

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

Input	Processing	Output
5 integers Num1 Num2 Num3 Num4 Num5	Display instructions Get Num1, Num2, Num3, Num4 and Num5 Calculate the Total Display label and Total	Total

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

	Total	Counter	Num
<p>AddFive(While Version)</p> <p> Display instructions</p> <p> Total = 0</p> <p> Counter = 1</p> <p> While Counter <= 5</p> <p> Get Num</p> <p> Total = Total + Num</p> <p> Counter = Counter + 1</p> <p> End While</p> <p> Display Total</p> <p>End</p>			

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

	Total	Counter	Num
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 - 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

	Total	Counter	Num
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

	Total	Counter	Num
<p>AddFive (While Exit Version)</p> <p>Display instructions</p> <p>Total = 0</p> <p>Counter = 1</p> <p>Do</p> <p> Get Num</p> <p> Total = Total + Num</p> <p> Counter = Counter + 1</p> <p>While Counter <= 5</p> <p>Display Total</p> <p>End</p>			

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

Input	Processing	Output
<p>A set of positive integers. Any negative number can be used to stop processing.</p>	<p>Display instructions Repeat for each number Get the number Add number to total Display label and Total</p>	<p>Total</p>

A Slightly Different Example

AddPositiveNumbers (While Version)

Display instructions

Total = 0

Get Num

Do while Num \geq 0

 Total = Total + Num

 Get Num

End while

Display Total

End

A Slightly Different Example

	Total	Num
<p>AddPositiveNumbers (While Version)</p> <p> Display instructions</p> <p> Total = 0</p> <p> Get Num</p> <p> Do while Num >= 0</p> <p> Total = Total + Num</p> <p> Get Num</p> <p> End while</p> <p> Display Total</p> <p>End</p>		

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

	Total	Num
AddPositiveNumbers (While Exit Version) Display instructions Total = 0 Get Num Do Get Num Total = Total + Num While Num >= 0 Display Total End		

A Slightly Different Example

AddPositiveNumbers (While Exit Version 2)

Display instructions

Total = 0

Do

 Get Num

 If Num \geq 0 Then

 Total = Total + Num

 End if

While Num \geq 0

Display Total

End

A Slightly Different Example

	Total	Num
<p>AddPositiveNumbers (While Exit Version 2)</p> <p> Display instructions</p> <p> Total = 0</p> <p> Do</p> <p> Get Num</p> <p> If Num \geq 0 Then</p> <p> Total = Total + Num</p> <p> End if</p> <p> While Num \geq 0</p> <p> Display Total</p> <p>End</p>		

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