



C# Collections (Data Structures)

INSTRUCTOR: ADEEN BIN WAHEED

LECTURE 11

Important Notes

- C# doesn't support the concept of Copy Constructor.
- In .NET Framework Class Library System, first most super class is:
System Object Class (System.Object).

Object Type in C#

The Object Type is the ultimate base class for all data types in C# Common Type System (CTS). The object types can be assigned values of any other types, value types, reference types, predefined or user-defined types.

Syntax:

```
Object var1;
```

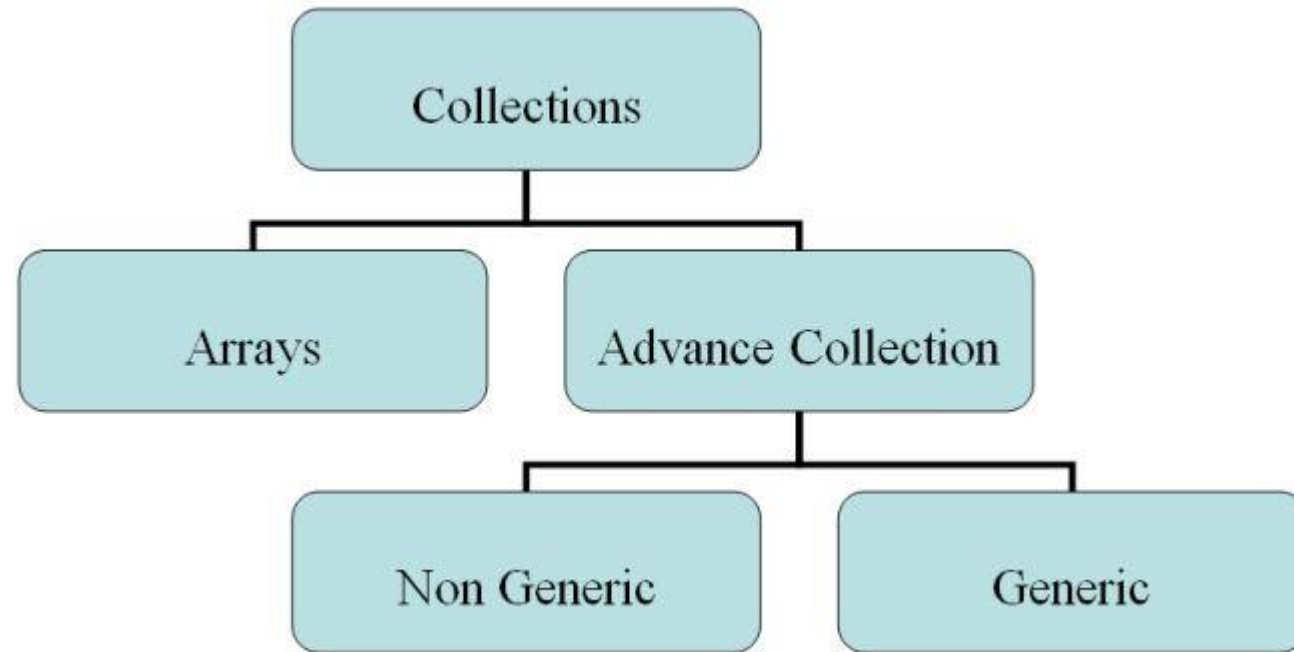
```
var1 = 100;
```

or

```
Object var2;
```

```
var2 = "ABC";
```

Collection Framework in C#



List

A list is a collection that maintains the order of its elements.

Syntax:

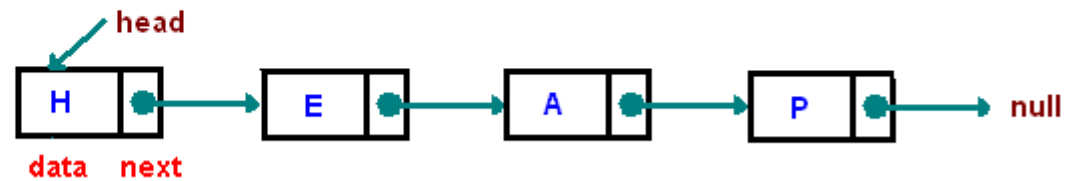
```
List<int> li=new List<int>();
```

Linked List

Linked lists use references to maintain an ordered lists of nodes.

- The head of the list references the first node.
- Each node has a value and a reference to the next node.

A linked list is a linear data structure where each element is a separate object.



Stacks

Stack is a collection that allows data to be inserted and removed only from the Top Position.

So it is a LIFO structure, meaning that the last data to be inserted will be the first data to be removed.

Queues

Queue represents an ordered list of objects just like a List, but its intended use is slightly different. A queue is designed to have elements inserted at the end of the queue, and elements removed from the beginning of the queue.

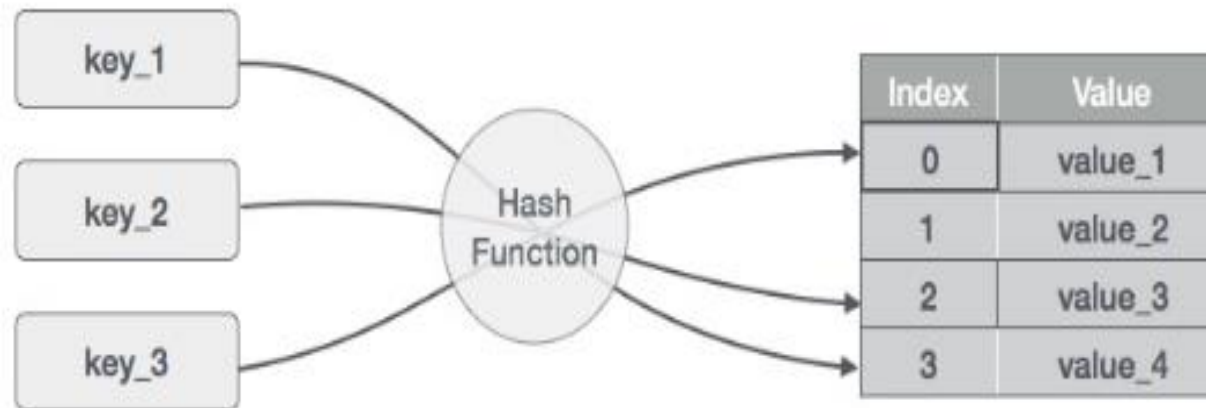
So it is a FIFO structure, meaning that the first data to be inserted will be the first data to be removed.

List, LinkedList, Stack and Queue Demos

Running Demos

Hashing

Hashing is a technique to convert a range of key values into a range of indexes of an array. We're going to use modulo operator to get a range of key values. Consider an example of hashtable of size 20, and following items are to be stored. Item are in (key,value) format.



Hash Method

Before hashing, define a hashing method to compute the hash code of the key of the data item.

For Example:

```
int hashCode(int key){  
    return key % SIZE;  
}
```

Hashing using the Hash Method

Key	Hash	Array Index
1	$1 \% 20 = 1$	1
2	$2 \% 20 = 2$	2
42	$42 \% 20 = 2$	2
4	$4 \% 20 = 4$	4
12	$12 \% 20 = 12$	12
14	$14 \% 20 = 14$	14
17	$17 \% 20 = 17$	17
13	$13 \% 20 = 13$	13
37	$37 \% 20 = 17$	17

Linear Probing

It may happen that the hashing technique used create already used index of the array. In such case, we can search the next empty location in the array by looking into the next cell until we found an empty cell. This technique is called linear probing.

Key	Hash	Array Index	After Linear Probing, Array Index
1	$1 \% 20 = 1$	1	1
2	$2 \% 20 = 2$	2	2
42	$42 \% 20 = 2$	2	3
4	$4 \% 20 = 4$	4	4
12	$12 \% 20 = 12$	12	12
14	$14 \% 20 = 14$	14	14
17	$17 \% 20 = 17$	17	17
13	$13 \% 20 = 13$	13	13
37	$37 \% 20 = 17$	17	18