
Let's all Repeat Together

Last Time

- We
 - Looked at complex examples that use the `if` selection structure
 - Covered the `if/else` selection structure
 - Learnt about the `?:` conditional operator
- Today we will
 - Learn how to nest `if/else` selection structures
 - Start looking at examples of repetition structures

Nested if/else Selection Structures

- What if there are more than two alternatives in a solution?

```
if (condition1)
    statement1;
else if (condition2)
    statement2;
...
else
    default statement;
```

Problem

- Write a C++ program segment that allows the user the ability to input an integer from the keyboard. If the integer is positive, increment a variable `poscount` by 1. If the integer is negative, increment a variable `negcount` by 1. If neither, increment `zerocount` by 1

Solution

```
cin >> intvalue;
if(intvalue > 0)
    poscount = poscount + 1;
else if(intvalue < 0)
    negcount = negcount + 1;
else
    zerocount = zerocount + 1;
```

- Can you come up with another way of doing this?

Solution

- Will this solution work?
- ```
cin >> intvalue;
if(intvalue > 0)
 poscount = poscount + 1;
if(intvalue < 0)
 negcount = negcount + 1;
if(intvalue = 0)
 zerocount = zerocount + 1;
```

## Problem

- Write a program that displays a letter grade corresponding to an exam score
  - 90 - 100 A
  - 80 - 89 B
  - 70 - 79 C
  - 60 - 69 D
  - 0-59 F

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## Repetition Structures

- All the C++ programs that we have seen so far are executed only once before the program terminates
- However, it is often the case that programmers would like to specify that an action continue repeating while a condition is true
- This is achieved by using repetition structures, also called loops

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## An Example of Repetition

- An example of where we might need to use repetition is if we are calculating the average grade of a class of students
- We would need to continue reading in student grades until we have covered all students
- In pseudocode this might be:
  - While there are more students in the class
  - Ask for student grade

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## C++ Example

- Write the segment of C++ code that will sum five numbers entered by the user

```
int sum, counter, num;

sum = 0;
counter = 0;

while(counter < 5)
{
 cout << "Enter a number: ";
 cin >> num;

 sum = sum + num;
 counter = counter + 1;
}

cout << "The sum of your numbers is: " << sum;
```

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## while Repetition Structure

```
int sum, counter, num;
sum = 0;
counter = 1;
while(counter <= 5)
{
 cout << "Enter a number: ";
 cin >> num;

 sum = sum + num;
 counter = counter + 1;
}

cout << "The sum of your numbers is: " << sum;
```

Initialize LCV

Loop Control Variable

Change the value of count

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## while loops

- The syntax for while loops is

```
while (condition is true)
 statement;

while (condition is true)
{
 statement1;
 statement2;
 ...
}
```

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## Key Ingredients of `while` loops

- ◆ Initialize
  - MUST initialize loop control variable
- ◆ Test
  - The value of the loop control variable is tested during each iteration of loop
- ◆ Update
  - Loop control variable is changed during each loop iteration

*If any one of these is missing or incorrect, your loop won't run properly--not at all, too many/few times or infinitely.*

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## Problems

- ◆ Write a `while` loop that outputs each integer from 1 to 5

- ◆ What's the output for `x = 2? 3? 5?`

```
cout << "Enter an integer";
cin >> x;
product = x;
count = 0;
while (count < 4)
{
 cout << product << endl;
 product *= x;
 count += 1;
}
```

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## Summary

- ◆ In today's lecture we covered
  - Nested `if/else` selection structures
  - `while` repetition structure
- ◆ Readings
  - P. 79 - 81: nested `if/else` selection structures and `if` structures with multiple statements
  - P. 81 - 83: `while` repetition structure

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