

A+ Computer Science

Hash tables

What is a hash code?

A hashcode is used to create a key for an item.

The hashcode may be the same as the value of the item or may involve the use of some elaborate formula in hopes of creating a unique key.

What is a hash code?

```
Character c = new Character('a');  
out.println(c.hashCode());
```

```
c = new Character('0');  
out.println(c.hashCode());
```

```
c = new Character('A');  
out.println(c.hashCode());
```

OUTPUT

97

48

65

What is a hash code?

```
Integer num = 45;  
out.println(num.hashCode());
```

```
num = new Integer(101);  
out.println(num.hashCode());
```

```
String s = "a";  
out.println(s.hashCode());
```

OUTPUT

45

101

97

What is a hash code?

```
public int hashCode( )  
{  
    return x % someSize;  
}
```

```
public int hashCode( )  
{  
    return (numVowels(s)+s.length)%aSize;  
}
```

hashCode.java

What is a hash table?

A hash table stores values based on the hash code of each value.

```
Object[] hashTable = new Object[10];
```

```
Character c = new Character('1');  
hashTable[c.hashCode()%10] = c;
```

What is a hash table?

```
Object[] hashTable = new Object[10];

Character c = new Character('1');
hashTable[c.hashCode()%10] = c;

Integer num = new Integer(113);
hashTable[num.hashCode()%10] = num;

String s = "e";
hashTable[s.hashCode()%10] = s;

for( Object thing : hashTable )
{
    System.out.println(thing);
}
```

OUTPUT

null

e

null

113

null

null

null

null

null

1

hashtableone.java

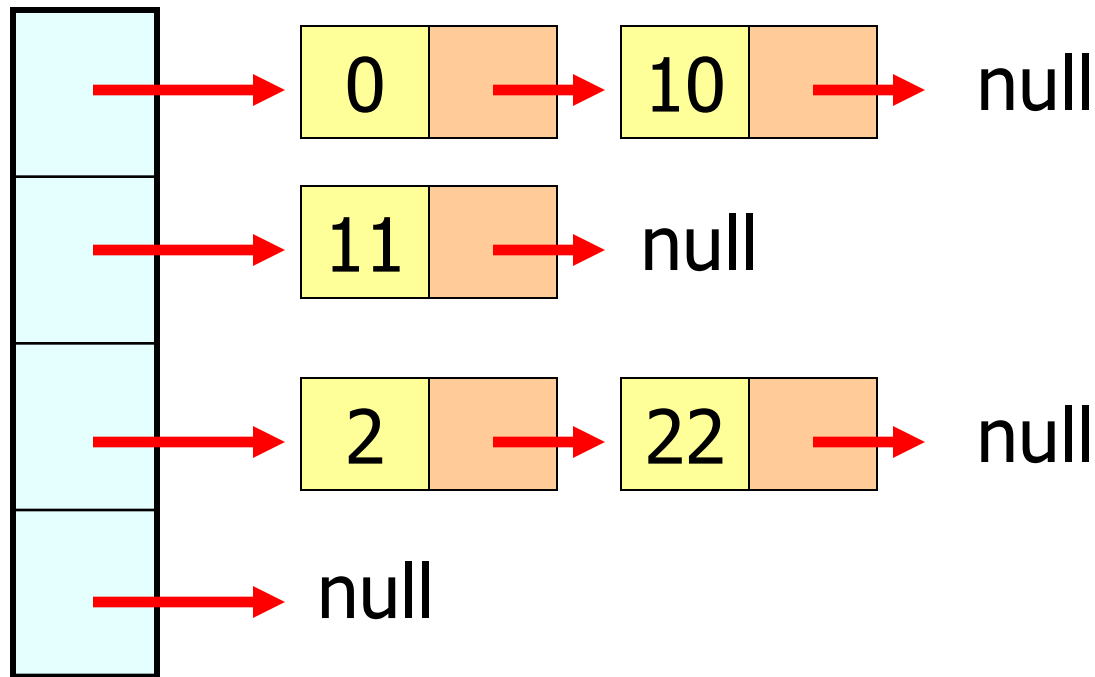
What is a hash table?

Most hash tables are built using an array of linked lists.

```
LinkedList[] table;
```

```
table = new LinkedList[10];
```

What is a hash table?



What is a hash table?

```
LinkedList[] hashTable = new LinkedList[5];
```

```
for( LinkedList list : hashTable )  
{  
    System.out.println(list);  
}
```

```
for(int i = 0; i < hashTable.length; i++)  
{  
    hashTable[i] = new LinkedList();  
}
```

```
for( LinkedList list : hashTable )  
{  
    System.out.println(list);  
}
```

OUTPUT

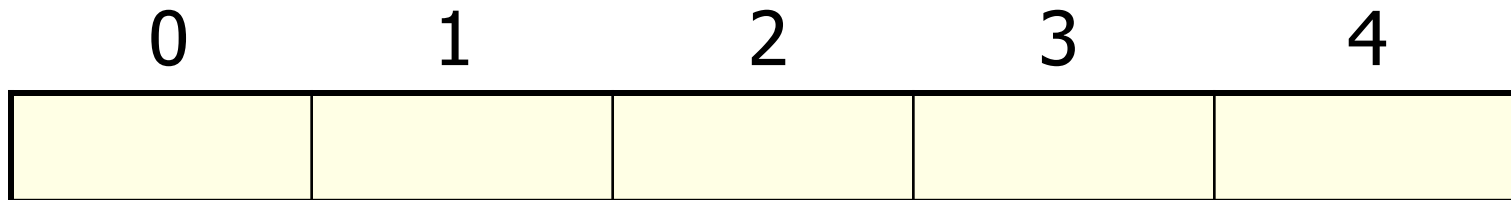
```
null  
null  
null  
null  
null  
[]  
[]  
[]  
[]  
[]
```

hashtabletwo.java
hashtablethree.java
hashtablefour.java

What is a hash table?

HashSet and HashMap were both created around hash tables.

A hash table is a giant array. Each item is inserted into the array according to a hash formula.



What is a hash table?

Key	Value
0	100
1	31
2	22
3	93
4	64
5	5

In most hash tables, the key involves some manipulation of the hash code and the value is just the thing being stored.

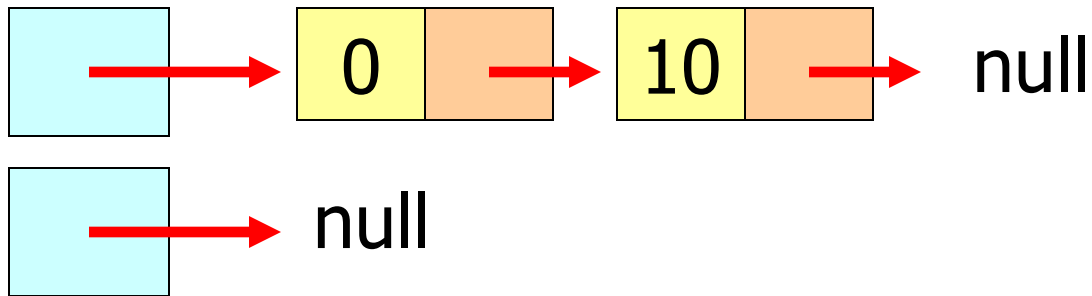
How are collisions handled?

Anytime you use a hash formula to generate index positions, you could end up with the same index position for several values.

Collisions are handled by putting all the values with the same hash code in a list and storing the list at the index position that matches the hash code.

How are collisions handled?

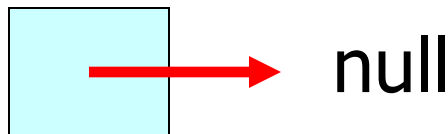
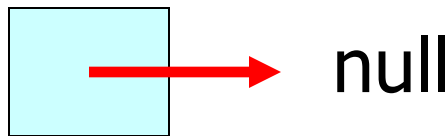
Using a bucket or a chain is a common way to describe putting all of the values with the same hash code in one list.



How are collisions handled?

With only two buckets, this table would have lots of collisions and very long chains and be quite pointless.

```
LinkedList[] table = new LinkedList[2];
```



How are collisions handled?

The larger the array, the less likely you are to have collisions. The table will be much more efficient as well.

```
LinkedList[] table = new LinkedList[100];
```

```
LinkedList[] bigTable = new LinkedList[1000];
```

How are collisions handled?

The LinkedList class works well to chain items together, but ListNode could also be used.

```
ListNode[] table = new ListNode[100];
```

```
ListNode[] bigTable = new ListNode[1000];
```

hashtablefive.java

Work on Programs!

Crank

Some Code!

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