Repetition Algorithms
Repetition

- Allows a program to execute a set of instructions over and over.
- The term loop is a synonym for a repetition statement.
A Repetition Example

Suppose that you have been asked to write a program that allows the user to enter 5 integers and displays the sum of the integers on the screen.
## A Repetition Example

<table>
<thead>
<tr>
<th>Input</th>
<th>Processing</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 integers Num1 Num2 Num3 Num4 Num5</td>
<td>Display instructions Get Num1, Num2, Num3, Num4 and Num5 Calculate the Total Display label and Total</td>
<td>Total</td>
</tr>
</tbody>
</table>
A Repetition Example

AddFive
   Display instructions
   Get Num1, Num2, Num3, Num4, and Num5
   Total = Num1 + Num2 + Num3 + Num4 + Num5
   Display label and Total

End
A Repetition Example - While

AddFive(While Version)

Display instructions
Total = 0
Counter = 1
While Counter <= 5
    Get Num
    Total = Total + Num
    Counter = Counter + 1
End While
Display Total
End
# A Repetition Example

<table>
<thead>
<tr>
<th>AddFive(While Version)</th>
<th>Total</th>
<th>Counter</th>
<th>Num</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display instructions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total = 0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counter = 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>While Counter &lt;= 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Get Num</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total = Total + Num</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counter = Counter + 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End While</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display Total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A Repetition Example - Until

AddFive(Until Version)
    Display instructions
    Total = 0
    Counter = 1
    Do until Counter = 6
        Get Num
        Total = Total + Num
        Counter = Counter + 1
    End do
    Display Total
End
### A Repetition Example

<table>
<thead>
<tr>
<th>AddFive(Until Version)</th>
<th>Total</th>
<th>Counter</th>
<th>Num</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display instructions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total = 0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counter = 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do until Counter = 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Get Num</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total = Total + Num</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counter = Counter + 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End do</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display Total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A Repetition Example - For

AddFive(For Version)
  Display instructions
  Total = 0
  For Counter = 1 to 5
    Get Num
    Total = Total + Num
  End for
  Display Total
End
A Repetition Example

<table>
<thead>
<tr>
<th>Total</th>
<th>Counter</th>
<th>Num</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AddFive(For Version)
  Display instructions
  Total = 0
  For Counter = 1 to 5
    Get Num
    Total = Total + Num
  End for
  Display Total
End
A Repetition Example – While Exit

AddFive (While Exit Version)
Display instructions
Total = 0
Counter = 1
Do

Get Num
Total = Total + Num
Counter = Counter + 1
While Counter <= 5
Display Total
End
## A Repetition Example

<table>
<thead>
<tr>
<th>AddFive (While Exit Version)</th>
<th>Total</th>
<th>Counter</th>
<th>Num</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display instructions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total = 0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counter = 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Get Num</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total = Total + Num</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counter = Counter + 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>While Counter &lt;= 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display Total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A Repetition Example – Until Exit

AddFive (Until Exit Version)
Display instructions
Total = 0
Counter = 1
Do
  Get Num
  Total = Total + Num
  Counter = Counter + 1
Until Counter = 6
Display Total
End
A Slightly Different Example

Assume that you have been asked to write a program that allows the user to enter and add positive integers. The user will enter any negative number when he/she is finished entering numbers and would like to see the result. The “dummy” number used to stop processing should not be added to the total.
## A Slightly Different Example

<table>
<thead>
<tr>
<th>Input</th>
<th>Processing</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>A set of positive integers. Any negative</td>
<td>Display instructions</td>
<td>Total</td>
</tr>
<tr>
<td>number can be used to stop processing.</td>
<td>Repeat for each number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Get the number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Add number to total</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Display label and Total</td>
<td></td>
</tr>
</tbody>
</table>
A Slightly Different Example

AddPositiveNumbers (While Version)
Display instructions
Total = 0
Get Num
Do while Num >= 0
  Total = Total + Num
  Get Num
End while
Display Total
End
A Slightly Different Example

<table>
<thead>
<tr>
<th>AddPositiveNumbers (While Version)</th>
<th>Total</th>
<th>Num</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display instructions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total = 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Get Num</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do while Num &gt;= 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total = Total + Num</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Get Num</td>
<td></td>
<td></td>
</tr>
<tr>
<td>End while</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>End</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A Slightly Different Example

AddPositiveNumbers (While Exit Version 1)

Display instructions
Total = 0
Do
  Get Num
  Total = Total + Num
While Num >= 0
Display Total
End
A Slightly Different Example

<table>
<thead>
<tr>
<th>AddPositiveNumbers (While Exit Version)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display instructions</td>
</tr>
<tr>
<td>Total = 0</td>
</tr>
<tr>
<td>Get Num</td>
</tr>
<tr>
<td>Do</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Get Num</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total = Total + Num</td>
</tr>
<tr>
<td>While Num &gt;= 0</td>
</tr>
<tr>
<td>Display Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total</th>
<th>Num</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

End
A Slightly Different Example

AddPositiveNumbers (While Exit Version 2)
Display instructions
Total = 0
Do
  Get Num
  If Num >= 0 Then
    Total = Total + Num
  End if
While Num >= 0
Display Total
End
### A Slightly Different Example

```
AddPositiveNumbers (While Exit Version 2)
   Display instructions
   Total = 0
   Do
      Get Num
      If Num >= 0 Then
         Total = Total + Num
      End if
   While Num >= 0
   Display Total
End
```
With Any Problem

• Follow the same process
  ▪ Can you ask clarifying questions?
  ▪ Can you create an IPO chart?
  ▪ Can you write an algorithm?
    • Can you do an example or describe the process in English?
    • Can you generalize that?
    • Does any of the processing involve selection?
    • Does any of the processing involve repetition?
Practice Problem

Assume that you are creating a program that will count the number of students in a class who are getting an A. The user will enter the letter grade for each student in the class, one grade at a time and will enter an S when all grades have been entered. The program will display the number of A grades to the screen.
Practice Problem

Assume that you are creating a program that will count the number of students in a class who are passing a course. The user will enter an integer value between 1 and 100 for each student in the class, one grade at a time and will enter a 0 when all grades have been entered. Students who score below 70 do not pass the course. The program will display the number of passing scores to the screen.
A More Complex Repetition Problem

Assume that you are creating a program that will be used by customers to locate a specific movie in a video store. The customer should be allowed to enter the name of the movie and the program will display the location of the movie on the screen.
A More Complex Repetition Problem

LookupMovie
  Display instructions
  Found = False
Get MovieTitle
Get first MovieRecord
Do Until Found or End Of File
  If MovieTitle = MovieRecord.Title Then
    Found = True
  Else
    Get nextMovieRecord
  End if
End Do
If Found Then
  Display label and MovieRecord.Location
Else
  Display "Not Available" message
End If
End
Practice Problem

Assume that you are creating a program that will determine if a number is a prime number. The user enters an integer between 4 and 100. The program prints either “Prime” or “Composite”.

Practice Problem

Assume that you’ve been asked to write a program that displays a multiplication chart like the one given below. The user enters an integer that represents the “dimension” of the chart.

```
1  2  3   4
2  4  6   8
3  6  9  12
4  8 12 16
```