Control Flow

INFO/CSE 100, Autumn 2004
Fluency in Information Technology

http://www.cs.washington.edu/100

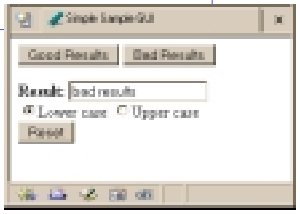
Readings and References

- Reading
  - » *Fluency with Information Technology*
    - Chapter 21, Iteration Principles

`if` statement in Simple Sample GUI

```
<script type="text/javascript">
function setResults(resultString) {
  var tempString = resultString;
  if (document.getElementById("radioLC").checked) {
    tempString = tempString.toLowerCase();
  } else if (document.getElementById("radioUC").checked) {
    tempString = tempString.toUpperCase();
  }
  document.getElementById("resultField").value = tempString;
}
</script>
```

- the `setResults(string)` function is called by several event processors
- in every case, it takes the string that it is given, decides if upper or lower case is desired, and sets the `resultField` accordingly



Result: bad results

● Lower case ○ Upper case

The `if` / `else` statement

The `if` statement is a *conditional statement*

- » a conditional expression is evaluated as being `true` or `false`
  - the expression is a *boolean expression* (ie, returns `true` or `false`)
- » if the condition is `true`, then one set of statements is executed
- » if the statement is `false`, then a different set of statements is executed

```
if (<boolean expression>) {
   <statements>
} else {
   <statements>
}
```

Examples

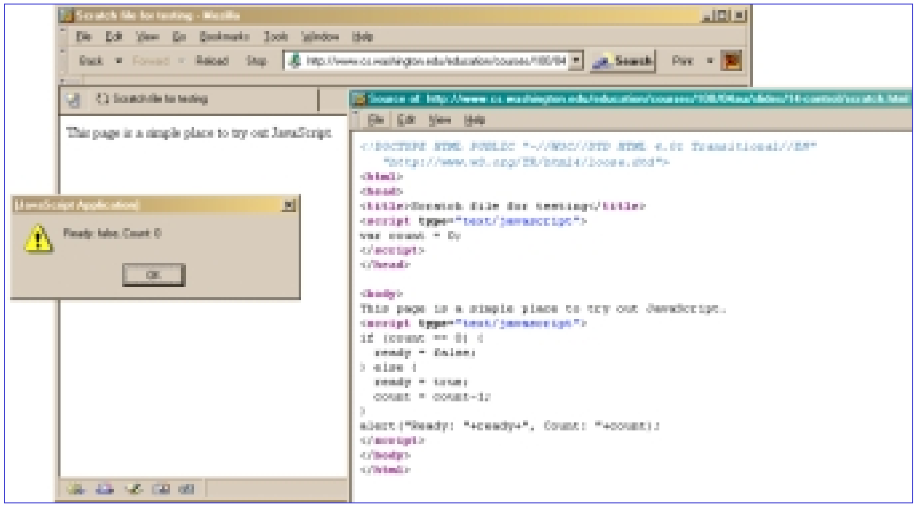
```
if (count == 0) {
  ready = false;
} else {
  ready = true;
  count = count-1;
}
```

What is the conditional expression?
What statements are part of the true block?
Which statements are part of the false block?
What happens when count is 21?   0? -1?

```
if (pageCount >= 100) {
  alert("This may take a few minutes.");
}
```

What is the conditional expression?
What statements are part of the true block?
Which statements are part of the false block?
What happens when pageCount is 21?   100? 200?

scratch.html



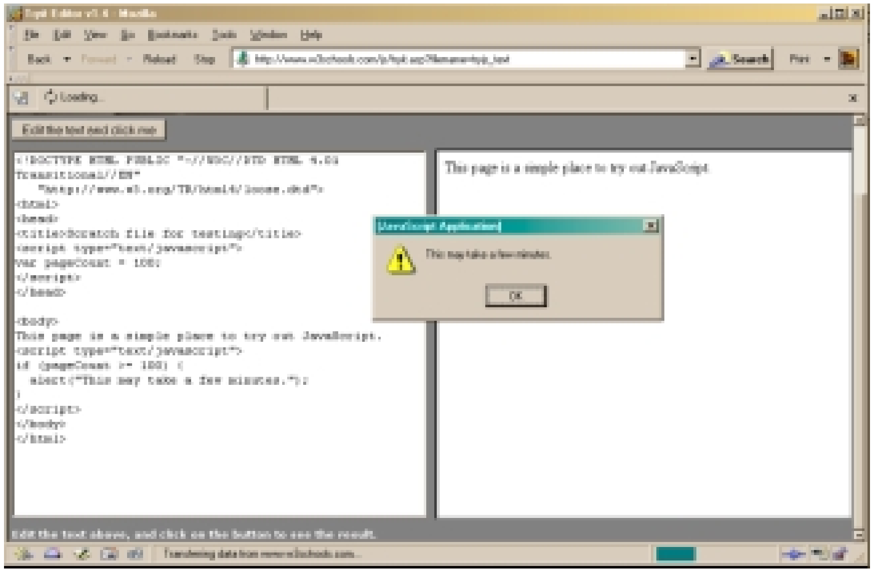
This page is a simple place to try out JavaScript.

Ready: false, Count: 0

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
    "http://www.w3.org/TR/html4/loose.dtd">
<html>
<head>
<title>Scratch file for testing</title>
<script type="text/javascript">
var count = 0;
</script>
</head>

<body>
This page is a simple place to try out JavaScript.
<script type="text/javascript">
if (count == 0) {
  ready = false;
} else {
  ready = true;
  count = count-1;
}
alert("Ready: "+ready+", Count: "+count);
</script>
</body>
</html>
```

W3Schools TryIt Editor



```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01
Transitional//EN"
   "http://www.w3.org/TR/html4/loose.dtd">
<html>
<head>
<title>Scratch file for testing</title>
<script type="text/javascript">
var pageCount = 100;
</script>
</head>

<body>
This page is a simple place to try out JavaScript.
<script type="text/javascript">
if (pageCount >= 100) {
  alert("This may take a few minutes.");
}
</script>
</body>
</html>
```

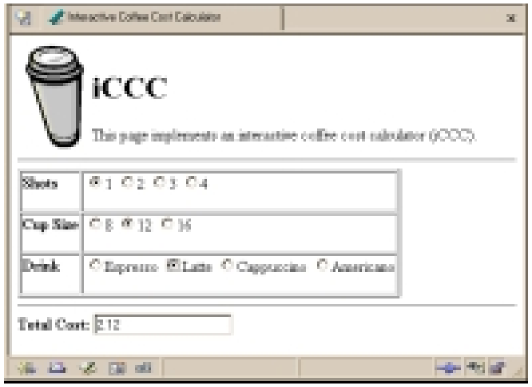
This page is a simple place to try out JavaScript.

This may take a few minutes.

Edit the text above, and click on the button to see the result.

Tryit Editor v1.4 - Mozilla
File Edit View Go Bookmarks Tools Window Help
Back Forward Reload Stop
http://www.w3schools.com/js/tryit.asp?filename=tryjs_text
Search
Print
Loading...
Edit the text and click me
[JavaScript Application]
OK
Transferring data from www.w3schools.com...

A Fancier Example of a GUI program



iCCC

This page implements an interactive coffee cost calculator (iCCC).

Shots	● 1 ○ 2 ○ 3 ○ 4
Cup Size	○ 8 ● 12 ○ 16
Drink	○ Espresso ● Latte ○ Cappuccino ○ Americano

Total Cost: 2.12

An `if` statement from bean.html

```
<html>
<head>
<title>Interactive Coffee Cost Calculator</title>
<script type="text/javascript">
function refresh() {

  var shotCount;          // number of espresso shots
  var cupSize;                    // size of the cup in ounces
  var drink;                      // name of the requested drink

  var price;                      // calculated price of the drink
  var taxRate = 0.087;            // Seattle retail tax

  var element;                    // the current gui element (radio button)

  for (var i=0; i<document.getElementById("shotForm").elements.length; i++) {
    element = document.getElementById("shotForm").elements[i];
    if (element.checked) {
      shotCount = parseInt(element.value,10);
    }
  }
...
```

Iteration

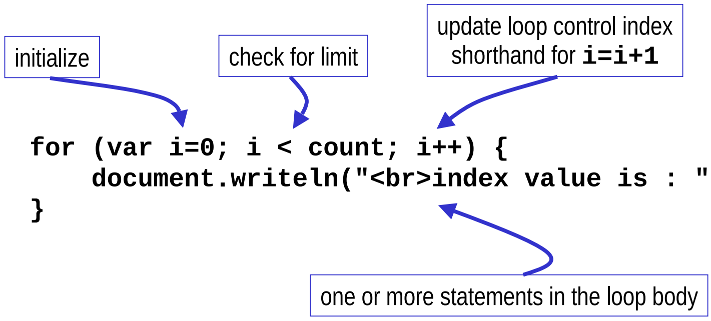
- Iteration or looping is a way to execute a block of program statements more than once
- we will use the **`for`** statement to create loops
  - » The **`for`** loop is generally controlled by counting
  - » There is an index variable that you increment or decrement each time through the loop
  - » When the index reaches some limit condition, then the looping is done and we continue on in the code

Why do we want loops in our code?

- Do something for a given number of times or for every object in a collection of objects
  - » for every radio button in a form, see if it is checked
  - » for every month of the year, charge $100 against the balance
  - » calculate the sum of all the numbers in a list
  - » etc.
- Many loops are counting loops
  - » they do something a certain number of times

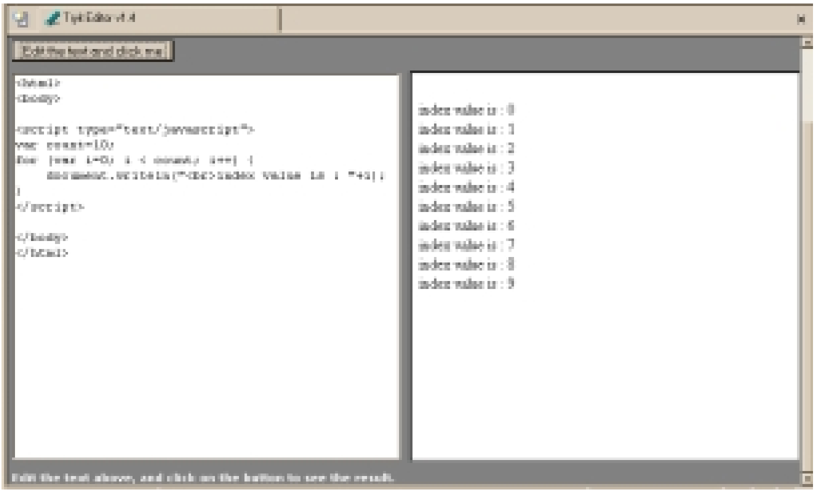
The **`for`** loop

A counting loop is usually implemented with **`for`**


initialize
check for limit
update loop control index
shorthand for **i=i+1**
one or more statements in the loop body

```
for (var i=0; i < count; i++) {
    document.writeln("<br>index value is : "+i);
}
```

for example



```
<html>
<body>

<script type="text/javascript">
var count=10;
for (var i=0; i < count; i++) {
    document.writeln("<br>index value is : "+i);
}
</script>

</body>
</html>
```

```
index value is : 0
index value is : 1
index value is : 2
index value is : 3
index value is : 4
index value is : 5
index value is : 6
index value is : 7
index value is : 8
index value is : 9
```

Edit the text above, and click on the button to see the result.

i++ is a shortcut

- `for (i=0; i < count; i++)`
- at the end of every pass through the **for** loop body, do the following:
  - » get the value of i
  - » increment i
  - » store the incremented value
- Used as it is here, this is the same as writing
  - » `i = i + 1`

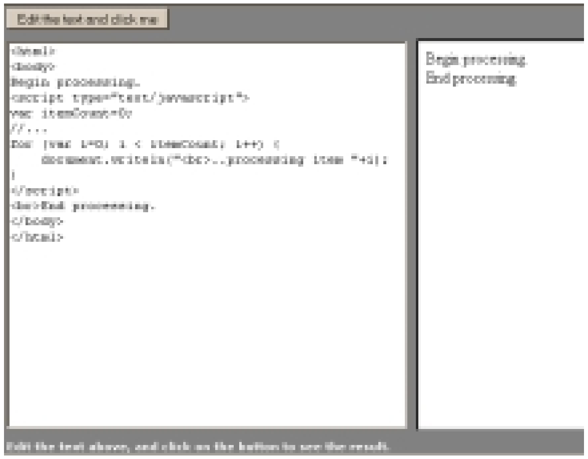
body of loop may not execute at all

- Notice that depending on the values of the control variables, it is quite possible that the body of the loop will not execute at all

check for limit condition
itemCount is 0 when we get here, so **i<itemCount** is immediately false and the loop body is skipped completely

```
var itemCount = 0;
...
for (var i=0; i < itemCount; i++) {
    document.writeln("<br>..processing item "+i);
}
```

loop body skip



```
<html>
<body>
Begin processing.
<script type="text/javascript">
var itemCount=0;
//...
for (var i=0; i < itemCount; i++) {
    document.writeln("<br>..processing item "+i);
}
</script>
<br>End processing.
</body>
</html>
```

```
Begin processing.
End processing.
```

Edit the text above, and click on the button to see the result.

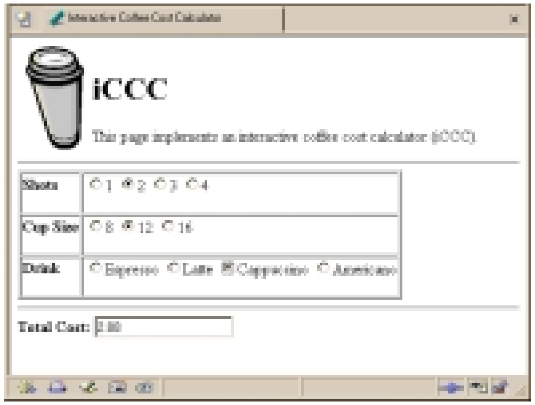
“Off By 1” Error

- The most common error when working with iterations is to miscount by 1
  - » ***Everyone*** makes this mistake
  - » A common place where the “off by 1” error matters is in how many times a loop loops
  - » One advantage of a simple loop control statement is that it's easier to tell how many loops there will be

```
for ( i=0; i<n;  i++) {
   <statement list>
}
```

Number of iterations

Another Example from the iCCC



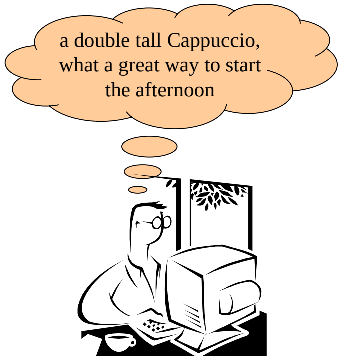
Interactive Coffee Cost Calculator

iCCC

This page implements an interactive coffee cost calculator (iCCC).

Shots	○ 1 ● 2 ○ 3 ○ 4
Cup Size	○ 8 ● 12 ○ 16
Drink	○ Espresso ○ Latte ● Cappuccino ○ Americano

Total Cost: 2.80


a double tall Cappuccio, what a great way to start the afternoon

A `for` loop from bean.html

```
<html>
<head>
<title>Interactive Coffee Cost Calculator</title>
<script type="text/javascript">
function refresh() {

  var shotCount;          // number of espresso shots
  var cupSize;                     // size of the cup in ounces
  var drink;                       // name of the requested drink

  var price;                       // calculated price of the drink
  var taxRate = 0.087;             // Seattle retail tax

  var element;                     // the current gui element (radio button)

  for (var i=0; i<document.getElementById("shotForm").elements.length; i++) {
    element = document.getElementById("shotForm").elements[i];
    if (element.checked) {
      shotCount = parseInt(element.value,10);
    }
  }
...
```

arrays

- On the previous page, we are selecting one element from a collection of elements
- this collection is an array named **`elements`**
  - » one entry for each radio button in the shotForm
  - » the length of this array is available
    `document.getElementById("shotForm").elements.length`
  - » we retrieve an individual element using the index variable
    ```
    element =
       document.getElementById("shotForm").elements[i];
    ```
  - » The index of the first element is 0