Arrays In JavaScript

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slides leveraged from those constructed by Eric Roberts

Simple Arrays

- An ***array*** is a collection of individual data values in which it is possible to count the values off in order: here is the first, here is the second, and so on.
- The individual values in an array are called ***elements***. The number of elements is called the ***length*** of the array. As with strings, you can determine the length of an array by checking its `length` property.
- Each element is identified by its position within the array, which is called its ***index***.
- In JavaScript, index numbers always begin with 0 and extend up to one less than the length of the array.

Creating an Array

- The simplest way to create an array in JavaScript is to list the elements of the array surrounded by square brackets and separated by commas. For example, the declaration

```
const COIN_VALUES = [ 1, 5, 10, 25, 50, 100 ];
```

  creates a constant array of six elements that correspond to the standard coins available in the United States.

- Arrays are commonly represented conceptually as a series of numbered boxes, as in the following representation of **`COIN_VALUES`**:

`COIN_VALUES`

1	5	10	25	50	100
0	1	2	3	4	5

Nonnumeric Arrays

- Arrays may contain values of any JavaScript type. For example, the declaration

```
const COIN_NAMES = [
    "penny",
    "nickle",
    "dime",
    "quarter",
    "half-dollar",
    "dollar"
];
```

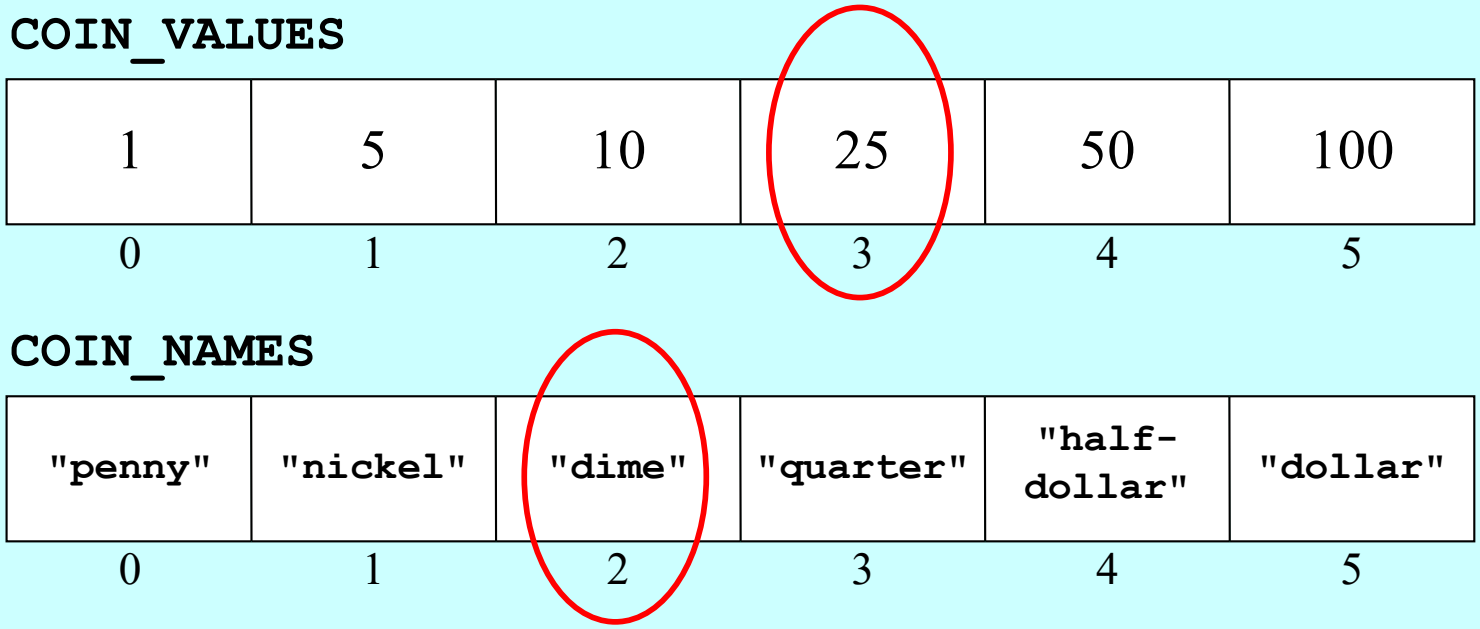
creates the following array:

COIN_NAMES

"penny"	"nickel"	"dime"	"quarter"	"half-dollar"	"dollar"
0	1	2	3	4	5

Array Selection

- Given an array, you can get the value of any element by writing the index of that element in brackets after the array name. This operation is called ***selection***.
- For example, given the declarations on the preceding slides, the value of `COIN_VALUES[3]` is 25.
- Similarly, the value of `COIN_NAMES[2]` is the string `"dime"`.



Cycling through Array Elements

- One of the most useful array idioms is cycling through each of the elements of an array in turn. The standard **`for`** loop pattern for doing so looks like this:

```
for (let i = 0; i < array.length; i++) {
    Operations involving the ith element of the array
}
```

- As an example, the following function computes the sum of the elements in **`array`**:

```
function sumArray(array) {
   let sum = 0;
   for (let i = 0; i < array.length; i++) {
      sum += array[i];
   }
   return sum;
}
```

Exercise: Making Change

- Write a function **`makeChange(change)`** that displays the number of coins of each type necessary to produce **`change`** cents using the values in the constant arrays **`COIN_VALUES`** and **`COIN_NAMES`**.
- In writing your program, you may assume that the currency is designed so that the following strategy always produces the correct result:
  - Start with the last element in the array (in this case, dollars) and use as many of those as possible.
  - Move on to the previous element and give as many of those as possible, continuing this process until you reach the number of pennies.
- Assume that someone has written **`createRegularPlural`**, which is exercise 9 in Chapter 7, on page 266.

Adding and Removing Elements

`push(`*element, . . .***`)`** Adds one or more elements to the end of the array.
`pop()` Removes and returns the last element of the array.
`shift()` Removes and returns the first element of the array.
`unshift(`*element, . . .***`)`** Adds one or more elements to the front of the array.
`slice(`*start, finish***`)`** Returns a subarray beginning at *start* and ending just before *finish*.
`splice(`*index, count, . . .***`)`** Removes *count* elements starting at *index,* and optionally adds new ones.

Although each of these has its use cases, we'll initially focus on the three most common operations: **`push`**, **`pop`**, and **`shift`**.

Growing an Array by Accretion

- The **`push`** method makes it possible to create an array by adding one element at a time. This pattern looks like this:

```
let array = [];
for (whatever limits are appropriate to the application) {
   array.push(the new element);
}
```

- As an example, the following function creates an array of **`n`** values, each of which is initialized to **`value`**:

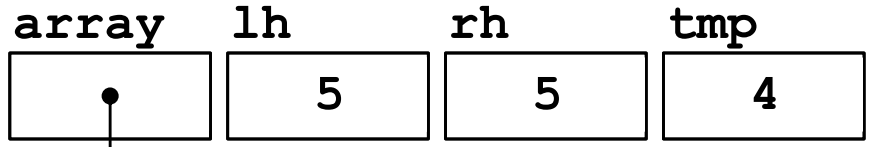
```
function createArray(n, value) {
   let array = [];
   for (let i = 0; i < n; i++) {
      array.push(value);
   }
   return array;
}
```

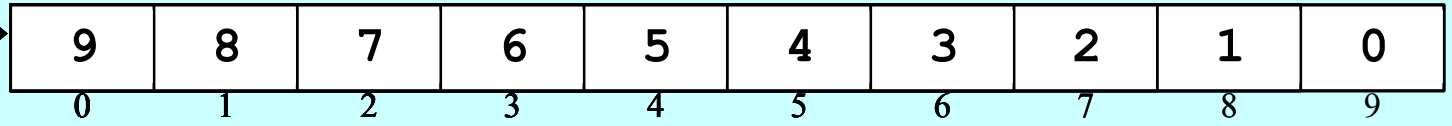
Passing Arrays as Parameters

- When you pass an array as a parameter to a function or return a function as a result, only the *reference* to the array is actually passed between the functions.
- The effect of JavaScripts's strategy for representing arrays internally is that the elements of an array are effectively shared between the caller and callee. If a function changes an element of an array passed as a parameter, that change will persist after the function returns.
- The next slide simulates a program that does the following:
    1. Generates an array containing the integers 0 to $N-1$.
    2. Prints out the elements in the array.
    3. Reverses the elements in the array.
    4. Prints out the reversed array on the console.

The `reverseArray` Function

```
function TestReverseArray() {
  function reverseArray(array) {
    for (let lh = 0; lh < array.length/2; lh++) {
      let rh = array.length - lh - 1;
      let tmp = array[lh];
      array[lh] = array[rh];
      array[rh] = tmp;
    }
}
```





Console

```
Forward: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
Reverse: [9, 8, 7, 6, 5, 4, 3, 2, 1, 0]
```

Other Array Methods

`concat(`*array, . . .***`)`** Concatenates one or more arrays onto the receiver array.
`indexOf(`*element***`)`** Returns the first index at which *element* appears, or –1 if not found.
`lastIndexOf(`*element***`)`** Returns the last index at which *element* appears, or –1 if not found.
`reverse()` Reverses the elements of the array.
`sort()` Sorts the elements of the array in ascending order.

The End