CSE 1530

Introduction to Computer Use II: Programming

Winter 2005 (Section M)

Topic C: Control Structures - Selection

Monday, January 30 2006

Bill Kapralos

Overview (1):

- **Before We Begin**
  - Some administrative details
  - Some questions to consider
- **Topic Overview**
  - Introduction to Topic C
- **Boolean Expressions**
  - Introduction to Boolean expressions
  - Boolean expressions in greater detail
  - Visual Basic example

Before We Begin

Administrative Details (1):

- **Lab Exercise 4-4**
  - This week, you should be working on Ex. 4-4 from your textbook
  - Due Monday, February 6 2006 before noon
    - As usual, place in the assignment drop-box located on the 1st floor of the CSE building just by the elevator and CSE undergraduate offices
  - Wednesday's office hours will be held in the Glade lab

Administrative Details (1):

- **Test 1**
  - Weight → 15%
  - Wednesday, February 8 2006 (entire period)
  - Recall that you do no have to write the test (if you don't, weight of the test will transferred to weight of final)
    - Probably a good idea to write it however!
  - More about the test on Friday

Some Questions to Consider (1):

- Describe how we can determine whether to declare a variable global or local ?
- Why not simply declare all variables global ?
- Do variables have to be explicitly declared ?
- What is the "Option Explicit" statement ?
- Why use the "Option Explicit" statement ?

Topic Overview

Introduction (1):

- **Up Until This Point, All Our Statements Relied on Sequential Processing**
  - We have used operators and variables to form expressions and assigned value resulting from the expression to a variable or object property
  - These statements have been executed sequentially → one after the other in the order they appear within the code of the event handler (e.g., in sequence)
    - This is of course very limiting → not adequate for many tasks we want to accomplish!

Introduction (2):

- **Limitations of Sequential Processing**
  - Does not provide the programmer the option of taking separate "program paths" depending on the outcome of certain operations
    - User input example → perhaps we want to perform one task if the user enters "x" and another task if the user enters "y"
    - Error checking example → what if we can examine a user's input to determine whether it is valid or not and perform one task if it is valid and another if it is not ?

Introduction (3):

- **Overview of Topic C**
  - We will learn how to write projects (programs) that can take one action or another based on a condition
    - How we can go about making the selection of which statements to execute within our code
  - Main concepts of the this topic
    - Comparison operators
    - Selection statements
    - Boolean operators
    - Option button and checkbox controls
    - Validation of user input

Boolean Expressions

Introduction (1):

- **True / False Considerations**
  - Any decision as to whether or not to take one course of action or whether to take one course of action instead of another is essentially the result of a true / false consideration
  - One action is taken only, not both!
  - For example → "Do I have enough money to do this?"
    - If the expression is true then I do have enough money hence I can "do this" otherwise, expression is false and I "cannot do this" since I don't have enough money

Introduction (2):

- **True / False Considerations (cont.)**
  - In a computer program you can also set up an expression that results in a true / false answer and determine program execution based on this outcome
    - This is actually a very powerful asset of any computer programming language including Visual Basic!
  - A decision made by the computer is formed as a question → Is a given condition true or false ?
    - If true, do one thing
    - If false, do something else

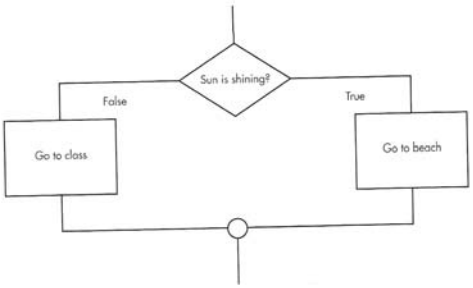
Introduction (3):

- **True / False Considerations (cont.)**
  - For example

```
If the sun is shining Then      (condition)
  go to the beach               (action to take if condition is true)
Else
  go to class                   (action to take if condition is false)
End If
```

Introduction (4):

- **True / False Considerations (cont.)**
  - Flowchart illustrations of previous examples



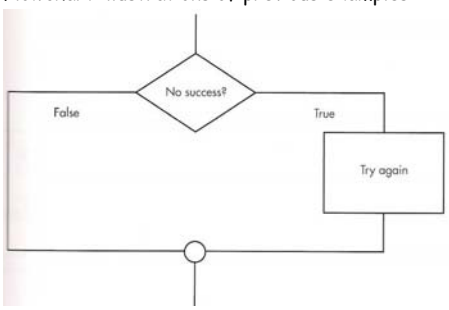
Introduction (5):

- **True / False Considerations (cont.)**
  - Another example
    - In this example, no action is explicitly taken if the condition is not true → action taken only if condition is true

```
If you don't succeed Then      (condition)
  try, try again               (action)
End If
```

Introduction (6):

- **True / False Considerations (cont.)**
  - Flowchart illustrations of previous examples



Boolean Expressions (1):

- **What is a Boolean Expression ?**
  - In a programming language, True / False conditions are expressed with Boolean expressions
  - Essentially a comparison between two values (variables)
  - Evaluate to either True or False
  - But aren't there many types of comparisons that can be made → yes!
    - Visual Basic does allow for various different comparisons to be made with various comparison operators

Boolean Expressions (2):

- **What is a Boolean Expression ? (cont.)**
  - Commonly used Visual Basic comparison operators

OPERATOR	DESCRIPTION
<	Less than
<=	Less than or equal to
>	Greater than
>=	Greater than or equal to
=	Equal to
<>	Not equal to

Boolean Expressions (3):

- **Using Comparison Operators**
  - Examples
    - myMoney > priceOfItem → compare whether "myMoney" is greater than priceOfItem and if it is, the expression evaluates to True (e.g., entire expression is replaced with True) otherwise it evaluates to False
    - myMoney = priceOfItem → Check whether myMoney is equal to priceofItem and if it is, the expression evaluate to True otherwise it evaluates to False

Boolean Expressions (4):

- **Using Comparison Operators (cont.)**
  - Be careful when using the comparison operators!
    - Should ensure that the data types of both the values (variables) are the same
    - Visual Basic will of course attempt to convert values for you but remember → result may not necessarily be what you expect
    - At times the automatic conversion by Visual Basic may give expected results → 2 > 2.3 will evaluate to False as expected (integer and double)
    - Result may not be correct when comparing Single and Double values → (Double converted to Single)

Boolean Expressions (5):

- **Equality vs. Assignment**
  - But we have seen that the "=" operator is the assignment operator ??? But we just saw it is also used as a comparison operator ???
    - In most other programming languages, a separate operator is used for the equality operator → for example, in C/C++ the comparison operator is "=="
    - There are some dangers associated with this → for example, if we want to compare two variables but we use the assignment operator accidentally varA = varB instead of varA == varB

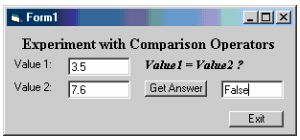
Boolean Expressions (6):

- **Equality vs. Assignment (cont.)**
  - In Visual Basic, the "=" operator has a dual meaning → correct meaning determined based on context!
    - Can be used as the assignment operator
    - Can also be used as the comparison operator
    - Determining correct meaning based on context can lead to confusion at times → what does the following mean and under what circumstances might the following be valid ?

```
varOne = varTwo = varThree
```

Boolean Expressions (7):

- **Equality vs. Assignment (cont.)**
  - Lets experiment with Boolean expressions by working with Exercise 4-1



  - Simple program to enter two values & compare them
    - We will experiment with various types by changing the program code of course!

Boolean Expressions (8):

- **Equality vs. Assignment (cont.)**
  - Lets take a closer look
    - varThree = (varOne = varTwo)
  - Meaning by context → what happens if the brackets are removed ??
    - varThree = varOne = varTwo
  - What happens if varThree is not a Boolean ?