Control Structures: 
Selection

CE 311 K - Introduction to Computer Methods

Daene C. McKinney

Introduction

• ASCII (ANSI) Character Set
• Relational Operators
• Logical Operators
• Program Control – Selection
  – If/Then, If/Else/Then, …
ASCII Characters

- All info is stored in the computer as strings of 0's and 1's
- Each character is coded to a binary value
- ASCII (American Standard Code for Information Interchange)
- Codes 33 to 126, represent letters, digits, punctuation marks, and a few miscellaneous symbols

ASCII Character Set

<table>
<thead>
<tr>
<th>Dec</th>
<th>Hex</th>
<th>Char</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>00</td>
<td>NUL</td>
</tr>
<tr>
<td>1</td>
<td>01</td>
<td>SOH</td>
</tr>
<tr>
<td>2</td>
<td>02</td>
<td>STX</td>
</tr>
<tr>
<td>3</td>
<td>03</td>
<td>ETX</td>
</tr>
<tr>
<td>4</td>
<td>04</td>
<td>EOT</td>
</tr>
<tr>
<td>5</td>
<td>05</td>
<td>ENQ</td>
</tr>
<tr>
<td>6</td>
<td>06</td>
<td>ACK</td>
</tr>
<tr>
<td>7</td>
<td>07</td>
<td>BEL</td>
</tr>
<tr>
<td>8</td>
<td>08</td>
<td>BS</td>
</tr>
<tr>
<td>9</td>
<td>09</td>
<td>HT</td>
</tr>
<tr>
<td>10</td>
<td>0A</td>
<td>LF</td>
</tr>
<tr>
<td>11</td>
<td>0B</td>
<td>VT</td>
</tr>
<tr>
<td>12</td>
<td>0C</td>
<td>FF</td>
</tr>
<tr>
<td>13</td>
<td>0D</td>
<td>CR</td>
</tr>
<tr>
<td>14</td>
<td>0E</td>
<td>SO</td>
</tr>
<tr>
<td>15</td>
<td>0F</td>
<td>SI</td>
</tr>
<tr>
<td>16</td>
<td>10</td>
<td>DLE</td>
</tr>
<tr>
<td>17</td>
<td>11</td>
<td>DC1</td>
</tr>
<tr>
<td>18</td>
<td>12</td>
<td>DC2</td>
</tr>
<tr>
<td>19</td>
<td>13</td>
<td>DC3</td>
</tr>
<tr>
<td>20</td>
<td>14</td>
<td>DC4</td>
</tr>
<tr>
<td>21</td>
<td>15</td>
<td>NAK</td>
</tr>
<tr>
<td>22</td>
<td>16</td>
<td>SYN</td>
</tr>
<tr>
<td>23</td>
<td>17</td>
<td>ETB</td>
</tr>
<tr>
<td>24</td>
<td>18</td>
<td>CAN</td>
</tr>
<tr>
<td>25</td>
<td>19</td>
<td>MS</td>
</tr>
<tr>
<td>26</td>
<td>1A</td>
<td>BS</td>
</tr>
<tr>
<td>27</td>
<td>1B</td>
<td>HT</td>
</tr>
<tr>
<td>28</td>
<td>1C</td>
<td>LF</td>
</tr>
<tr>
<td>29</td>
<td>1D</td>
<td>VT</td>
</tr>
<tr>
<td>30</td>
<td>1E</td>
<td>FF</td>
</tr>
<tr>
<td>31</td>
<td>1F</td>
<td>DLE</td>
</tr>
</tbody>
</table>

http://www.chris.com/ASCII/
ASCII Character Set

<table>
<thead>
<tr>
<th>Dec</th>
<th>Hex</th>
<th>Char</th>
<th>Dec</th>
<th>Hex</th>
<th>Char</th>
<th>Dec</th>
<th>Hex</th>
<th>Char</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>00</td>
<td>Null</td>
<td>32</td>
<td>20</td>
<td>Space</td>
<td>64</td>
<td>40</td>
<td>B</td>
</tr>
<tr>
<td>1</td>
<td>01</td>
<td>Start of heading</td>
<td>65</td>
<td>41</td>
<td>A</td>
<td>96</td>
<td>60</td>
<td>:</td>
</tr>
<tr>
<td>2</td>
<td>02</td>
<td>Start of text</td>
<td>66</td>
<td>42</td>
<td>B</td>
<td>97</td>
<td>61</td>
<td>a</td>
</tr>
<tr>
<td>3</td>
<td>03</td>
<td>End of text</td>
<td>67</td>
<td>43</td>
<td>C</td>
<td>98</td>
<td>62</td>
<td>d</td>
</tr>
</tbody>
</table>

- \( \text{Chr}(n) = \) character with ASCII value \( n \) (\( 0 < n < 255 \))
- \( \text{Asc}(str) = \) ASCII value of the first character of \( str \)
- TextBox1.Text = \( \text{Chr}(65) \) displays “A”
- ListBox1.Items.Add(Asc(“Apple”)) displays 65

Relational Operators

= equal to
<> not equal to
< less than
> greater than
\( \leq \) less than equal to
\( \geq \) greater than equal to

- All relational operators have equal precedence and are evaluated left to right
Example - Relational Operators

**True or false?**

- $1 \leq 1$
- $1 < 1$
- "car" < "cat"
- "Dog" < "dog"

<table>
<thead>
<tr>
<th>Expression</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>$5 = 1$</td>
<td>0 (false)</td>
</tr>
<tr>
<td>$5 &gt; 1$</td>
<td>1 (true)</td>
</tr>
<tr>
<td>$5 &lt;&gt; 1$</td>
<td>1 (true)</td>
</tr>
<tr>
<td>$5 + 10 = 3 * 5$</td>
<td>1 (true)</td>
</tr>
</tbody>
</table>

Logical Operators

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
<th>Example</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>And</td>
<td>Both sides must be true</td>
<td>T And T</td>
<td>T</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F And T</td>
<td>F</td>
</tr>
<tr>
<td>Or</td>
<td>One side or other must be true</td>
<td>T Or T</td>
<td>T</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F Or T</td>
<td>T</td>
</tr>
<tr>
<td>Not</td>
<td>Negates truth</td>
<td>Not (T)</td>
<td>F</td>
</tr>
</tbody>
</table>
Logical Operators

<table>
<thead>
<tr>
<th>A</th>
<th>not A</th>
<th>B</th>
<th>not B</th>
<th>A and B</th>
<th>A or B</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>F</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
</tbody>
</table>

Examples

Suppose: \( n = 4 \) and \( ans = \text{"Y"} \)

True or False?

1. \(( 2 < n ) \text{ AND } ( n < 6 )\)
2. \(( \text{ans} < n ) \text{ OR } ( n = 6 )\)
3. \(\text{NOT } ( n < 6 )\)
4. \(( \text{ans} = \text{"Y"} ) \text{ OR } ( \text{ans} = \text{"y"} )\)
5. \(\text{NOT } ( \text{ans} = \text{"y"} )\)
6. \(( ( \text{ans} < n ) \text{ AND } ( n = 7 ) ) \text{ OR } ( \text{ans} = \text{"Y"} )\)
7. \(( n - 2 ) \text{ AND } (( n = 7 ) \text{ OR } ( \text{ans} = \text{"y"} ))\)
Order of Operations

1. Parentheses
2. ^
3. * / \ MOD
4. + -
5. NOT
6. AND
7. OR

3 * 5 > 8 * 2 OR 6 * 7 < 100 – 5 ^ 2

T or F?

Program Control

• Sequence
• Selection
• Repetition
Selection: If – Then

If \textit{condition} Then
Action 1
End If

Is the condition true?

No
Yes
Execute Action 1

Selection: If – Then – Else

If \textit{condition} Then
Action 1
Else
Action 2
End If

Is the condition true?

No
Yes
Execute Action 1
Execute Action 2
Selection: If – Then (variations)

If – Then

\[ \begin{array}{c}
? \\
Y \\
\text{Y} \\
\text{N} \\
\text{N}
\end{array} \]

If – Then - Else

\[ \begin{array}{c}
? \\
Y \\
\text{Y} \\
\text{N}
\end{array} \]

If – Then - Elseif

\[ \begin{array}{c}
? \\
Y \\
\text{N}
\end{array} \]

Example

- Find the larger of two numbers input by a user

```vbnet
Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Button1.Click
    Dim num1, num2, large As Double
    num1 = CDbl(TextBox1.Text)
    num2 = CDbl(TextBox2.Text)
    If num1 > num2 Then
        large = num1
    Else
        large = num2
    End If
    TextBox3.Text = "Larger number = " & large
End Sub
```
Example

• This if block has a logical operator in its condition

```vba
Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
    Dim answer As Double
    answer = CDbl(TextBox1.Text)
    If (answer >= 0.5) And (answer <= 1) Then
        TextBox2.Text = "Good."
    Else
        TextBox2.Text = "No."
    End If
    TextBox1.Text = "It holds about 3/4 gallon."
End Sub
```

Example

• If the two numbers are equal, the program reports this

```vba
Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
    Dim num1, num2 As Double
    num1 = CDbl(TextBox1.Text)
    num2 = CDbl(TextBox2.Text)
    If num1 > num2 Then
        TextBox3.Text = "The larger number is: " & num1
    ElseIf num1 < num2 Then
        TextBox3.Text = "The larger number is: " & num2
    Else
        TextBox3.Text = "The two numbers are equal."
    End If
End Sub
```
Select Case Statement

Select Case testExpression
  Case a
    statements-a
  Case b
    statements-b
  Case c
    statements-c
  ...  
  Case z
    statements-z
  Case else
    statements-else
End Select

Summary

• ASCII (ANSI) Character Set
• Relational Operators
• Logical Operators
• Program Control – Selection
  – If/Then, If/Else/Then, ...