If Java did not have a stack or map, how would you ….

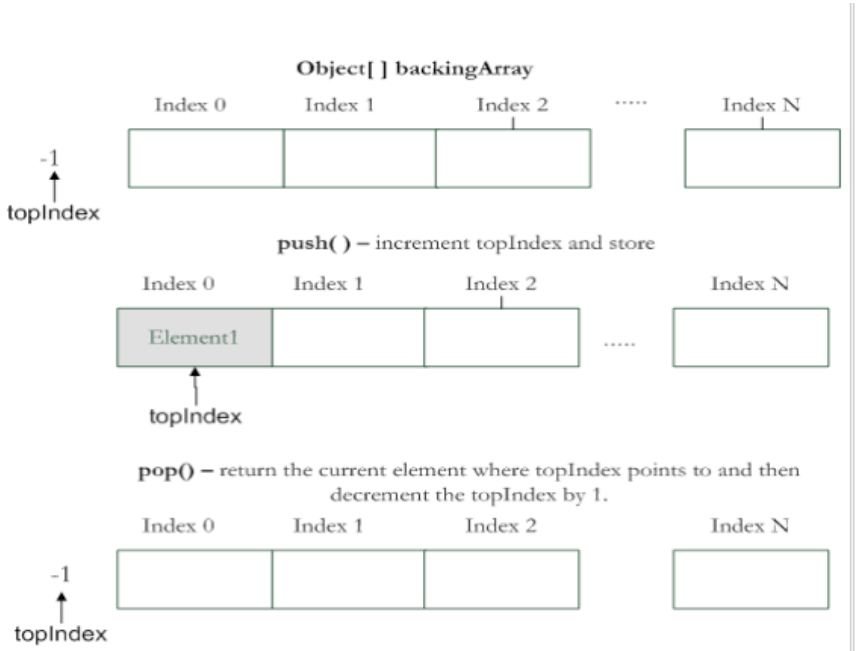
Posted on October 11, 2014 by Arulkumaran Kumaraswamipillai — 1 Comment ↓

Q1 If Java did not have a **Stack** implementation, how would you go about implementing your own?

A1

1) Determine the backing data structure (e.g. array, linked list, etc).
2) Determine the methods that need to be implemented like pop( ), push( ), peek( ), clear( ), empty( ), etc.
3) Determine how you are going to keep track of the last item added. For example, keeping track with an index variable “topIndex”.
4) Determine what to do if the capacity is reached? Double the capacity of the backing array.

5) Drawing a diagram as shown below could make things clearer.



Here are some code snippets to get started. Define the interface first.

```
1 public interface Stack<E> {
2     E push(E item);
3     E pop( );
4     boolean empty( );
5     //other methods like peek( ), etc omitted for
6 }
```

Now provide the implementation class.

```
1  public class MyStack<E> implements Stack<E> {
2
3      private Object[ ] backingArray;
4      private int topIndex;
5      private static final int DEFAULT_CAPACITY =
6
7      public MyStack( ) {
8          this.backingArray = new Object[DEFAULT_C
9          topIndex = -1;
10     }
11
12     @Override
13     @SuppressWarnings("unchecked")
14     public E pop( ) {
15         if (empty( )) {
16             throw new RuntimeException("No data
17         }
18         // return the index element and reset th
```


16 Technical Key Areas

```
19          return (E) backingArray[topIndex--];
20      }
21
22      @Override
23      public E push(E item) {
24          doubleTheArrayIfLimitIsReached( );
25          //increment the index and store the item
26          this.backingArray[++topIndex] = item;
27          return item;
28      }
29
30      @Override
31      public boolean empty( ) {
32          return topIndex == -1;
33      }
34
35      /**
36       * If the array capacity is reached, double
37       */
38      private void doubleTheArrayIfLimitIsReached(
39          if (topIndex + 1 == this.backingArray.le
40              Object[ ] newArray = new Object[back
41              // copy the existing elements to the
42              System.arraycopy(backingArray, 0, ne
43                      backingArray.length);
44              // set the backingArray to the expan
45              backingArray = newArray;
46              System.out.println(
47                          "The backing array has b
48          }
49      }
50  }
```

Q2 If Java did not have a **Queue** implementation, how would you go about implementing your own?
A2 A queue can be implemented in a similar fashion to a **Stack** by declaring a backingArray, a frontIndex, a backIndex, and a currentSize. Initialize the frontIndex to 0 and the backIndex to -1. You will have to provide the relevant methods like enque( ), deque( ), etc.

enqueue( ):

1) If the currentSize == backingArray.length extend the backing array capacity by doubling it.
2) Increment the backIndex by 1. If the incremented index is equal to the array length (backingArray.lenth), set the backIndex to 0 (i.e. imagine it as an endless circular array).
3) Set the element to the backIndex (i.e. bacckingArray[backIndex] = element).
4) Increment the currentSize by 1 (i.e. currentSize++).

dequeue( ):

⊞ Low Latency (7)
⊞ Memory Managemen
⊞ Performance (13)
⊞ QoS (8)
⊞ Scalability (4)
⊞ SDLC (6)
⊞ Security (13)
⊞ Transaction Managen

1) Decrement the currentSize by 1 (i.e currentSize-1).
2) Return the value that frontIndex points to (i.e. backingArray[frontIdex]).
3) Increment the frontIndex by 1. If the frontIndex == backingArray.length, set the frontIndex to 0 (i.e. imagine it as an endless circular array).

Q3 If Java did not have a **HashMap** implementation, how would you go about writing your own one?
A3 Writing a HashMap is not a trivial task. It is also not a good practice to reinvent the wheel. The interviewer is trying to evaluate your level of technical knowledge and thought process. What really important here are, how you approach the problem?, how good your understanding of the data structures are?, and how well you can logically think and code?

1) Firstly, decide on the backing data structure. Arrays are fast and memory efficient. Hence an array can be used to back up the map. This will be an indexed bucket.

2) Decide on a hashing algorithm to index the array and store the entries in a particular slot of the array.

3) Decide on a strategy to store two or more keys that result in the same hash code value. More objects can be linked with each other occupying the same index. This means each bucket can contain 0..N entries. This linking strategy is shown in the diagram.

4) Decide on an approach to evaluate the hash code, which determines the array bucket index to use.

```
1 int index = Math.abs(key.hashCode( ) % buckets.le
```

5) Come up with a strategy for resizing the backing array when the capacity is reached. This process is known as rehashing whereby existing items are mapped to new bucket locations.

Written Test JEE (1)

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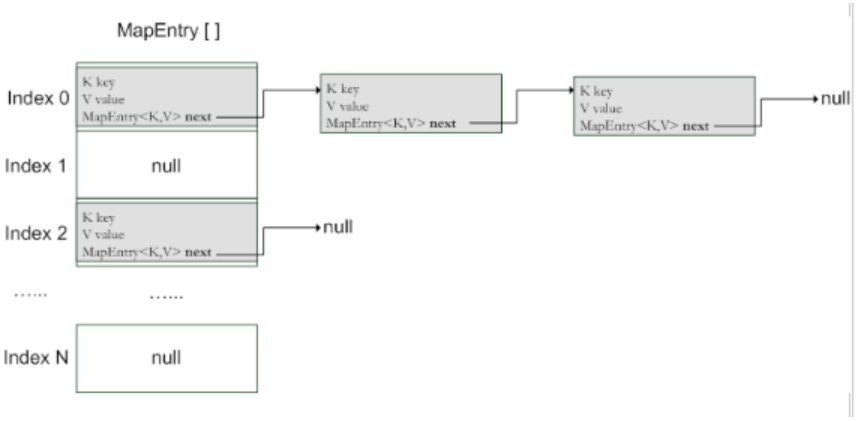
6) Consider implementing the Map interface and fill in the empty methods that need to be implemented.



The following code snippets demonstrate how you could go about implementing your own **HashMap** class.

```
1  public class MapEntry <K, V> {
2
3      private final K key;
4      private V value;
5      private MapEntry<K, V> next;
6
7      public MapEntry(K key, V value){
8          this.key = key;
9          this.value = value;
10     }
11
12     // getters and setters are ignored for brevi
13 }
```

Next, the **HashMap** class that is composed of the **MapEntry**.

```
1  import java.util.Collection;
2  import java.util.Map;
3  import java.util.Set;
4
5  public class MyHashMap<K, V> implements Map<K,
6
7      private MapEntry<K, V>[ ] buckets = null;
8
9      public MyHashMap( ) {
10         this(10);
11     }
12
13     @SuppressWarnings("unchecked")
14     public MyHashMap(int capacity) {
15         buckets = new MapEntry[capacity];
16     }
17
18     @Override
19     @SuppressWarnings("unchecked")
```

```
20      public V get(Object key) {
21          // check for pre-condition.
22          if (key == null)
23              throw new IllegalArgumentException(
24
25          MapEntry<K, V> entry = getMatchingEntry
26          return entry != null ? entry.getValue(
27      }
28
29      @Override
30      public V put(K key, V value) {
31          // check for pre-condition.
32          if (key == null)
33              throw new IllegalArgumentException(
34
35          MapEntry<K, V> entry = getMatchingEntry
36
37          if (entry != null) {
38              entry.setValue(value);
39          }
40          else {
41              int index = evalBucketIndex(key);
42              if (buckets[index] != null) {
43                  entry = linkEntry(buckets[index
44
45
46              } else {
47                  entry = new MapEntry<K, V>(key,
48                  buckets[index] = entry;
49              }
50          }
51          return entry.getValue( );
52      }
53
54     /**
55       * Hashing function. The more spaced out th
56       * performance is. Only positive values can
57       */
58      private int evalBucketIndex(K key) {
59          int index = Math.abs(key.hashCode( ) %
60          return index;
61      }
62
63      /**
64       * Return the matching entry if found, othe
65       */
66      private MapEntry<K, V> getMatchingEntry(K k
67          MapEntry<K, V> entry = buckets[evalBuck
68
69          // same index can have more entries lin
70          // in the MapEntry class. So find the o
71          while (entry != null && !key.equals(ent
72              entry = entry.getNext( );
73          }
74
75          // conditional operator
76          return entry != null ? entry : null;
77      }
78
79      /**
80       * Create a new entry and link it to the gi
81       */
82      private MapEntry<K, V> linkEntry(MapEntry<K
83          boolean linked = false;
84
85          while(!linked){
```

```
86              if(entry.getNext( ) == null){
87                  entry.setNext(new MapEntry<K, V
88
89                  linked = true;
90              }
91              else{
92                  entry = entry.getNext( );
93              }
94          }
95
96          return entry;
97      }
98
99      //other methods that need to be implemented
100     //Map interface not shown for brevity.
101 }
```

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One comment on "If Java did not have a stack or map, how would you ...."

hzstanley says:

April 4, 2016 at 11:32 am

Hi Arun

Please would you be able to post a demo class for the above Stack example.

Thanks

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