Searching in a sorted array

Johan Montelius

KTH

HT23

searchin through an array

```
public static boolean search_unsorted(int[] array, int key
  for (int index = 0; index < array.length ; index++) {
    if (array[index] == key) {
      return true;
    }
  }
  return false;
}
```

what if

What if the array is sorted?

what if

What if the array is sorted?

benchmark a sorted array

```
private static int[] sorted(int n) {
  Random rnd = new Random();
  int[] array = new int[n];
  int nxt = 0;
  for (int i = 0; i < n ; i++) {
    nxt += rnd.nextInt(10) + 1;
    array[i] = nxt;
  }
  return array;
}
```

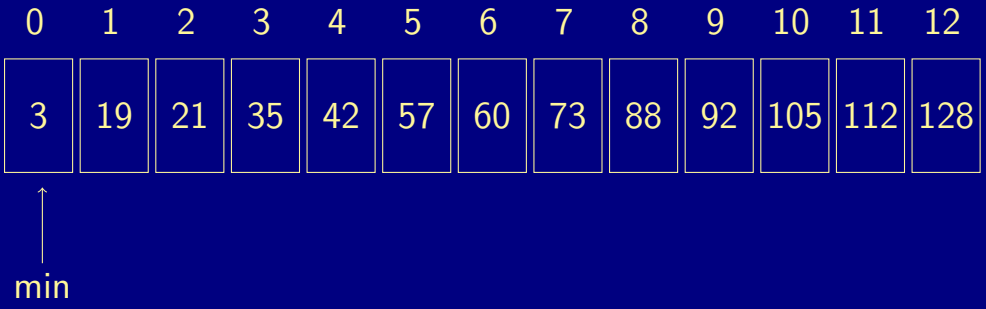
a better way

a better way

search for 42

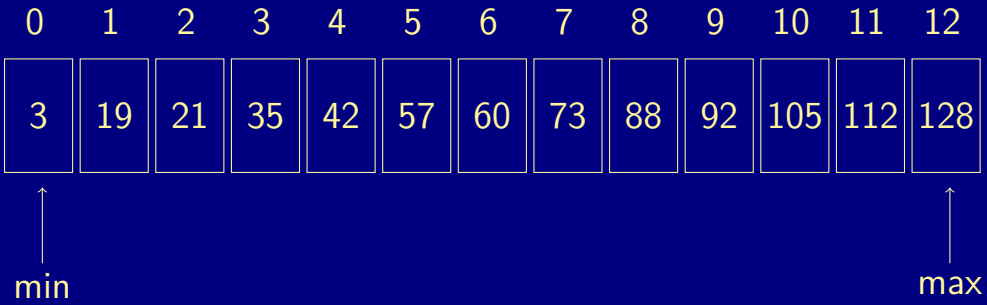
a better way

search for 42



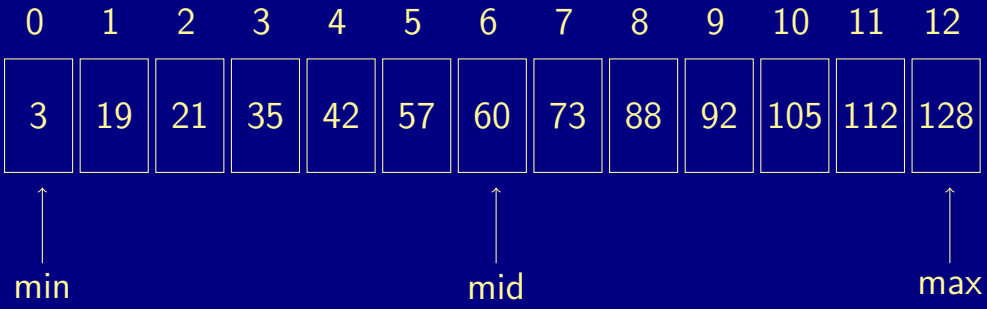
a better way

search for 42



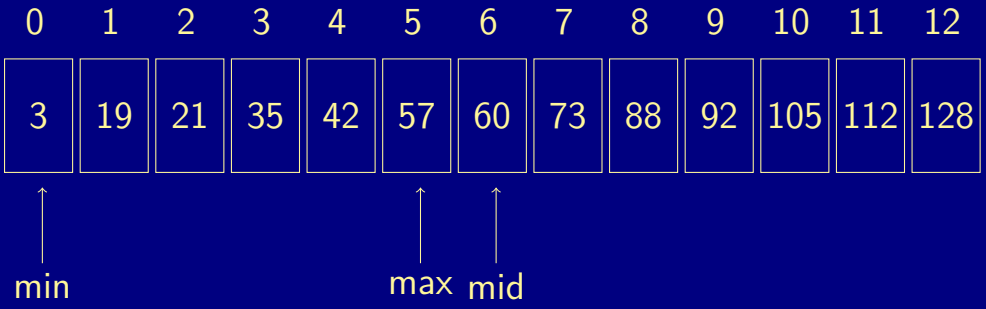
a better way

search for 42



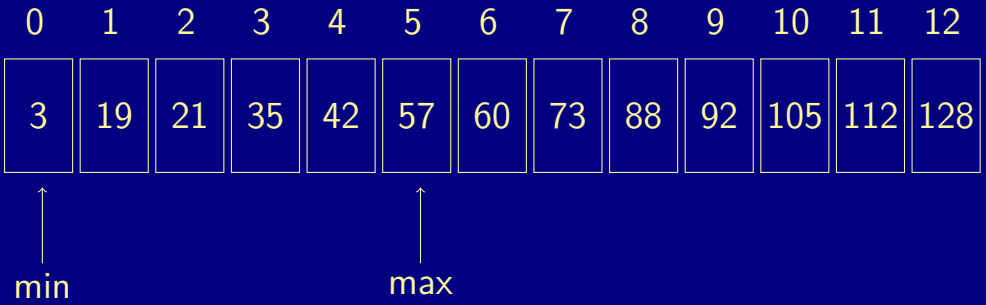
a better way

search for 42



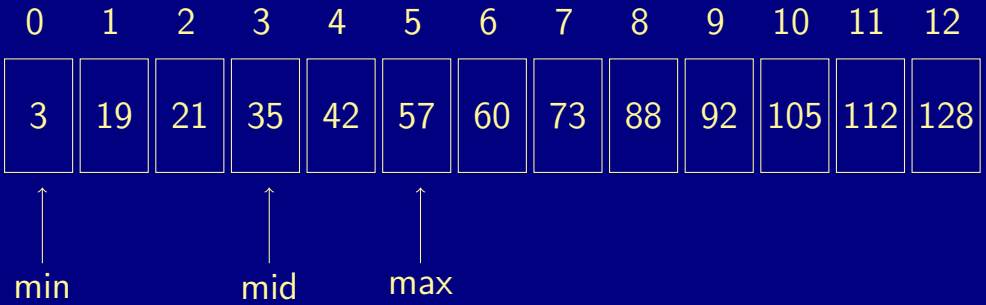
a better way

search for 42



a better way

search for 42

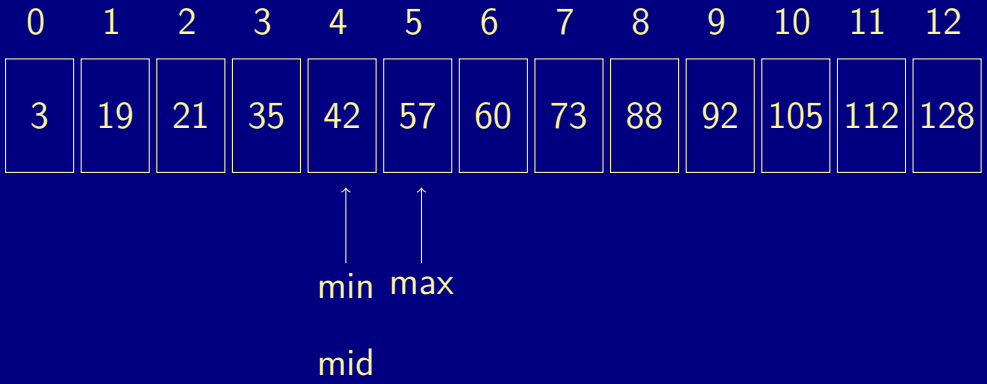


a better way

search for 42

a better way

search for 42



binary search

- set min and max boundries
- check middle element
- found? done
- move left or right - if possible - and iterate
- or else the elememt is not there

search for duplicates

search for duplicates

$\{ 2, 8, 4, 1, 5, 7 \ldots\ldots \}$

search for duplicates

$\{ 2, 8, 4, 1, 5, 7 \ldots\ldots \}$

$\{ 17, 2, 14, 23, 11, 4 \ldots\ldots \}$

search for duplicates

$\{ 2, 8, 4, 1, 5, 7 \ldots\ldots \}$

$\{ 17, 2, 14, 23, 11, 4 \ldots\ldots \}$

If both are of length n then runtime complexity i $O(n^2)$

search for duplicates

search for duplicates

$\{ 2, 8, 4, 1, 5, 7 \ldots\ldots \}$

search for duplicates

$\{ 2, 8, 4, 1, 5, 7 \ldots\ldots \}$

$\{ 2, 3, 8, 11, 17 \ldots\ldots \}$

search for duplicates

$\{ 2, 8, 4, 1, 5, 7 \ldots\ldots \}$

$\{ 2, 3, 8, 11, 17 \ldots\ldots \}$

Does the runtime complexity change?

search for duplicates

search for duplicates

$\{ 1, 2, 7, 8, 15, ... \}$

search for duplicates

$\{ 1, 2, 7, 8, 15, ... \}$

$\{ 2, 4, 8, 11, 17 ..... \}$

search for duplicates

$\{ 1, 2, 7, 8, 15, ... \}$

$\{ 2, 4, 8, 11, 17 ..... \}$

Does the runtime complexity change?

search for duplicates

search for duplicates

If searching in two ordered arrays is more efficient, then what is the cost of sorting?