 1.7

Constructor:

* TreeMap t = new TreeMap(Natural sorting order)
* TreeMap t = new TreeMap(Comparator)
* TreeMap t = new TreeMap(Map)
* TreeMap t = new TreeMap(SortedMap)

**HashTable**:

* Underline data structure is HashTable
* Insertion order is not preserved and it is based on hash-code of keys
* Duplicate keys are not allowed and values can be duplicated
* Hystrogeneous objects are allowed for both keys and values
* Null is not allowed both key and value otherwise we’ll get runtime exception(null pointer)
* It implements sereilizable and clonable interface but not random-access
* Every method is synchronized
* HashTable is the best choice for search operation

**Constructor**:

* HashTable = new HashTable()
* Hashtable h=new hashtable(int initialcapacity)
* HashTable h = new hashtable(int initialcapacity , float fillratio)
* HashTable h = new hashtable(Map m)
* Hashtable h = new HashTable();
* h.put(new Temp(5),”a”);
* h.put(new Temp(2),”b”);
* h.put(new Temp(6),”c”);
* h.put(new Temp(15),”d”);
* h.put(new Temp(23),”e”);
* h.put(new Temp(16),”f”);

if we change hashCode method of tempclass as

public int hashCode()

{

Return i%9;

}

**Queue (1.5):**

* PriorityQueue
* BlockingQueue
* PriorityBlockingQueue
* LinkedBlokingQueue
* If we want to represent individual object prior to processing
* Ex: before sending sms message all mobile no’s we have to store all mobile no in some data structure in which order we added mobile no in the same order only message should be delivered for this FIFO requirement queue is the best choice
* Usually queue follows FIFO but based on our requirement we can implement ouor own priority order also(Priority queue)
* from 1.5 version onwards linked also implements queue interface
* LinkedList based implementation of queue always follow FIFO

Queue Methods:

* Offer(Object o) - add object
* Poll()
  + remove and return if the queue is empty return null
* Remove()
  + remove and return – if queue is empty return exception NoSuchElementFound
* Peek()
  + get head element if queue is empty return null
* Element()
  + get head element if queue is empty return NoSuchElementFound

PriorityQueue:

* if we want to represent a group of individual object prior to processing according to some priority then we should go for priority que
* priority can be either default natural sorting order or customized sorting order defined by comparator
* insertion order is not preserved it’sbased on some priority
* duplicate objects are not allowed
* if we are depending on default natural sorting order compulsory object should be homogeneous and comparable otherwise we will get runtime exception saying ClassCastException
* if we are defining our sorting by comparator then objects need not be homogeneous and comparable
* Null is not allowed even as the first element also.
* Constructor
  + PriorityQueue q= new PriorityQueue() – initialcapacity 11 and all object will be inserted in DNSO
  + PriorityQueue q= new PriorityQueue(int initialcapacity)
  + PriorityQueue q= new PriorityQueue(int initialcapacity,comparator)
  + PriorityQueue q= new PriorityQueue(SortedSet s)
  + PriorityQueue q= new PriorityQueue(Collection c)
* **Arrays Utility class**
  + Methods
    - Public static void sort(primitive[] p) for natural sorting order
    - Public static void sort(object o) : for natural sorting order
    - Public static void sort(object o, comarator c) for customized sorting
* We can sort primitive array only based on default natural sorting order whereas we can sort object array either based on default natural sorting or based on customized sorting order
* Array class defined binary search methods
  + Public static int binarySearch(primitive[] p, primitive target)
  + Public static int binarySearch(object[] o, object target)
  + Public static int binarySearch(object[] p, object target, comparator c )
  + asList() method won’t create any object it will use to view array as listonly