Control Flow

INFO/CSE 100, Spring 2006
Fluency in Information Technology

http://www.cs.washington.edu/100
Readings and References

• Reading
  » Fluency with Information Technology
    • Chapter 21, Iteration Principles
A `<input type="radio" ...>` tag allows the user to select one of several choices. The `name="case"` attribute identifies all the buttons in the same group (only one will be selected at a time). The `onclick` attribute gives the JavaScript to execute when the user clicks this button. The `id="radioLC"` gives us a way to identify this particular control in our JavaScript.
a `<button>` with `type="reset"` resets all the other controls in the same form to their original values
Events Cause Processing

• After drawing a page, the browser sits idle waiting for something to happen ... when we give input, we cause *events*

• Processing events is the task of a block of code called an *event handler*
  » The code to execute is identified in the tag using the appropriate attribute
  » There are many event types
    • onClick, onChange, onMouseOver ...
request processing of an event

```html
<form>
  <button type="button" onclick="setResults('good results')">Good Results</button>
  <button type="button" onclick="setResults('bad results')">Bad Results</button>
</form>
```

- the `onclick` attribute defines some JavaScript to call when the button is clicked.
- in this case, the code is a call to the `setResults(string)` function defined in the page `<head>`.
- the appropriate string value is supplied to the `setResults(string)` function and then the function executes.
process a button’s onclick event

```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
setResults(resultString)

```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>
```

parameter variable, local variable, if/else statement, field reference, call to toLowerCase() function
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
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

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

```java
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?

```java
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?
This page is a simple place to try out JavaScript.

```html
<!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>
```
This page is a simple place to try out JavaScript.

```html
<?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>
```
A Fancier Example of a GUI program

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

a single tall latte, what a great way to start the morning
An if statement from bean.html

```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);
    }
  }
...
```
Nested if/else Statements

```javascript
if (temp < 32) {
    if (sky == "cloudy") {
        alert("Snow is forecast!");
    }
}

if (temp < 32 && sky == "cloudy") {
    alert("Snow is forecast!");
}
```
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**

```javascript
var count = 10;

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

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

```html
<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
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

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

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

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

Number of iterations
Avoid Infinite Loops

```
var count = 10;

for ( var i=0; i<count;  j++ ) {
    document.write("All work and no play, makes Jack a dull boy.");
}
```
Another Example from the iCCC

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

<table>
<thead>
<tr>
<th>Shots</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cup Size</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Drink</td>
<td>Espresso</td>
<td>Latte</td>
<td>Cappuccino</td>
<td>Americano</td>
</tr>
</tbody>
</table>

Total Cost: $2.38

a double tall Cappuccio, what a great way to start the afternoon
A for loop from bean.html

```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
    \[
    \text{document.getElementById("shotForm").elements.length}
    \]
  » we retrieve an individual element using the index variable
    \[
    \text{element = document.getElementById("shotForm").elements[i];}
    \]
  » The index of the first element is 0