**Data Structures and Algorithms Using Java**
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**Lecture 10**
**Topic: Java Legacy Classes**

In the discussion of collection framework, the discussion will not be complete if we do not include Java Legacy Classes. Actually Java Legacy Classes, I understand that it is not so much useful at the moment because the more better facilities is basically provided by the Java collection framework there, but Java Legacy Classes still many programmers like it.

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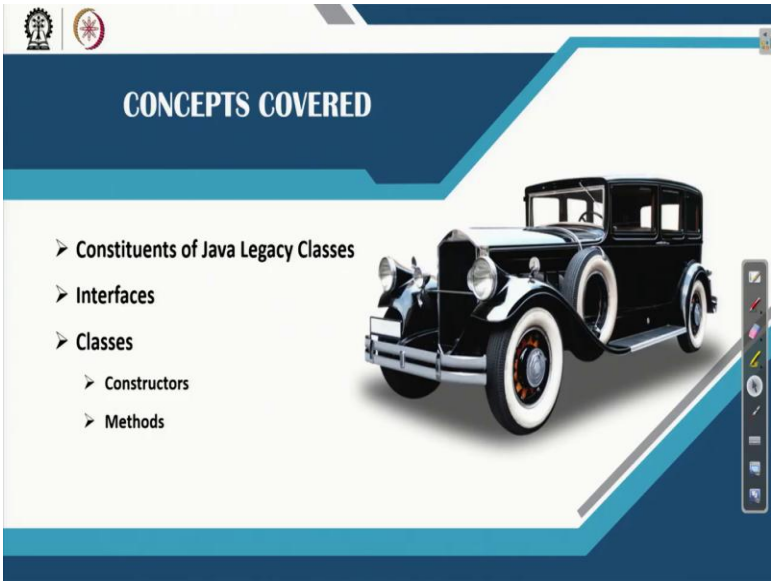


There are two reasons for this, first of all it is fast, this means that it is very useful but second thing is that it has a more, what is called the sophistication in the context of the synchronized versus non-synchronized manner. What exactly we want to point out is that all the collection frame, collections that we have discussed under the categories of Java collection framework and Java map framework, they are basically not synchronized whereas all the collections if you maintain using Java Legacy Classes then they are synchronized.

Now, what is the difference between synchronized collection and non-synchronized collection? The synchronized collection means as you know the parallel execution so that means if two or more programs access the same collection, which is very much common in distributed

programming because if you store your collection in a server and then there are request from the different client that collection needs to be access, either modify or whatever it is there, then parallelism or concurrent execution is an important issue.

So, if you want to have your concurrent execution for your collection then definitely the collection framework, the latest collection framework is not suitable because they are non-synchronized, whereas the Java Legacy Classes, the collection to according to this Java Legacy Classes are synchronized that means the parallel program execution is possible. Now, let us, we have a brief idea about the different constituents in Java Legacy Classes.

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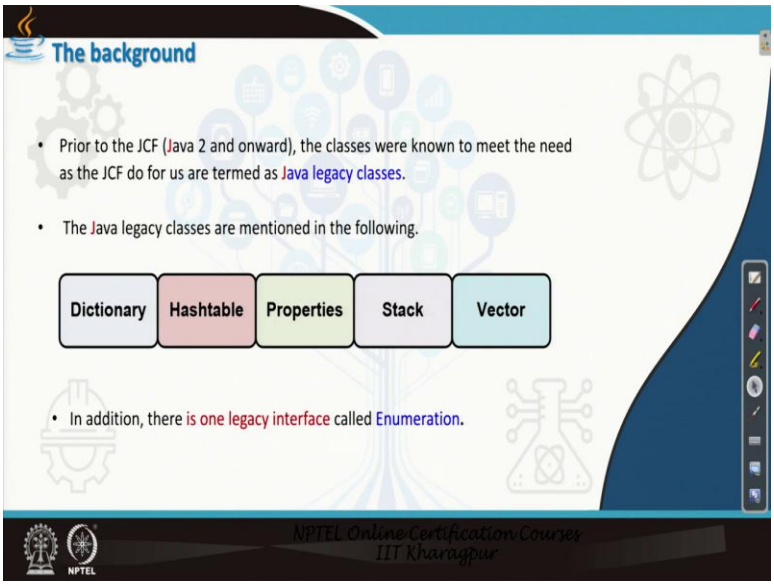


So, here in this lecture we will little bit elaborate the different compositions. Now, before going to know about the different elements in it, I just want to say that what exactly the history of creating Java Legacy Classes is there. Now, prior to Java 2, actually Java Legacy Classes is the only ways handle a large collection and to facilitate the older collection sets. They proposed many classes, the Dictionary, Dictionary is very similar to the map that we have discussed.

Then Hashtable, it is basically is an another, what is call the way of viewing, it is just like a hash concept, that means if you want to access a particular object, then you have to have the key value for that object and then hash. It is just like map only. Properties is also similar map, so Dictionary, Hashtable, Properties, basically same as map only. And then Stack and Vector, Stack is basically the concept of just Queue and then Stack concept those are there, and Vector is basically a simple the index collection.

And here you can note that there is no more collection view using linkeds, index or sequential or tree form or whatever it is there. So, in that sense Java Legacy Class was not so exhaustive or elaborative or we can say it is not so much efficient compared to this a current the collection framework facilities is there. And now interface, again it is very simple most, it does not have many interfaces, only all classes are there, only one interface is there, this interface is called enumeration.

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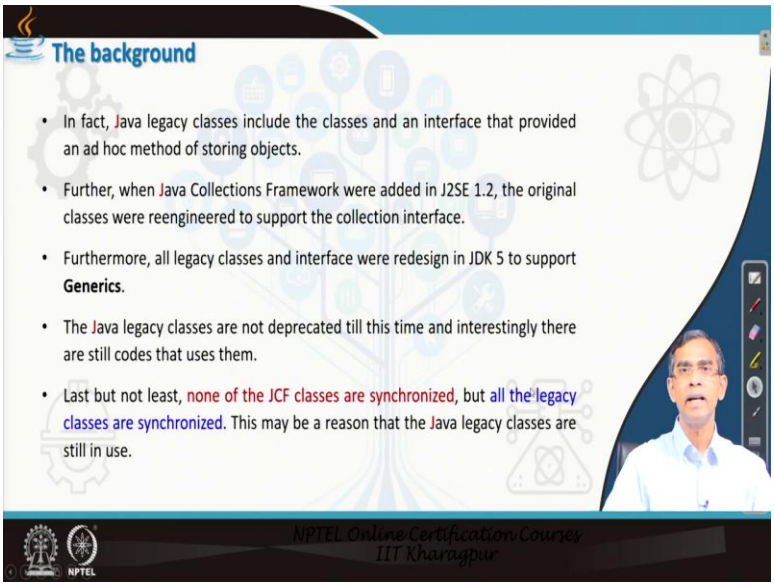



So, this is basically the idea about this one and this is basically main important that user still likes not only because of its simplicity, but because of that it allows you to access the collection in a synchronized manner. And as it is synchronized manner, so complexities those are there, in case of collection framework is not here, or in other word, collection framework is so complex, so different mechanism, or so different structures or views are there, so the synchronization implementation a bit difficult that is why Java developer carefully ignore it but it retains in its Java Legacy Classes.

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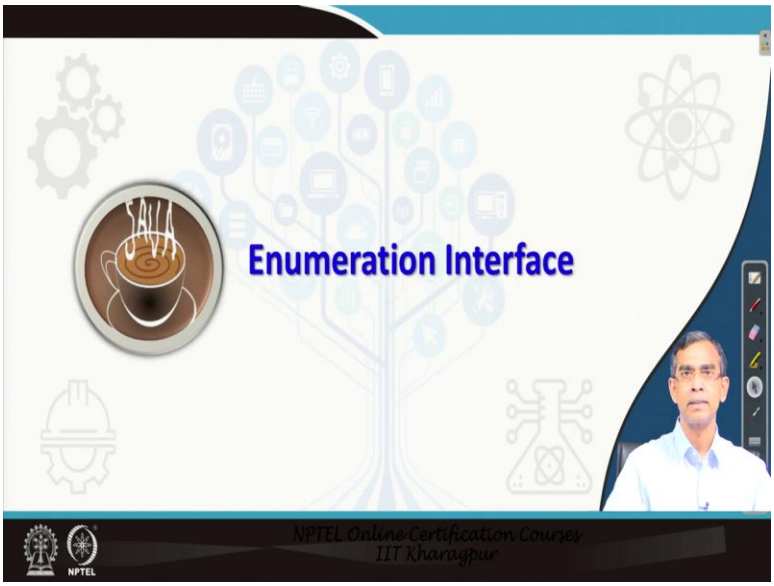


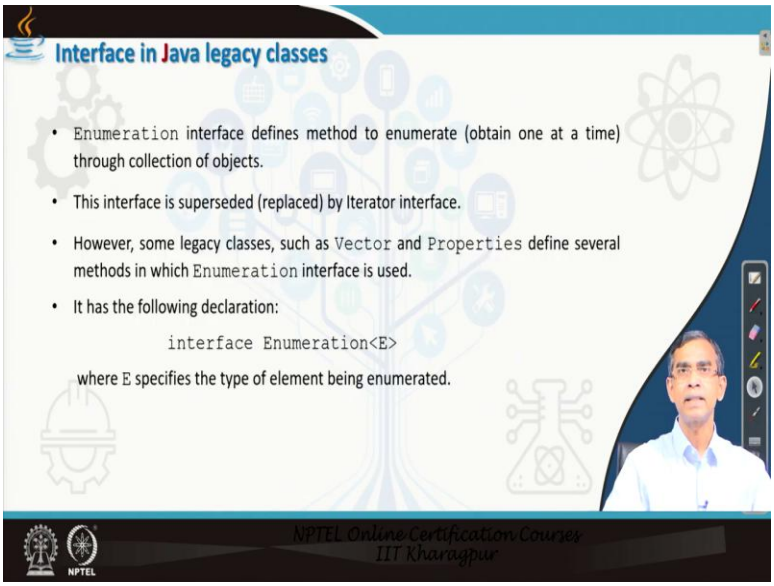

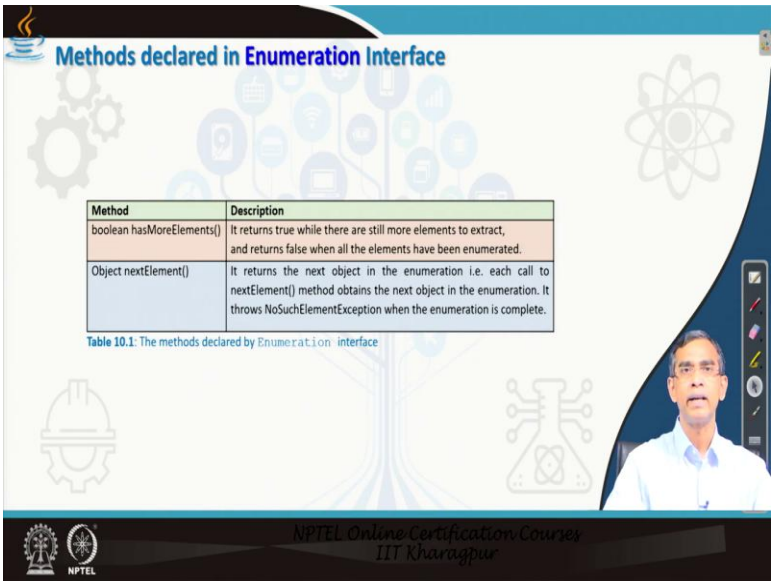


Now, let us first discuss about the enumeration interface. It basically create an enumerated collection, enumerated collection means we have that user define datatype that enumerated type, and it basically useful for creating a new enumerate, it is an interface so no object of this type can be created but if you can create any collection that can be stored in a enumeration list actually, that is the way that you can do it.

And it has basically main purpose about traversing a particular collection. So, for this traversing there is a methods, those are there, is an interface method, all these interface methods are basically available to other methods, so it has more elements and next element are the two methods are there.

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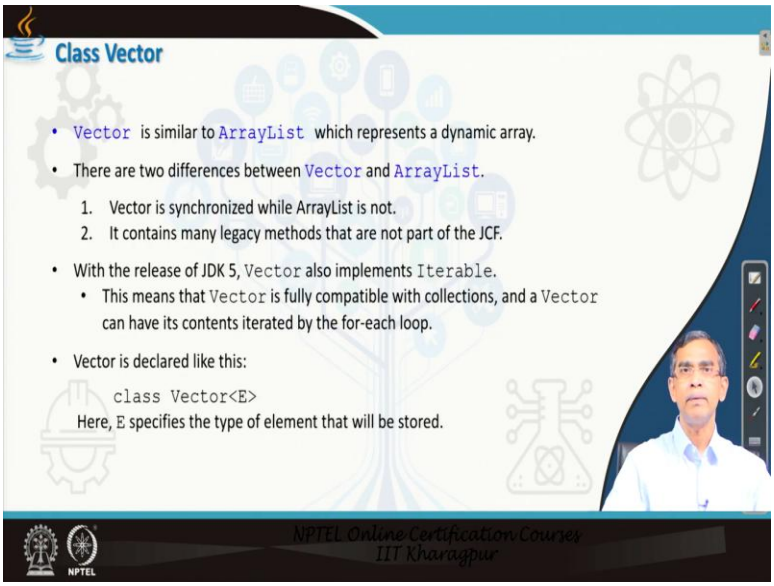


Now, let us see the class vector. It is a very important one on concept, this concept later on has been incorporated in Java collection framework as the name there is called the ArrayList. So, which is ArrayList in Java collection framework is basically the vector in Java Legacy Class. Now, vector has very simplicity, vector is basically an array, that means a indexed mechanism to store the data.

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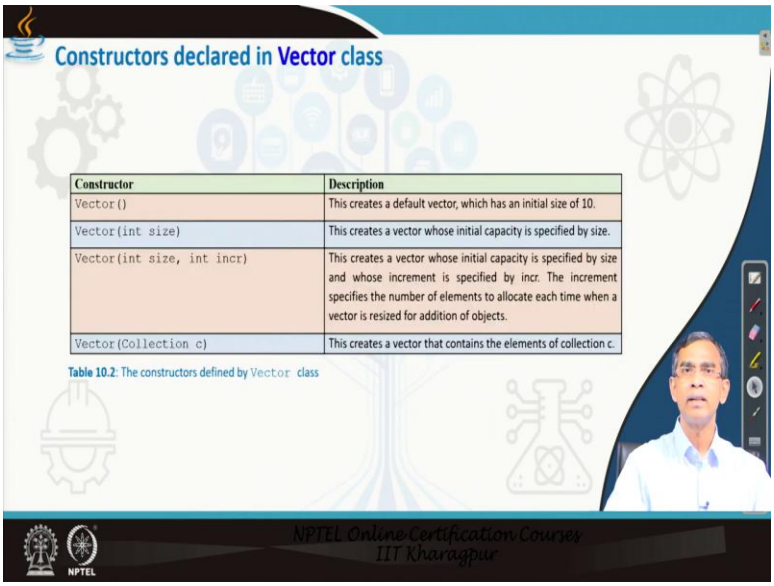


You can store any store any type of objects into this vector and it has only few simple what is called the constructors, the default constructor you do not have to mention anything, it will create a collection of type vector and then if you can mention the size of the vector, initial size. You can also mention initial size and by which the increment, that automatically the vector will grow. Also a vector can be created, a collection of type vector can be created having an existing collection say C. So, if you can give an input of the existing collection then a vector can be created then. So, these are the different constructors under this vector class.

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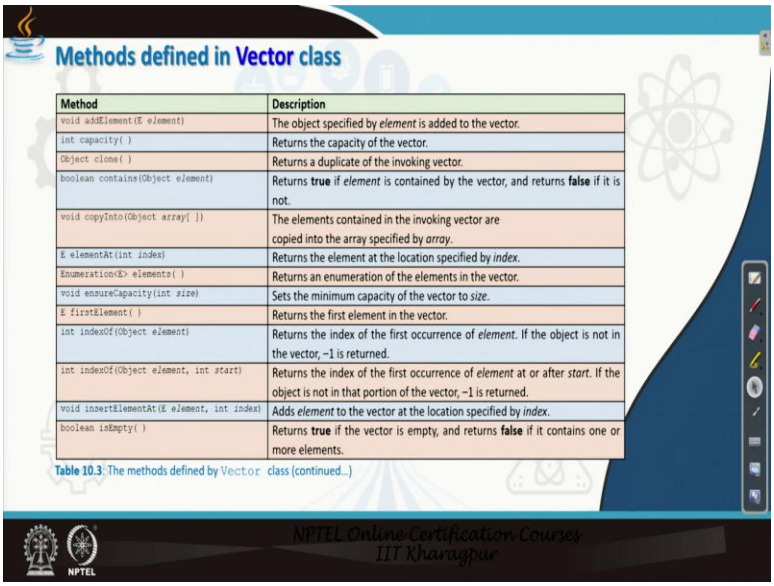
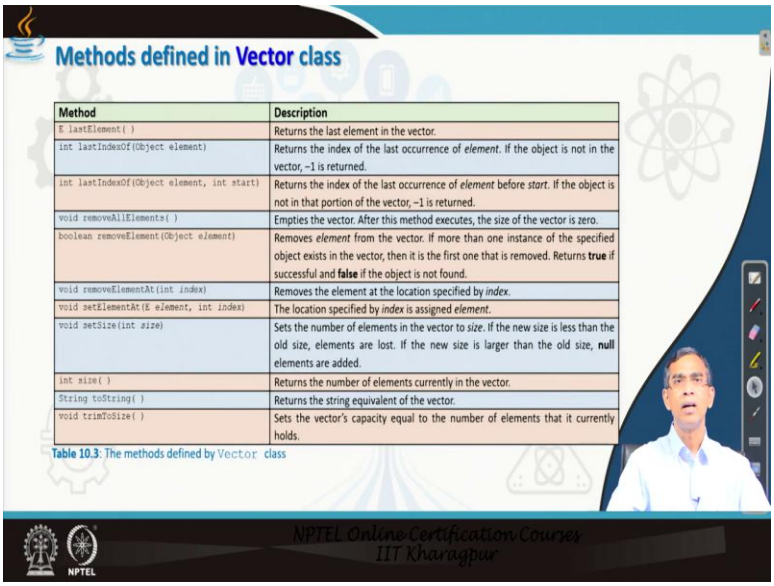



| Method | Description |
|---|---|
| void addElement(E element) | The object specified by *element* is added to the vector. |
| int capacity( ) | Returns the capacity of the vector. |
| Object clone( ) | Returns a duplicate of the invoking vector. |
| boolean contains(Object element) | Returns **true** if *element* is contained by the vector, and returns **false** if it is not. |
| void copyInto(Object array[ ]) | The elements contained in the invoking vector are copied into the array specified by *array*. |
| E elementAt(int index) | Returns the element at the location specified by *index*. |
| Enumeration<E> elements( ) | Returns an enumeration of the elements in the vector. |
| void ensureCapacity(int size) | Sets the minimum capacity of the vector to *size*. |
| E firstElement( ) | Returns the first element in the vector. |
| int indexOf(Object element) | Returns the index of the first occurrence of *element*. If the object is not in the vector, −1 is returned. |
| int indexOf(Object element, int start) | Returns the index of the first occurrence of *element* at or after *start*. If the object is not in that portion of the vector, −1 is returned. |
| void insertElementAt(E element, int index) | Adds *element* to the vector at the location specified by *index*. |
| boolean isEmpty( ) | Returns **true** if the vector is empty, and returns **false** if it contains one or more elements. |

Table 10.3: The methods defined by Vector class (continued...)




| Method | Description |
|---|---|
| E lastElement( ) | Returns the last element in the vector. |
| int lastIndexOf(Object element) | Returns the index of the last occurrence of *element*. If the object is not in the vector, −1 is returned. |
| int lastIndexOf(Object element, int start) | Returns the index of the last occurrence of *element* before *start*. If the object is not in that portion of the vector, −1 is returned. |
| void removeAllElements( ) | Empties the vector. After this method executes, the size of the vector is zero. |
| boolean removeElement(Object element) | Removes *element* from the vector. If more than one instance of the specified object exists in the vector, then it is the first one that is removed. Returns **true** if successful and **false** if the object is not found. |
| void removeElementAt(int index) | Removes the element at the location specified by *index*. |
| void setElementAt(E element, int index) | The location specified by *index* is assigned *element*. |
| void setSize(int size) | Sets the number of elements in the vector to *size*. If the new size is less than the old size, elements are lost. If the new size is larger than the old size, **null** elements are added. |
| int size( ) | Returns the number of elements currently in the vector. |
| String toString( ) | Returns the string equivalent of the vector. |
| void trimToSize( ) | Sets the vector's capacity equal to the number of elements that it currently holds. |

Table 10.3: The methods defined by Vector class

Now, so far method is concerned I again reiterate that all the methods are very similar to the method that we have discussed in the context of Java collection framework that is there in collection interface, like here add element, capacity, then cloning. Cloning means if you want to create from the vector to new array. If you given an array as an object, you can copy all these object into a vector collection that methods is there.

And then like insert, indexOf, knowing the status, whether a particular vector collection is empty or if you want to remove an element, if you want to see what is a current size, all these things are

basically are there. So, all these operations related to the insertion, deletion, traversal, and modification and knowing the status, so these methods are defined there in vector class.

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Now, you can note one thing the stack. Stack is very important data structure but if you recall the Java collection framework, there is no explicitly define any collection type stack, only queue is there, there is no stack like there in there. This is because queue is basically planned in such a way that using this queue as a collection you can use the queue as a stack, you can queue as a queue, you can queue as a priority queue, you can queue, use queue as a double ended queue or deck, so that is one form, but it can be used to facilitate many other what is called the requirements.

But here the same thing it is stack, here stack is the only one representation, is a collection, but it can be used to use it as a stack as well as queue, and then priority queue. So, that is why here queue is not mentioned explicitly, whereas in Java collection framework stack was not mentioned explicitly.

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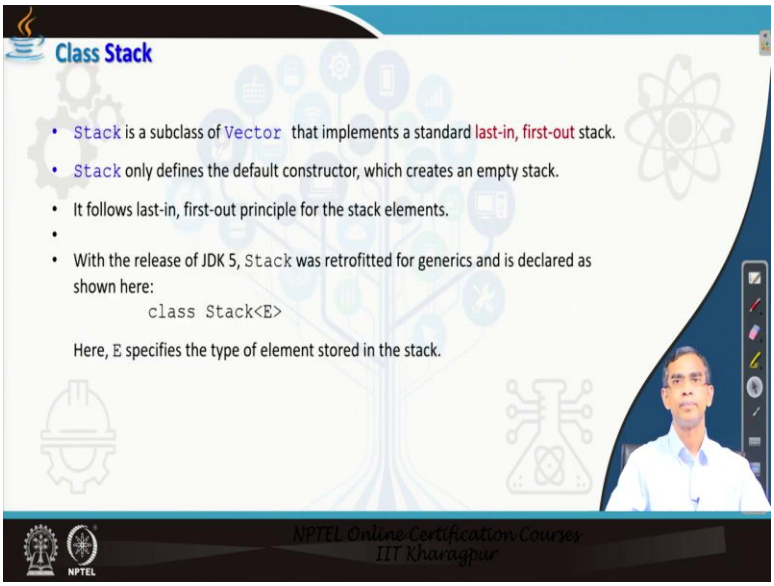


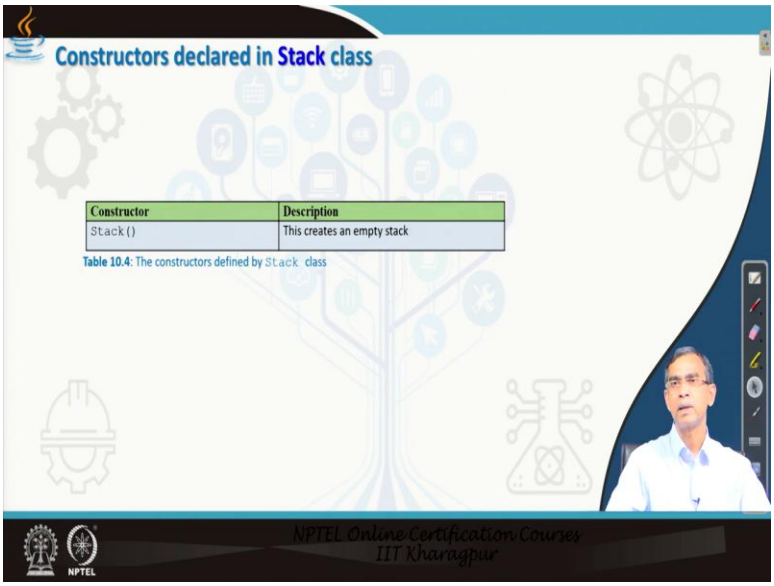


Now, stack is basically to, I mean, enforce one policy, it is called ‘last-in, first-out’ policy, that mean the element which will be insert last will be deleted first, you cannot do the deletion in any order, it is thus, order is the order of insertion deletion like and then it can also includes any type of objects in it irrespective of whatever it is there. And it has only one constructor, the default constructor to create a stack, we do nor have any other constructor there.

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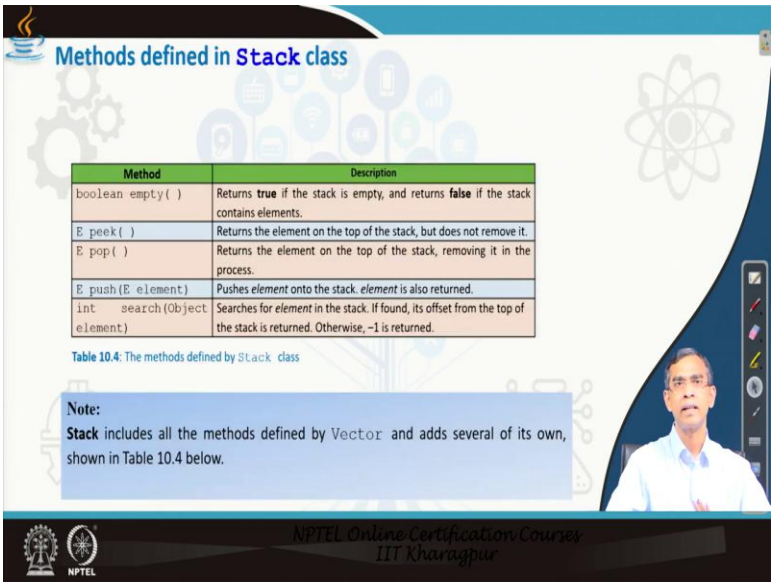


And so fact method is concerned, very simple method, the push method is basically to add an element into the stack and then pop element is basically return the element at the top and it also remove the element once the pop operation is carried out. Now, peek operation just like is pop, it basically you see the value but it will not remove the element from there and it will also check whether stack is currently empty or not by means of empty method it is there. And obviously search method is there by which we can say whether particular element in the stack or not. So, these are the only few simple most methods are there in the stack class.

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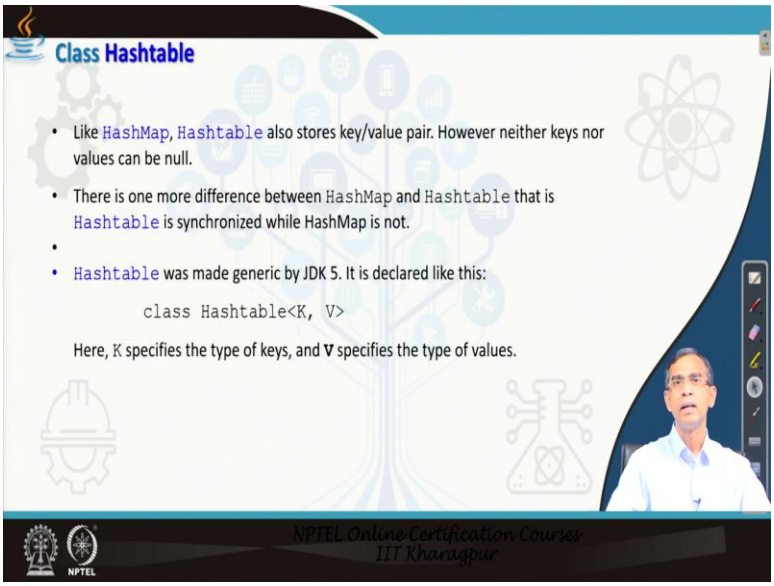


Now, class Hashtable and subsequently Dictionary, Properties, whatever are there in the Java Legacy Classes, they are basically the hash content I means the objects along with the key values are to be mentioned there. So, Hashtable has the two different type K and V, and here K can be of any type and V can be of any, V is of any objects, so basically the concept is the same that is there in map, it is also useful here in Hashtable also.

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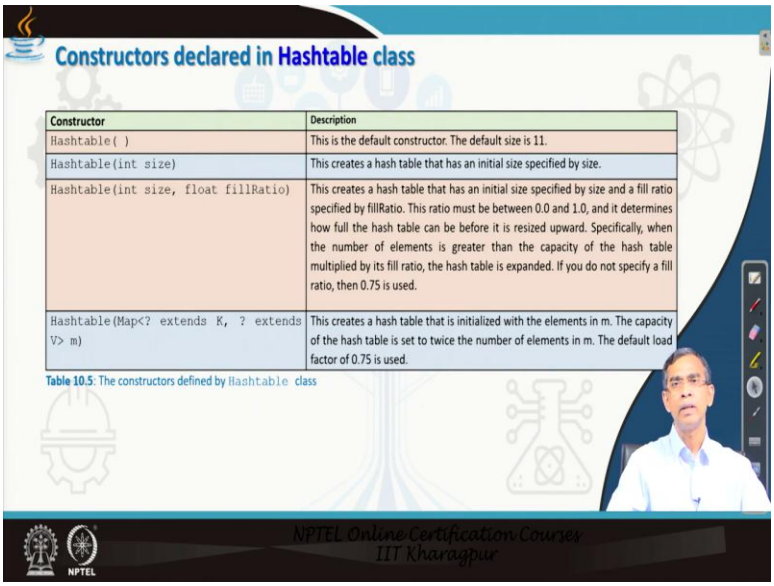


Now, if you want to create a Hashtable according Java Legacy Class, there are few constructors that you can follow, the default constructor without specifying any arguments and it basically create a collection of Java Legacy Class of default size 11. And then size also you can mention, whatever the size for the better memory utilization and also at the same time size and feel ration that mean in which rate the Hashtable collection can grow automatically and also it can be created using upper bound specifying the keys and as well as object. So, upper bounded argument object can be there, so this is the last constructor.

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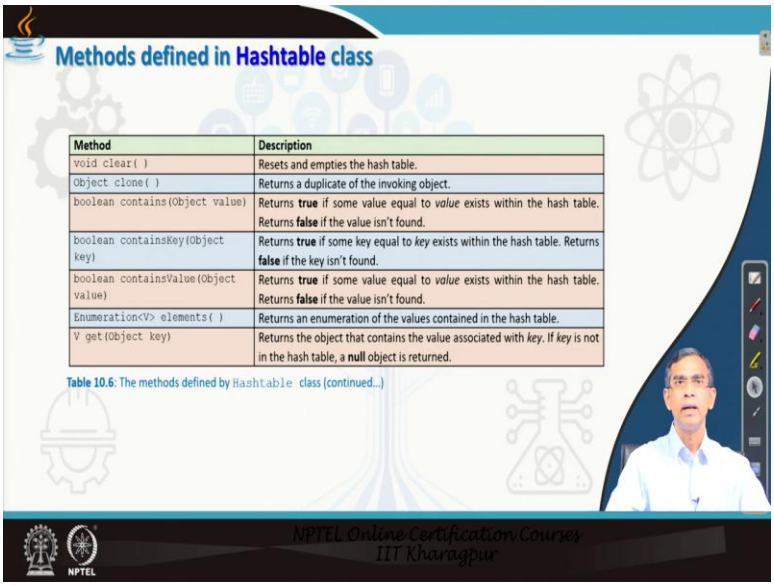


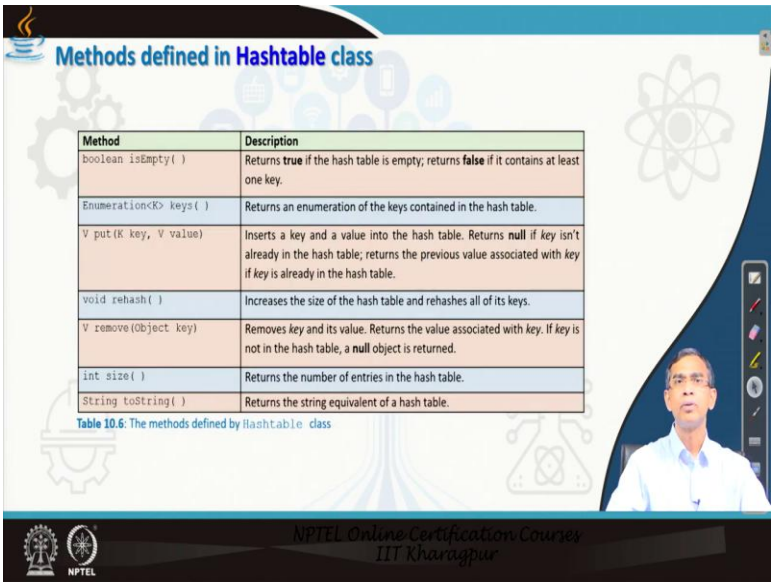


Now, the methods are very similar to the map methods those are there or we have already discussed like clear, clone, contains, containsKey, containsValue, and then get, and then put, then the method is basically called isEmpty of whatever it is there. So, those are the very standard method by which you can access elements, can modify the entries in the collection and then know the different status or traversing the collection.

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Now, Class Properties, Properties very similar to Hashtable, it is very similar in the sense that it basically use the key and value pair but there is only one difference is that for the Properties key values as well as object values are to be string type only. So, that is the only difference otherwise it is there. So, which you can implement using properties can be utilized using Hashtable but opposite is not possible.

This is because the Java initially sees everything as a string, so if you can represent a number as a string and user define object also as a form of a string, a floating point values also as a string

and there is a facilities by which Java can allow a programmer to convert a string to a integer values or a floating point values or a Boolean values or any other type of values.

So, string is basically in the sense transfer, convertible from one from to another. Likewise an integer number also can be converted to string and whatever it is there. So, this mechanism is basically exercised here so the Properties is basically has stable, but with the constant that both key and value are of string type.

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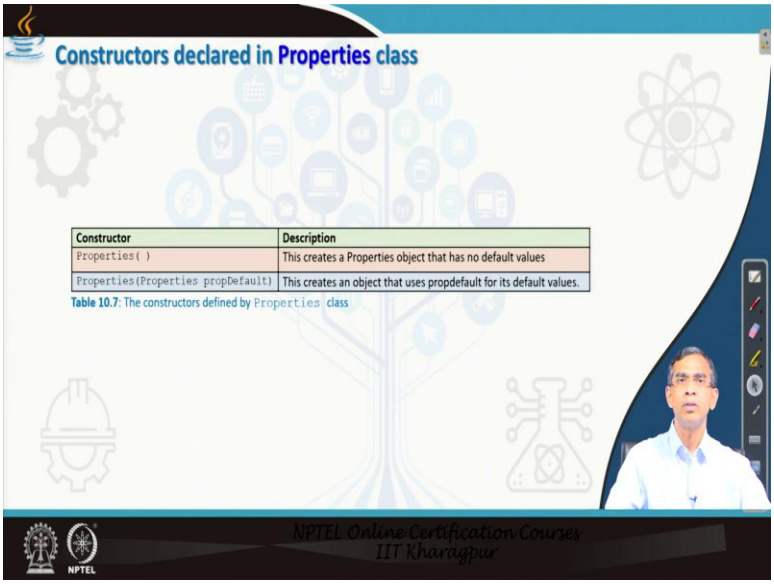


Now, so there are two constructors only, one is the default constructor, so create a collection without any values in it and then there is a another is that given an existing properties if you create a new properties then you can create it, so these are the two ways the constructors are there in for the Properties class.

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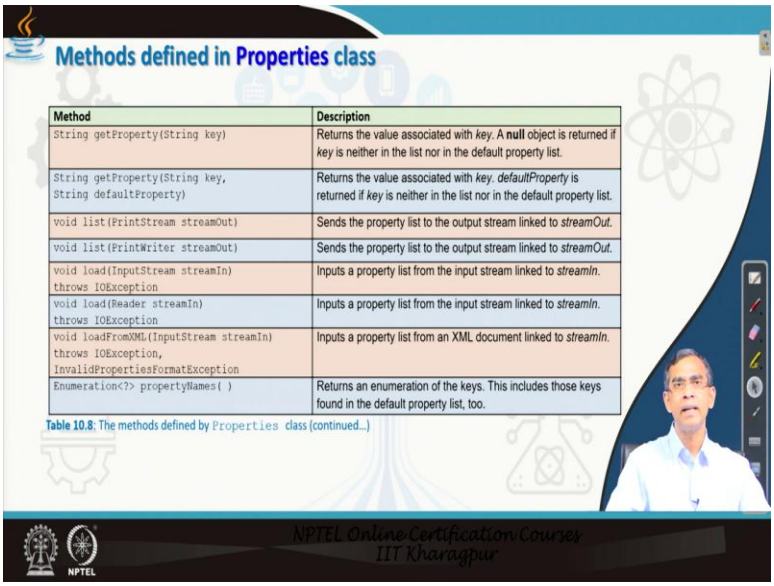


And the methods are basically almost same as the Hashtable methods in addition to its there are few methods, obviously those methods are for internal conversion from string to values and values to string and vice versa, so those methods are mentioned here. So, one is basically get property, it basically return a string, that means what is the property of a key values it is there and then there is a list also, it will list all the key values that is stored in there.

Similarly, load, and there is another is that, so also from the file you can create objects and then store them as a map like means Properties, so there are few methods in which they are using inputStream and outputStream. Those things are basically the advance concept well the file input output or data input output or inputStream outputStream needs to be considered, so it is basically is versatile.

Properties are very huge so far compared to other classes those are there in Java Legacy Classes because initially Java gives enough importance to string only, therefore, storing an efficient manner according the older version of Java is basically using the properties only.

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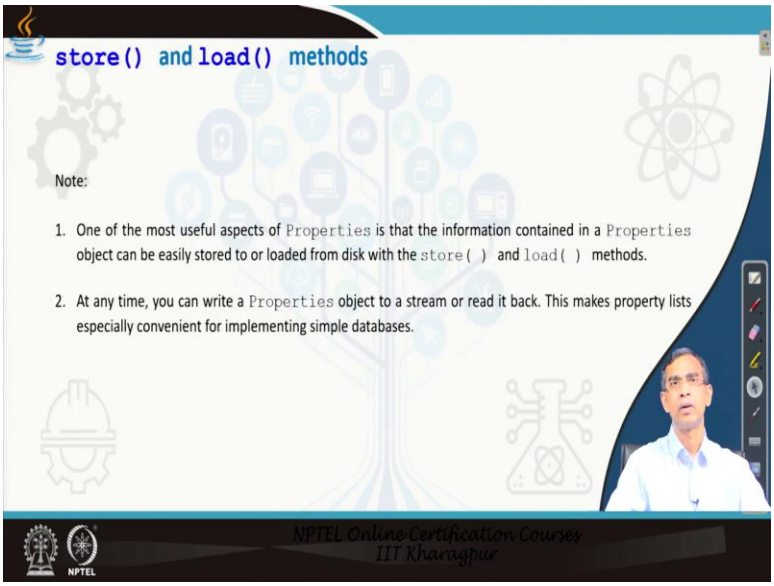


And there is another store and load methods also allows the programmer to store and load data, I mean storing data and loading from data from the external memory also, store and load is very useful method for external, whatever the other methods are basically from the internal memory or primary memory but store and load for the secondary memories.

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Now, there is another class Dictionary. Dictionary class is very similar to the map concept that we have discussed, is a map only unlike the Hashtable and properties that we have discussed, it also like the discuss, it is unlike the properties of Hashtable, it is basically is an abstract class. What is the concept? That means all the methods those are there defined in, defined actually you can create a customize class extending Dictionary class to be in your own.

So, Java gives, it is little bit a blank cheque like, so whatever the things that you want to do, you just simply implement Dictionary, that means the compatibility issue can be restore and it can ensure it. So, there is no much about so far the current programming situation is concerned. The Dictionary is really hardly used by any programmer because the Dictionary which is now, which is earlier and the map is which is now is much more, so map gives more facilities than the Dictionary, so people prefer maps only, the Dictionary is highly overlooked here.

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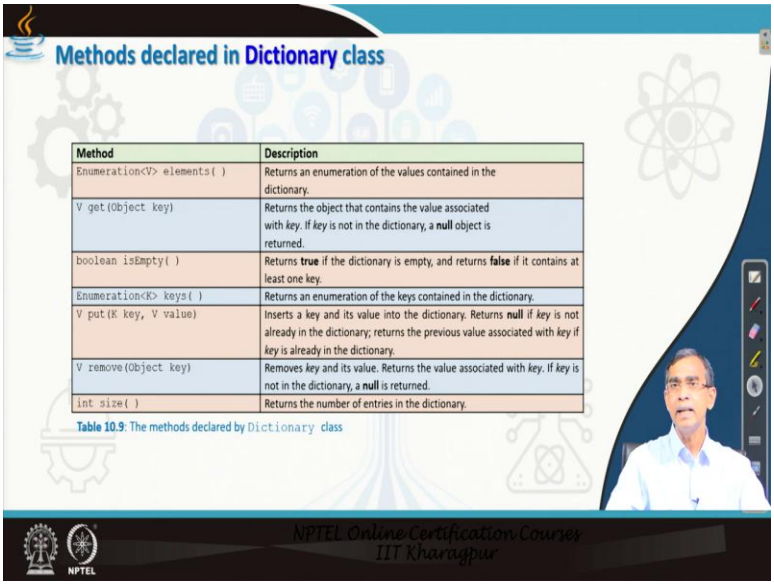


| Method | Description |
|---|---|
| Enumeration<V> elements( ) | Returns an enumeration of the values contained in the dictionary. |
| V get(Object key) | Returns the object that contains the value associated with *key*. If *key* is not in the dictionary, a **null** object is returned. |
| boolean isEmpty( ) | Returns **true** if the dictionary is empty, and returns **false** if it contains at least one key. |
| Enumeration<K> keys( ) | Returns an enumeration of the keys contained in the dictionary. |
| V put(K key, V value) | Inserts a key and its value into the dictionary. Returns **null** if *key* is not already in the dictionary; returns the previous value associated with *key* if *key* is already in the dictionary. |
| V remove(Object key) | Removes *key* and its value. Returns the value associated with *key*. If *key* is not in the dictionary, a **null** is returned. |
| int size( ) | Returns the number of entries in the dictionary. |

**Table 10.9**: The methods declared by Dictionary class

But Dictionary is an interface, it gives design rule that what are the different methods that a programmer, if you want to implement a Dictionary can utilize here. So, there are the few basic methods I have mentioned here, elements is a method, get is a method, isEmpty, and then put method, remove method, know the size of a Dictionary collection, size method, those are the few methods are there in the Dictionary.

Again I want to say is that if you want to implement Dictionary, it is your responsibility to implement all these things. Now, why you can go for implementation? This is because implementation enables you to access all those collection in a synchronized or parallel execution otherwise why you should go for having this one when the map, the better supports is available to you.

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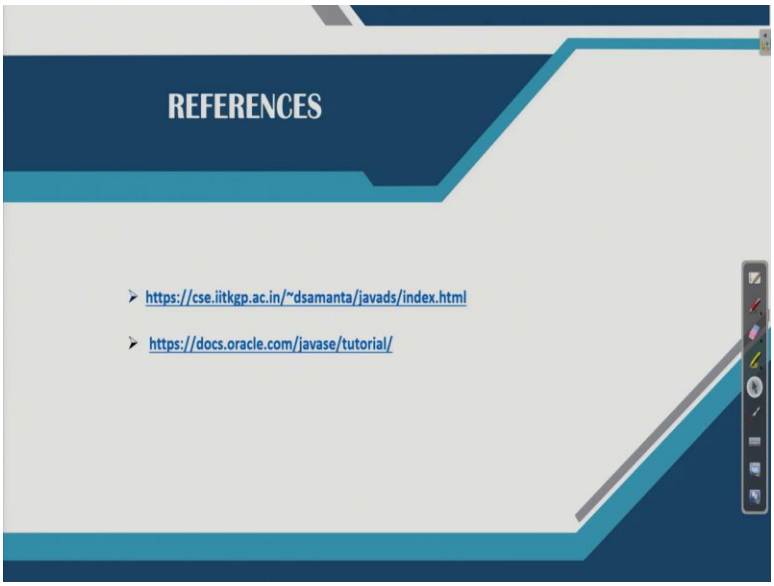


So, with these things I just want to conclude the discussion about Java collection concept and its facilities. Definitely, learning will be complete only when we can utilize all those methods in some program based, so programming issues will be discussed next. Now, our plan of the discussion for the remaining course is basically to cover one by one the different data structure. Different data structure means those are the theoretically data structures are available like array, linked list, tree and graph, many things are there.

Then we will discuss about how all those data structures without using JCF can be implemented. So, realization of this data structure from the core, that mean without taking the help of java dot util. Then we shall discuss about how a particular data structures can be exercised using the Java collection framework facilities or map framework facilities. So, this is basically the plan from the next week onwards, and I hope you are enjoying this course and be involved. What are the link has been given, you should go through the link, study materials and then enjoy it. Thank you.