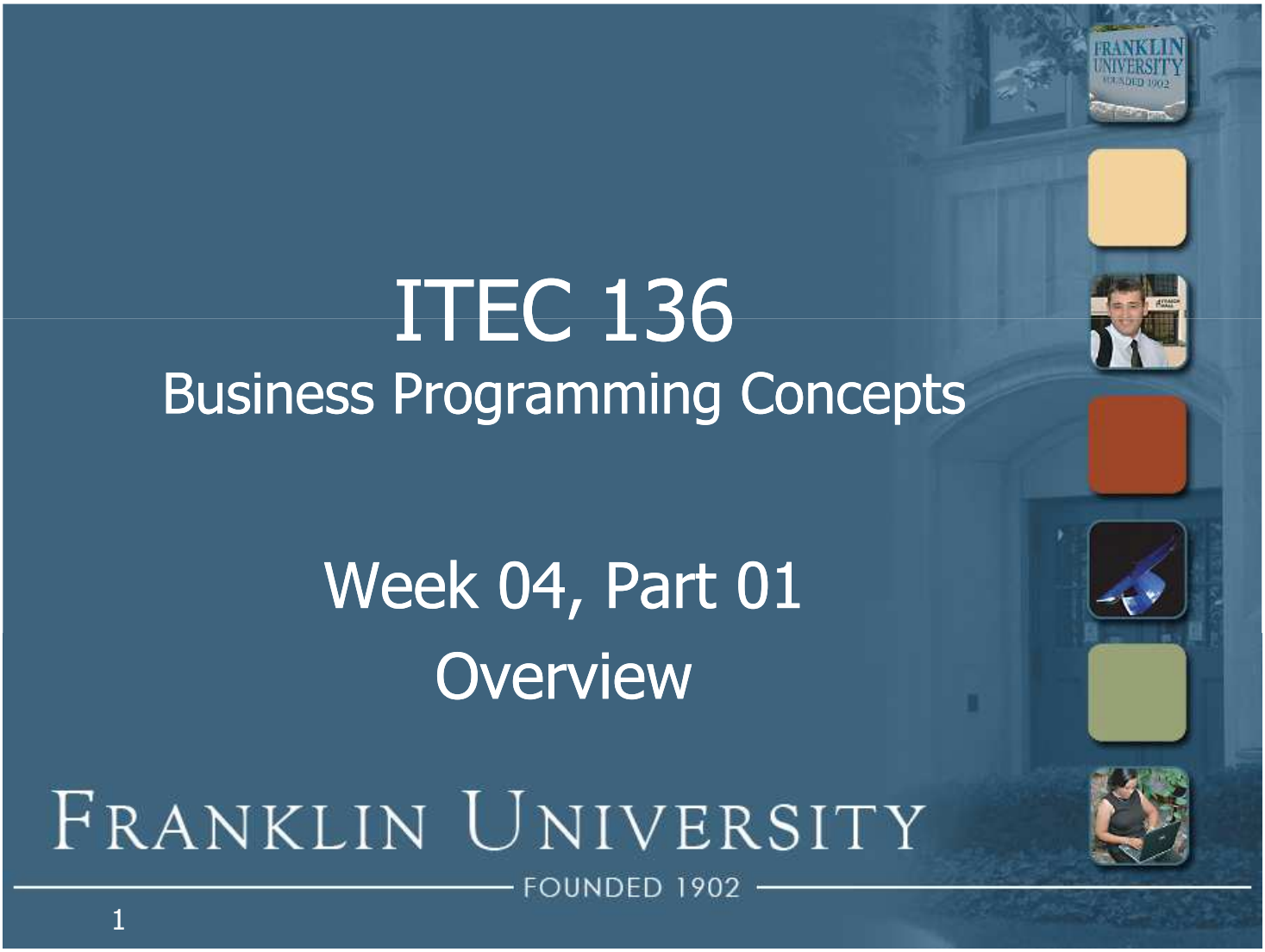

ITEC 136

Business Programming Concepts

Week 04, Part 01

Overview

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Week 4 Overview

- Week 3 review
  - Functional Decomposition
    - Top-down design
    - Bottom-up implementation
  - Functions
    - Global vs. Local variables (scope)
    - Arguments/Parameters
    - Return values

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Week 4 Overview

- Week 3 review
  - Event handlers
    - `<input>` tag for user input
    - `onclick`, `onfocus`, etc. events
    - Attach code to events

Week 4 Overview

- Outcomes
  - Sketch the solution to a problem requiring conditional execution.
  - Write correct conditional statements to solve a given problem.

ITEC 136

Business Programming Concepts

Week 04, Part 02

Homework Solutions

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Homework 2 Solution

- Change maker

change.html

```
<html>
  <head><title>Change maker</title></head>
  <body>
    <h1>Change maker</h1>
    <p>Author: Todd Whittaker</p>
    <script type="text/javascript" src="change.js">
    </script>
    <p>Reload or click <a href="">here</a>
       to run again</p>
  </body>
</html>
```

Homework 2 Solution

- Change maker

change.js

```
var cents = parseInt(prompt(
    "Enter a number of cents", 87));
var remaining = cents;

var quarters = Math.floor(remaining / 25);
remaining = remaining % 25;
var dimes = Math.floor(remaining / 10);
remaining = remaining % 10;
var nickles = Math.floor(remaining / 5);
remaining = remaining % 5;
var pennies = remaining;
```


Homework 2 Solution

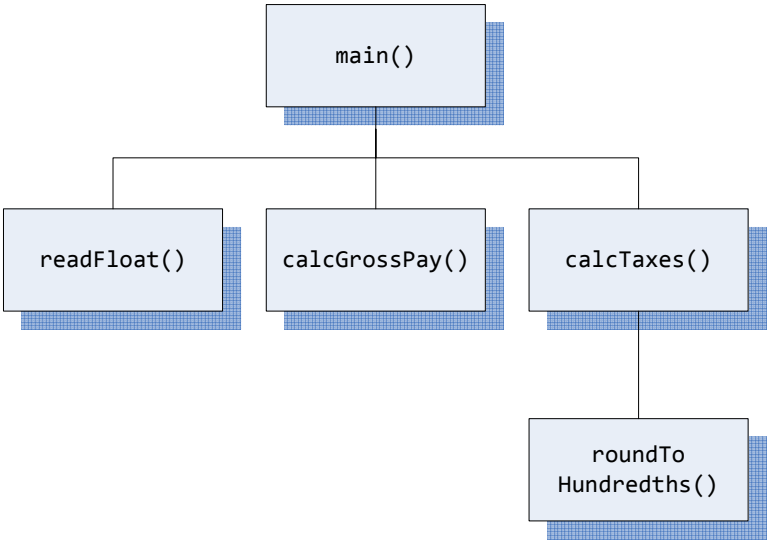
- Change maker

change.js

```
document.writeln(cents + " cents is comprised " +
    "of:<br />");
document.writeln(quarters + " quarter(s)<br />");
document.writeln(dimes + " dime(s)<br />");
document.writeln(nickles + " nickle(s)<br />");
document.writeln(pennies + " pennies<br />");
```

Homework 3 Solution

- Wages calculator



Homework 3 Solution

- Wages calculator

wages.html

```
<html>
  <head>
    <title>Wages calculator</title>
    <script type="text/javascript" src="wages.js">
    </script>
  </head>
  <body>
    <h1>Wages calculator</h1>
    <p>Author: Todd Whittaker</p>
```

Homework 3 Solution

- Wages calculator

wages.html

```
    <label for="payRate">Pay rate:</label><br />
    <input type="text" id="payRate" value="25" /><br />
    <label for="hoursWorked">Hours:</label><br />
    <input type="text" id="hoursWorked" value="40" />
    <br />
    <input type="button" value="Calculate"
        onclick="main()" /><br /><br />
    <div id="output"></div>
    </body>
</html>
```


Homework 3 Solution

- Wages calculator

wages.js

```
function main() {
  var LOCAL_RATE = 0.02;
  var STATE_RATE = 0.08;
  var FED_RATE = 0.31;

  // input
  var payRate = readFloat("payRate");
  var hoursWorked = readFloat("hoursWorked");
```

Homework 3 Solution

- Wages calculator

wages.js

```
// process
var grossPay = calcGrossPay(payRate, hoursWorked);
var taxes = calcTaxes(grossPay, LOCAL_RATE,
  STATE_RATE, FED_RATE);
var netPay = grossPay - taxes;
```


Homework 3 Solution

- Wages calculator

wages.js

```
// output
document.getElementById("output").innerHTML =
  "Gross pay is: $" + grossPay.toFixed(2) + ".<br />"
  + "Taxes are: $" + taxes.toFixed(2) + ".<br />“
  + "Net pay is: $" + netPay.toFixed(2) + ".<br />";
}
```

Homework 3 Solution

- Wages calculator

wages.js

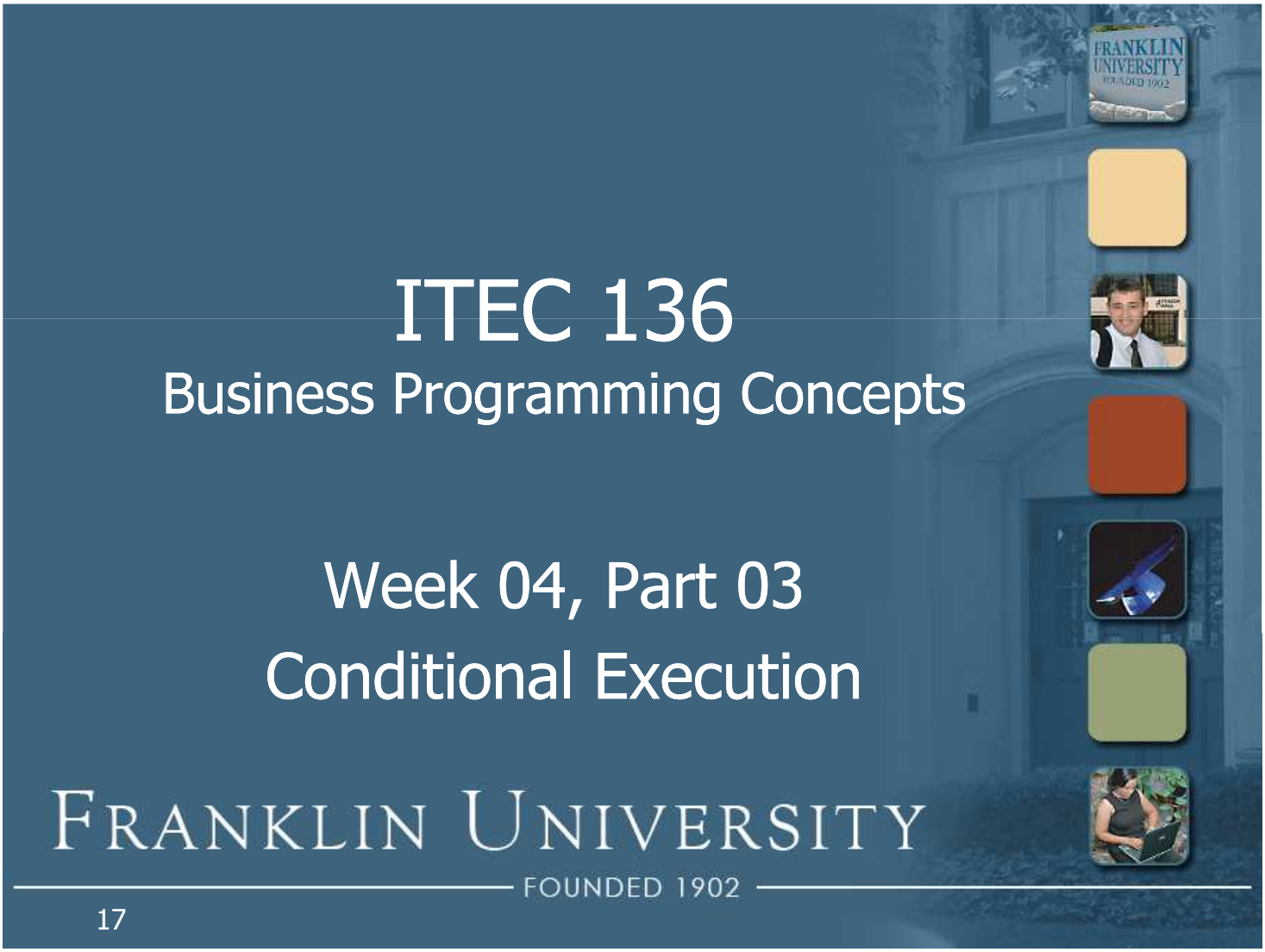
```
function readFloat(field) {
  return parseFloat(
    document.getElementById(field).value);
}

function roundToHundredths(number) {
  return Math.round(number * 100) / 100;
}

function calcGrossPay(payRate, hoursWorked) {
  return hoursWorked <= 40 ? payRate * hoursWorked :
    payRate * (1.5 * hoursWorked - 20);
}
```


Homework 3 Solution

- Wages calculator

wages.js

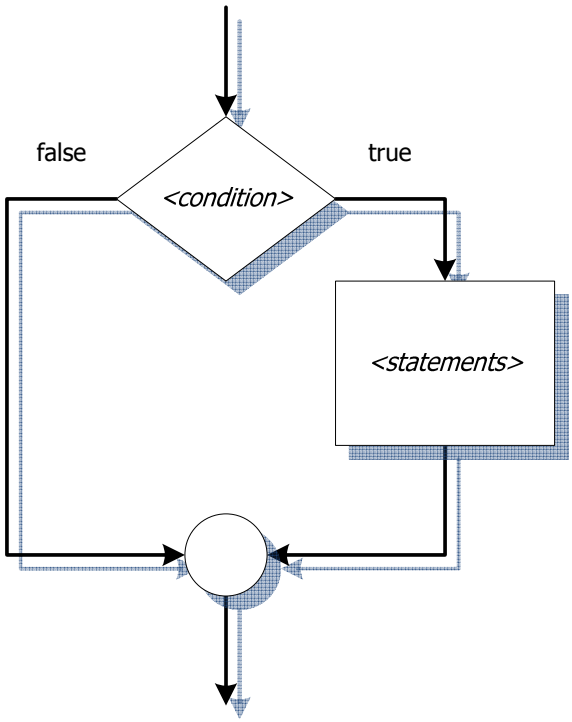
```
function calcTaxes(grossPay,
    localRate, stateRate, fedRate) {
  var localTax = roundToHundredths(grossPay *
    localRate);
  var stateTax = roundToHundredths((grossPay -
    localTax) * stateRate);
  var fedTax = roundToHundredths((grossPay -
    localTax - stateTax) * fedRate);
  return fedTax + stateTax + localTax;
}
```



Conditional Execution

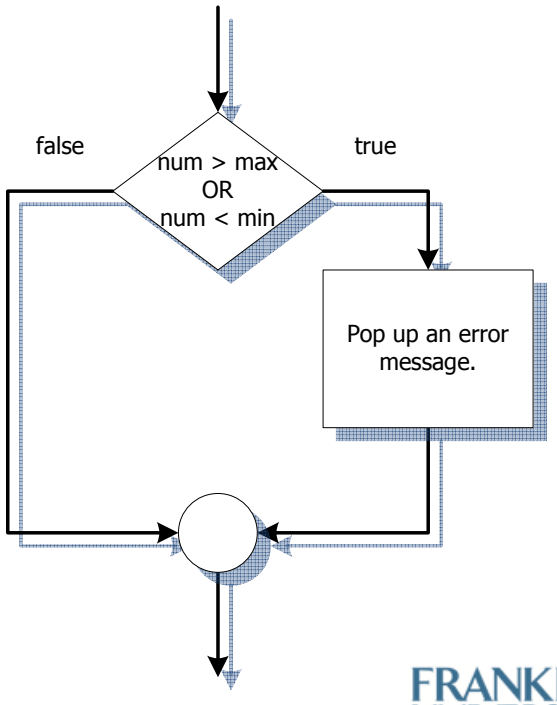
- Conditional Execution
  - Want to do something when a particular condition is met. e.g.:
    - Charging an ATM usage fee only for another bank's customers, not your own.
    - Tagging an e-mail message as spam only if it contains certain words.
    - Alert the user only if they didn't fill in a required field on a form.

Conditional Execution

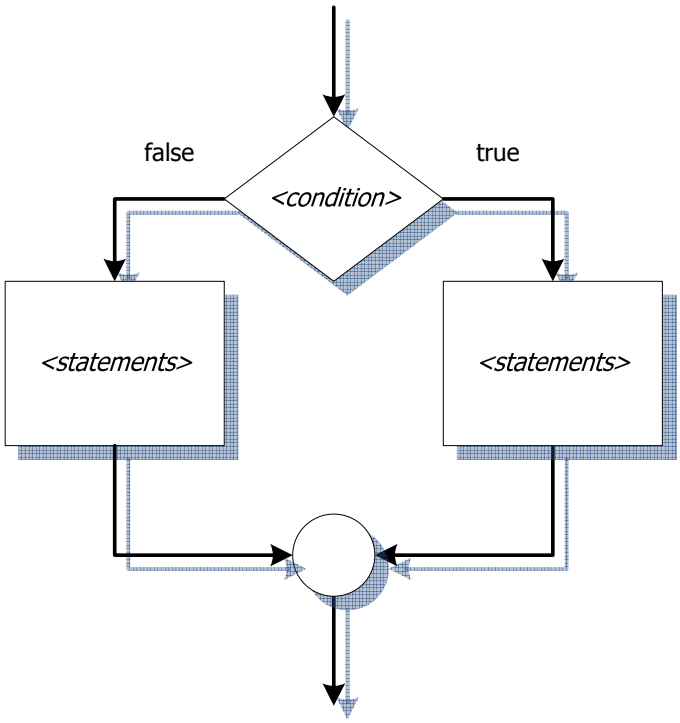


Conditional Execution

- Ex: If a number is outside the range [min, max], pop up an error message:

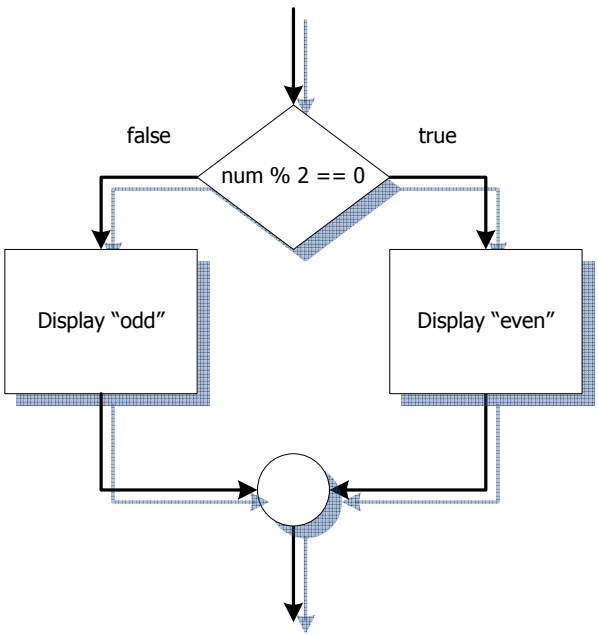


Conditional Execution



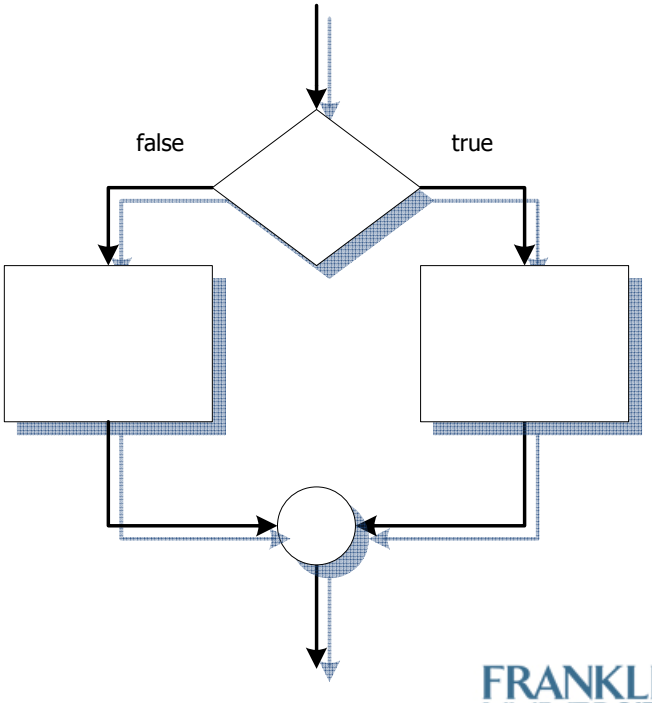
Conditional Execution

- Ex: Determine if the number is even or odd, displaying the result:



Conditional Execution

- Ex: Display "valid" or "invalid" if an entered number is a valid month of the year:



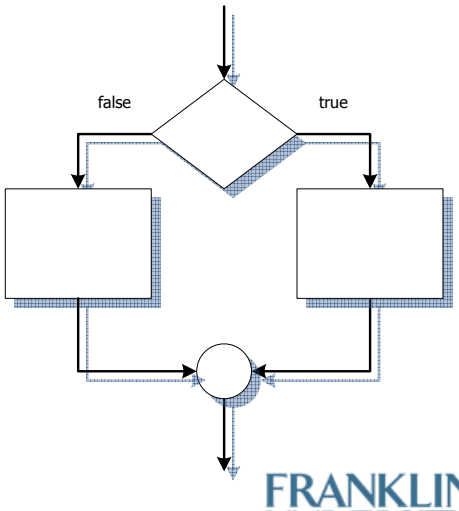
Conditional Execution

- Ex: Given a height and a weight, determine if a person healthy or unhealthy:

Body mass index: uses weight (kilograms) and height (meters) according to the following formula:

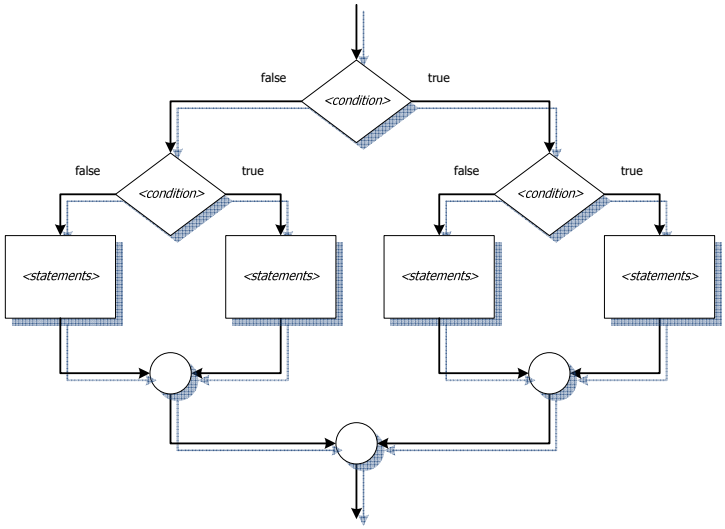
$$bmi = \frac{w}{h^2}$$

Anything outside the range [19,26] is considered unhealthy.



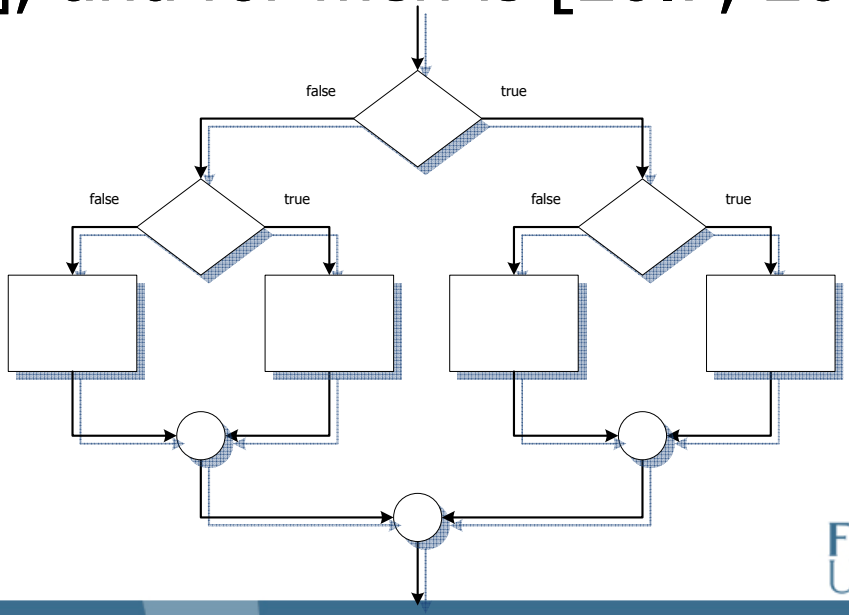
Conditional Execution

- Nested conditions
  - Multiple decisions within one another



Conditional Execution

- Ex: Normal BMI for women is [19.1, 25.8], and for men is [20.7, 26.4]:



ITEC 136
Business Programming Concepts

Week 04, Part 04
`if/else` Statements

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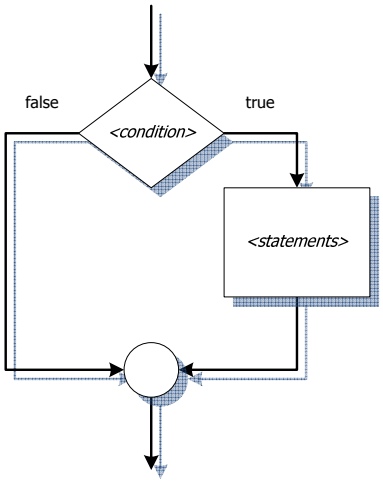
`if/else` Statements

- Keywords `if` and `else` implement conditional execution

```
if (<condition>) {
    <statements>
}
```



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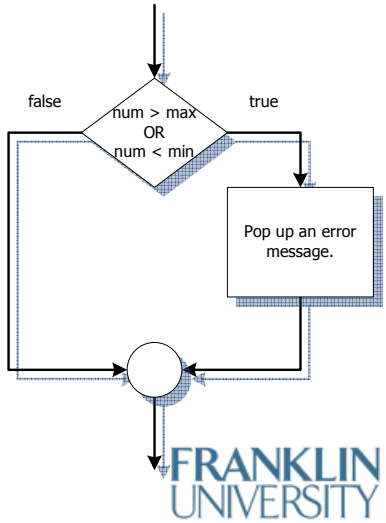
`if/else` Statements

- Ex: If a number is outside the range [min, max], pop up an error message:

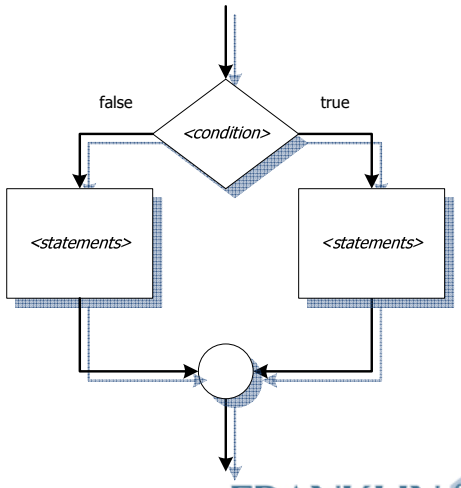
```
function validRange(num, min, max) {
  if (num < min || num > max) {
      alert(num + " is outside ["
        + min + ", " + max + "]")
  }
}
```



`if/else` Statements

- Keywords `if` and `else` implement conditional execution

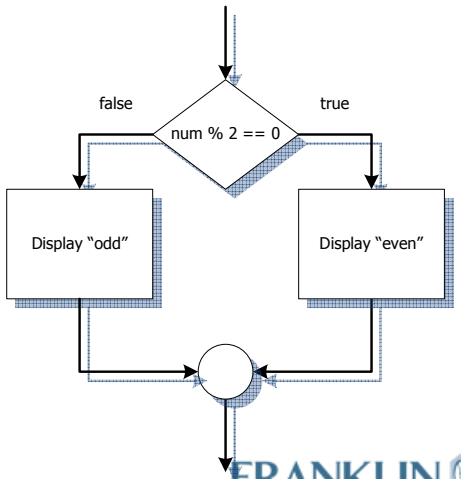
```
if (<condition>) {
    <statements>
} else {
    <statements>
}
```



`if/else` Statements

- Ex: Determine if the number is even or odd, displaying the result:

```
var num = parseInt(
    prompt("Enter a number"));
if (num % 2 == 0) {
    alert(num + " is even");
} else {
    alert(num + " is odd");
}
```



Conditional Execution

- Ex: Given a height and a weight, determine if a person healthy or unhealthy:

Body mass index: uses weight (kilograms) and height (meters) according to the following formula:

$$bmi = \frac{w}{h^2}$$

Anything outside the range [19,26] is considered unhealthy.

if/else Statements

- Highly complex conditions require if/else structures within if/else structures.

```
if (condition1)
  if (condition2)
    doSomething();
 else
    doAnotherThing();
else
  doSomethingEntirelyDifferent();
```

Which "if" does this "else" match? How can it be made to match the other "if"? Called the "dangling else" problem.

if/else Statements

- Highly complex conditions require if/else structures within if/else structures.

```
if (condition1)
  if (condition2)
    doSomething();
 else
    doAnotherThing();
else
  doSomethingEntirelyDifferent();
```

Indentation is only for people, and doesn't mean anything to the interpreter. This matches the 2nd (closest) if-statement.

if/else Statements

- Highly complex conditions require if/else structures within if/else structures.

```
if (condition1)
  if (condition2)
    doSomething();
 else
    doAnotherThing();
else
  doSomethingEntirelyDifferent();
```

Tip: always use curly braces around the body of if-statements.

…only for …esn't mean …is matches …t) if-statement.

if/else Statements

- Highly complex conditions require if/else structures within if/else structures.

```
if (condition1) {
  if (condition2) {
    doSomething();
  } else {
    doAnotherThing();
} else {
  doSomethingEntirelyDifferent();
}
```

if/else Statements

- Some simple transformations

```
if (condition1)
  if (condition2)
    doSomething();
```

```
if (condition1 && condition2)
    doSomething();
```


if/else Statements

- Some simple transformations

```
if (condition1)
  doSomething();
else if (condition2)
  doSomething();
```

```
if (condition1 || condition2)
    doSomething();
```

Case study: Date Validation

- Date validation
  - Given three numbers (month, day, and year) do the three form a valid date?
    - Month: 1-12
    - Day: 1-28 always valid, 29, 30, 31 sometimes valid depending on year
    - No year 0, account for leap year

Case study: Date Validation

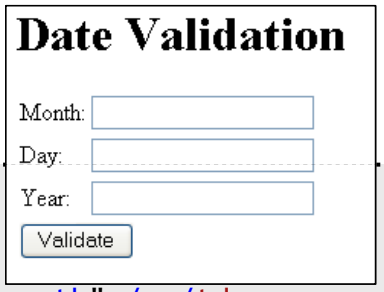
- Date validation – User interface

```
<!DOCTYPE html PUBLIC
    "-//W3C//DTD XHTML 1.0 Transitional//EN"
    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html xmlns="http://www.w3.org/1999/xhtml">
 <head>
  <meta http-equiv="Content-Type"
    content="text/html; charset=iso-8859-1" />
  <title>Date Validation</title>
  <script language="JavaScript" type="text/javascript"
     src="DateValidation.js">
  </script>
 </head>
```

Case study: Date Validation

- Date validation – User




```
<table>
 <tr><td>Month:</td>
  <td><input type="text" id="month" name="month" /></td>
 </tr>
  <tr><td>Day:</td>
   <td><input type="text" id="day" name="day" /></td>
 </tr>
 <tr><td>Year:</td>
  <td><input type="text" id="year" name="year" /></td>
 </tr>
 <tr><td colspan="2"><input type="button" value="Validate"
     onclick="main('month', 'day', 'year')" /></td>
 </tr>
</table>
```


Case study: Date Validation

- Date validation – main program

```
function main(monthId, dayId, yearId)
{
    var month = getInt(monthId);
    var day = getInt(dayId);
    var year = getInt(yearId);
    if (isValidDate(month, day, year))
        alert("Valid date");
    else
        alert("Invalid date");
}
```

Case study: Date Validation

- Date validation – user input

```
function getInt(id) {
    return parseInt(
       document.getElementById(id).value);
}
```


Case study: Date Validation

- Date validation – months and years

```
function isValidMonth(month) {
    return month >= 1 && month <= 12;
}

function isValidYear(year) {
    return year != 0;
}
```

Case study: Date Validation

- Date validation
  - Leap year
    - Keeps solar year and calendar year synchronized.
    - Rule: any year divisible evenly by 4 is a leap year, unless it is also divisible by 100, unless it is also divisible by 400

Case study: Date Validation

- Date validation
  - Leap year test cases
    - Ex: 1986 is not a leap year (why?)
    - Ex: 1988 is a leap year (why?)
    - Ex: 1900 is not a leap year (why?)
    - Ex: 2000 is a leap year (why?)

Case study: Date Validation

- Date validation

```
function isLeapYear(year) {
    return year % 4 == 0 && year % 100 != 0
        || year % 400 == 0
}
```


Case study: Date Validation

- Date validation

```
function isValidDay(month, day, year) {
    var result = false;
    if (isValidMonth(month) &&
        isValidYear(year)) {
        // do some calculation...
    }
    return result;
}
```

What is returned if the month or year is invalid?

Case study: Date Validation

- Date validation

```
// here's the calculation...
var maxDay = 31;
if (month == 9 || month == 4 ||
    month == 6 || month == 11)
    maxDay = 30;
else if (month == 2)
    if (isLeapYear(year))
        maxDay = 29;
    else
        maxDay = 28;
result = day >= 1 && day <= maxDay;
```

How are January, March, May, etc handled?

Case study: Date Validation

- Date validation
  - The working application (properly formatted for course coding conventions):

http://cs.franklin.edu/~whittakt/ITEC136/examples/DateValidation.html

On your own...

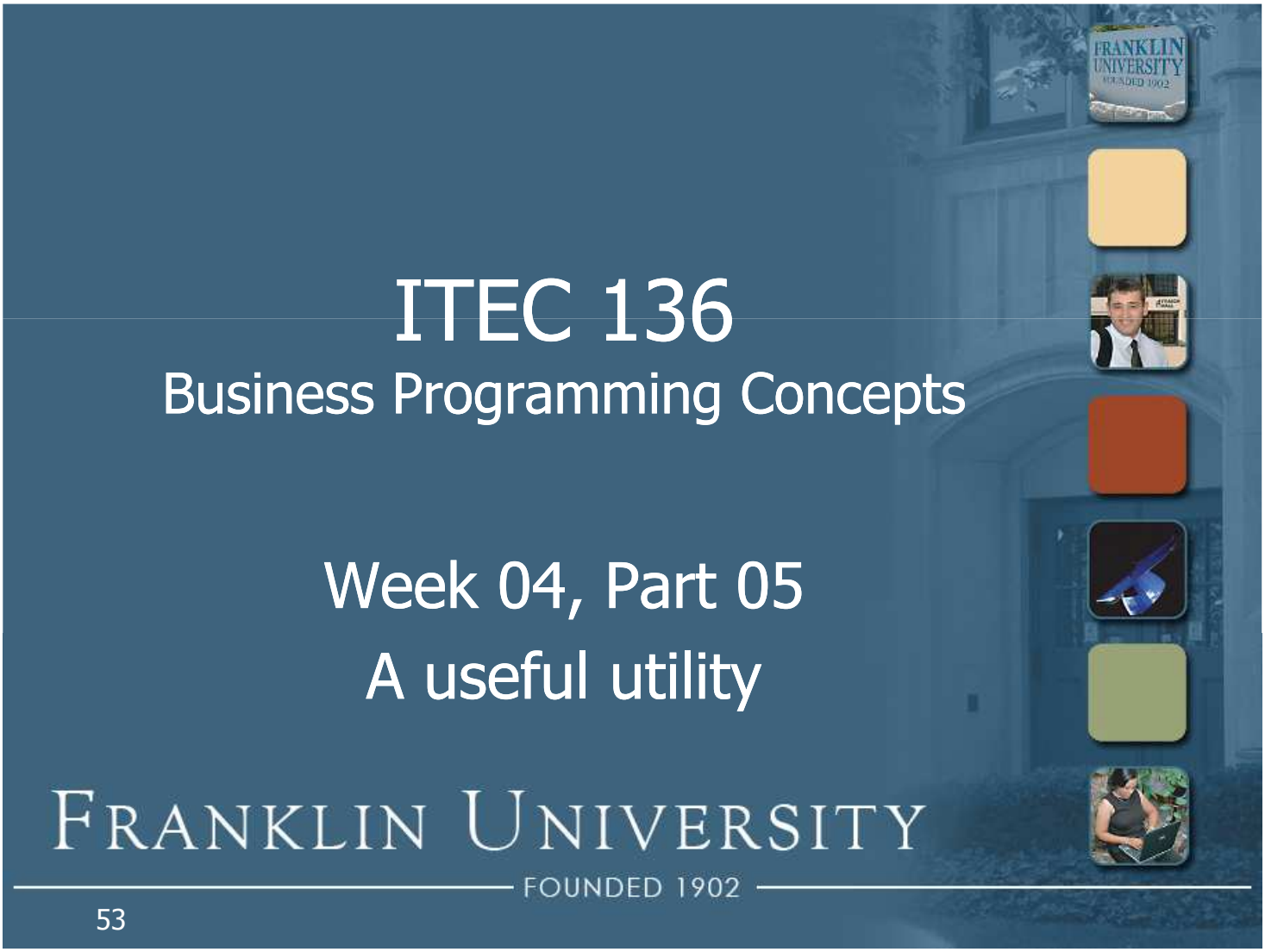
- Federal tax calculation schedule X*

If taxable income is over--	But not over--	The tax is:
$0	$7,825	10% of the amount over $0
$7,825	$31,850	$782.50 plus 15% of the amount over 7,825
$31,850	$77,100	$4,386.25 plus 25% of the amount over 31,850
$77,100	$160,850	$15,698.75 plus 28% of the amount over 77,100
$160,850	$349,700	$39,148.75 plus 33% of the amount over 160,850
$349,700	no limit	$101,469.25 plus 35% of the amount over 349,700

*Source: http://www.irs.gov/formspubs/article/0,,id=164272,00.html

On your own...

- Federal tax calculation schedule X*
  - Write a program that inputs the adjusted gross income and outputs the expected tax bill.



Testing programs

- Wouldn't it be nice if your program told you when you wrote in a bug?
  - What if it could do this:

```
if (programHasABug())
    alert("Bug detected!");
```

Testing programs

- We can get close!
  - Unit testing
    - Making sure that each function, when provided correct inputs, produces correct outputs.
    - Also, when provided incorrect inputs, it doesn't do harm

Testing programs

- A testing function

testing.js

```
function assertEquals(expected, actual, message) {
  if (!(expected == actual)) {
    var str = "Error!" +
      "\n   Expected: " + expected +
      "\n   Actual: " + actual;
    if (message) {
      str += "\n   Message: " + message;
    }
    alert(str);
  }
}
```

Testing programs

- A testing function

testing.js

```
function assertEquals(expected, actual, message) {
  if (!(expected == actual)) {
    var str = "Error!" +
      "\n   Expected: " + expected +
      "\n   Actual: " + actual;
    if (message) {
      str += "\n   Message: " + message;
    }
    alert(str);
  }
}
```

Only if the message is non-null and non-undefined will it appear in the alert.

Testing programs

- Writing a test

DateValidation.js

```
function testIsValidMonth(){
  // try some valid months...
  assertEquals(true, isValidMonth(3),
    "March should be valid");
  // and some invalid months...
  assertEquals(false, isValidMonth(13),
    "Febtober should be invalid");
}
```

Testing programs

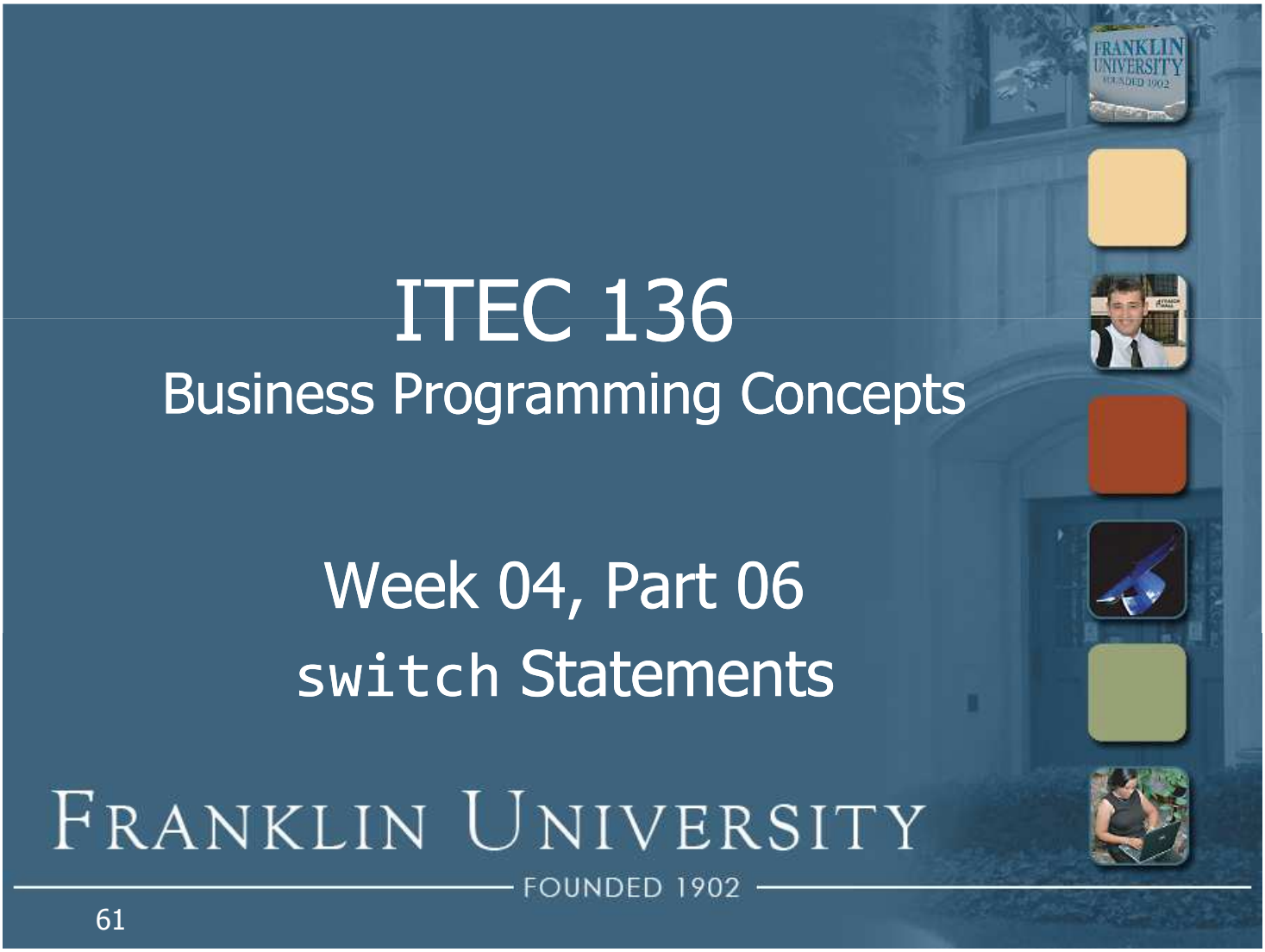
- Writing a test

DateValidation.js

```
function testIsValidMonth(){
  // try some valid months...
  assertEquals(true, isValidMonth(3),
    "March should be valid");
  // and some invalid
  assertEquals(false,
    "Febtober should b
}
```

Testing programs

- Advantages of writing tests
  - Makes you think clearly about the inputs and outputs of functions
  - Makes you write small, testable code
  - Gives you a safety net when you change your code (rerun the tests)
  - You see progress toward a solution (more tests pass)



`switch` Statements

- Switch statements
  - A shortcut to compare many values and conditionally execute code based strictly on *equality*.
    - *Good* for a limited number of enumerable options.
    - *Bad* for testing ranges of values, deciding between two mutually exclusive options.

switch Statements

- Switch statements – suitability

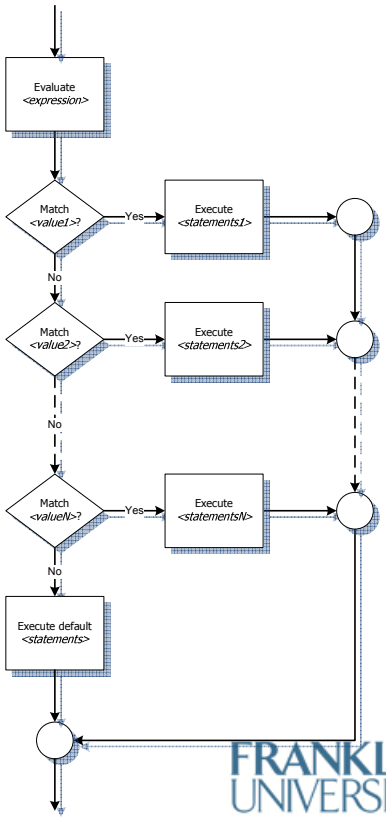
Example	If/else or switch?
Determining point values of letter grades.	
Determining letter grades from a percentage.	
Determining insurance rates based on age.	
Determine the name of a month based on a month number.	
Determine form letter salutation based on gender.	

switch Statements

- Switch statements

```
switch (<expression>) {
    case <value1>:
        <statements1>;
        break;
    case <value2>:
        <statements2>;
        break;
    //...
    case <valueN>:
        <statements2>;
        break;
    default:
        <statements>;
        break;
}
```

What if "break" is missing?



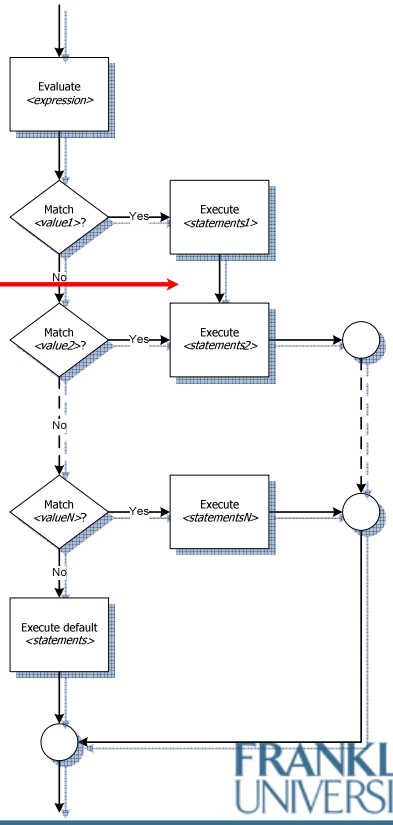
`switch` Statements

- Switch statements

```
switch (<expression>) {
    case <value1>:
        <statements1>;

    case <value2>:
        <statements2>;
        break;
    //...
    case <valueN>:
        <statements2>;
        break;
    default:
        <statements>;
        break;
}
```

Execution "falls through" to the next case!



`switch` Statements

- Switch statements
  - Ex: prerequisites for courses

Course	Prerequisite(s)
ITEC 495	ITEC 400, MIS 484, ITEC 430
ITEC 400	ITEC 136, ITEC 275
ITEC 430	MIS 310, MIS 320, MATH 215
MIS 310	COMM 320
MIS 320	COMM 320
ITEC 350	ITEC 136, ITEC 275
ITEC 450	COMP 281

switch Statements

```
function prerequistesFor(course) {
    var result = "";
    switch (course) {
        case "ITEC495":
            result += "MIS484, ITEC400, ITEC430"; break;
        case "ITEC350":
        case "ITEC400":
            result += "ITEC136, ITEC275"; break;
        case "ITEC136":
            result += "COMP107 MATH160"; break;
        case "MIS310":
        case "MIS320":
            result += "COMM320"; break;
        case "ITEC430":
            result += "MIS310, MIS320, MATH 215"; break;
        case "ITEC450":
            result += "COMP281"; break;
        default:
            alert("Unknown course: " + course)
    }
    return result;
}
```

Note the fall through cases for ITEC 350 and MIS 310.

switch or if / else

- Any `switch` can be rewritten as a series of `if` / `else` statements.
  - This is a good exam question…

`switch` Statements

```
function prerequistesFor(course) {
    var result = "";
    switch (course) {
        case "ITEC495":
            result += "MIS484, ITEC400, ITEC430"; break;
        case "ITEC350":
        case "ITEC400":
            result += "ITEC136, IT
        case "ITEC136":
            result += "COMP107 MAT
        case "MIS310":
        case "MIS320":
            result += "COMM320"; b
        case "ITEC430":
            result += "MIS310, MIS
        case "ITEC450":
            result += "COMP281"; b
        default:
            alert("Unknown course:
    }
    return result;
}
```

```
function prerequistesFor(course){
    var result = "";
    if (course == "ITEC495") {
        result += "MIS484, ITEC400, ITEC430";
    } else if (course == "ITEC350" ||
        course == "ITEC400") {
        result += "ITEC136, ITEC275";
    } else if (course == "ITEC136" ){
        // more if/else cases removed...
    } else {
        alert("Unknown course: " + course)
    }
    return result;
}
```


Try it yourself…

- For the suitable cases mentioned previously, try writing a switch statement to determine the answer.

Questions?

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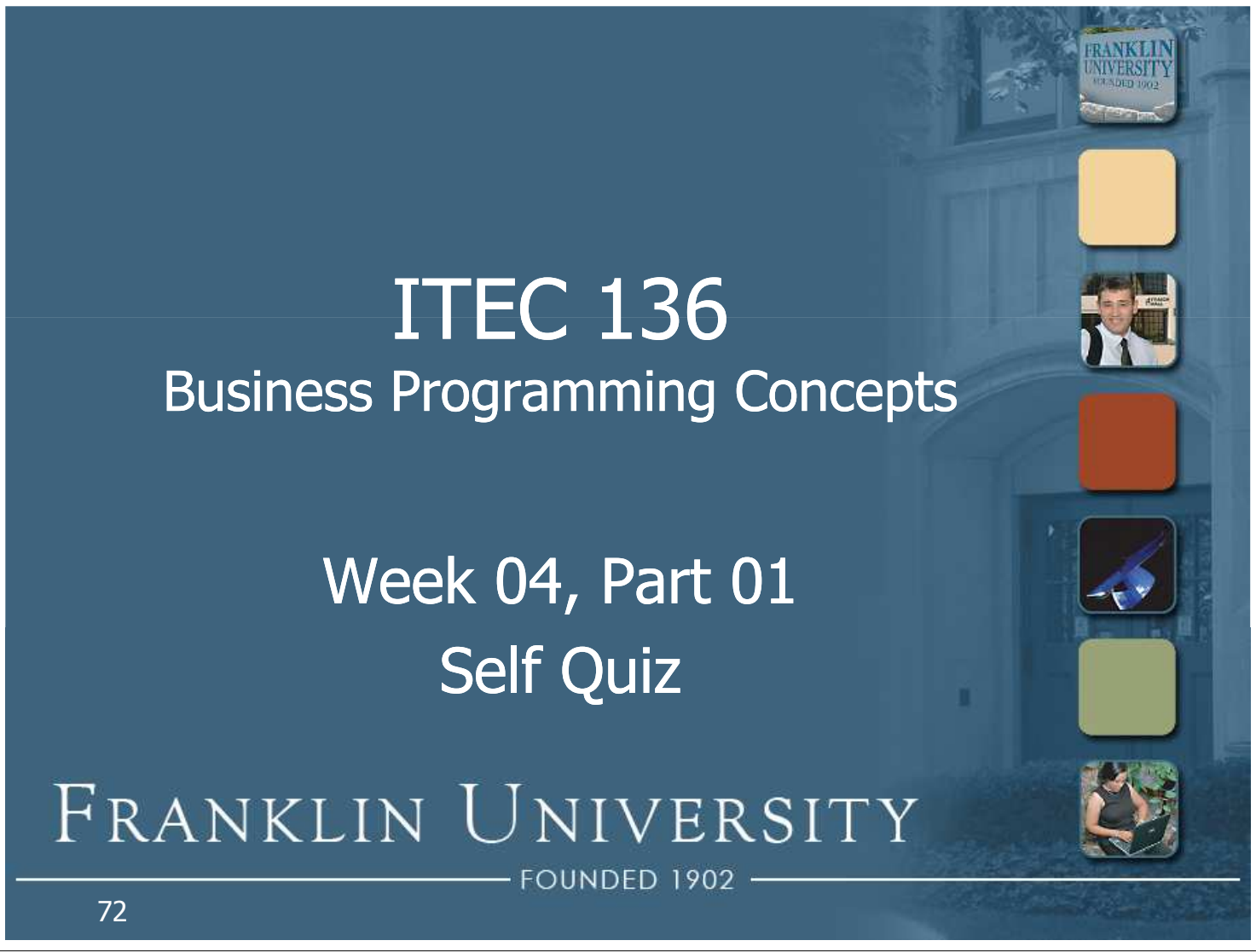

ITEC 136

Business Programming Concepts

Week 04, Part 01

Self Quiz

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Self Quiz

- Question 1: An "if" statement whose condition evaluates to "true" can only execute a single statement after the "if" unless the statements are surrounded by _____.

Self Quiz

- Question 2: When the value returned by a "switch" statement does not match a "case" label, then the statements with the _____ label execute.

Self Quiz

- Question 3: In the following code, which line contains the "if" statement that corresponds to the "else" on line 4?

```
1.  if (a < 10)
2.    if (b > 7)
3.      x = 5;
4.  else
5.    x = 7;
```


Self Quiz

- Question 4: This program pops up "foo" as the result. What is the problem?

```
1.  var x = "5";
2.  var result;
3.  if (x = 7)
4.    result = "foo";
5.  else
6.    result = "bar";
7.  alert(result);
```

Self Quiz

- Question 5: Water exists in three states (solid, liquid, and gas) at one atmosphere of pressure based on the current temperature. Given a temperature as input, you are to alert the user about the state of water at that temperature. Should you use an if/else or a switch? Why?

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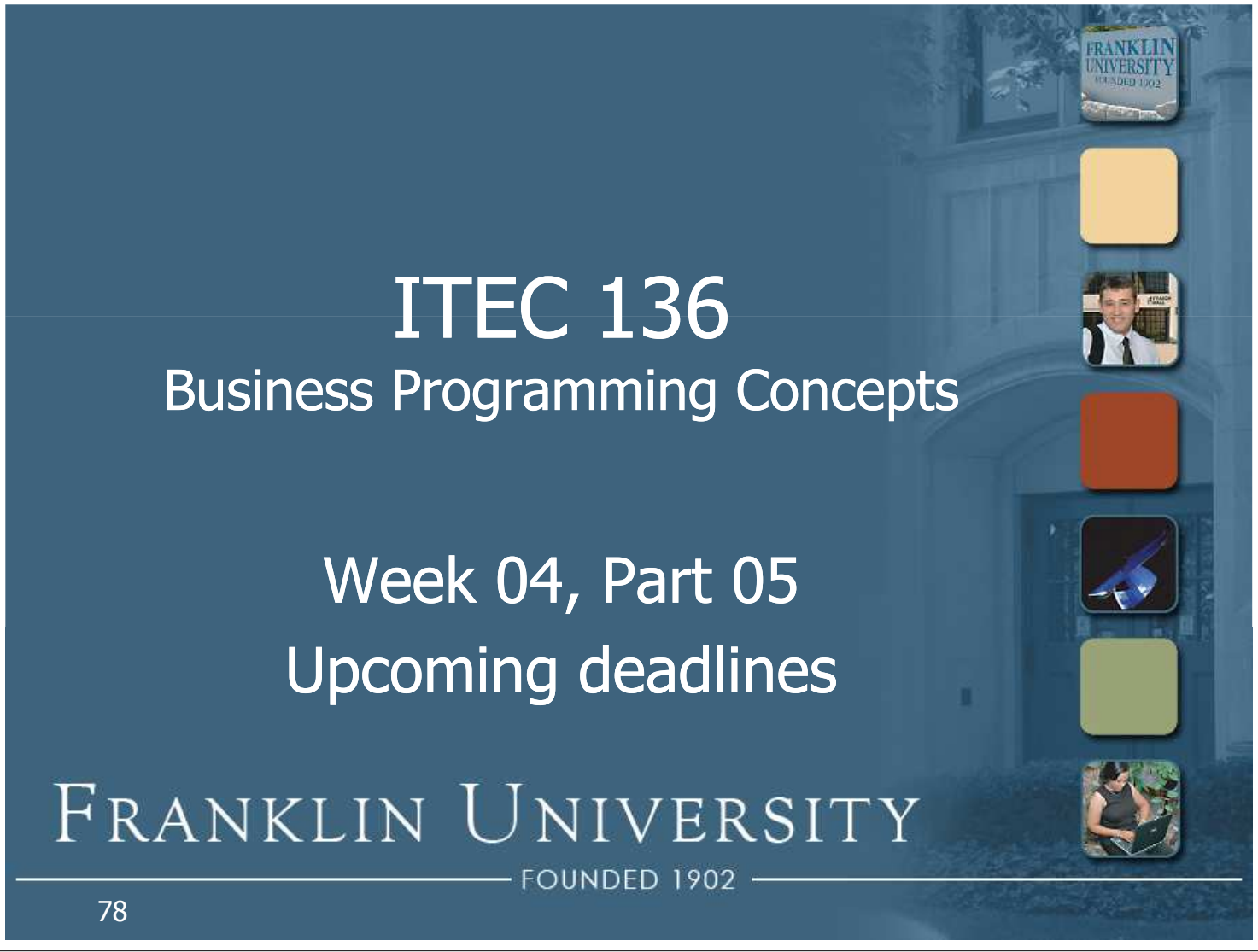

ITEC 136

Business Programming Concepts

Week 04, Part 05

Upcoming deadlines

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Upcoming Deadlines

- Lab 1 – Due February 2
- Exam 1 – In class February 2
- Reflection paper draft 1 – Due February 2
- Week 6 pre-class exercise – Due February 9

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