Logical Operators and if/else statement

If Statement

- We may want to execute some code if an expression is **`true`**, and execute *some other code* when the expression is **`false`**.
- This can be done with two if statements…

```
if (value >= LIMIT)

{
    // do something
}
 if (value < LIMIT)
{
    // do something else
}
```

If/Else (4.3)

- C++ provides a shortcut to combine two `if` statements:
- The statements in the else clause are executed only when the expression is false.

```
if (expression)
{
   // do stuff
}
else
{
   // do other stuff
}
```

Example

```
int number;
cout << "Enter a number, I'll tell you";
cout << " if it is odd or even: ";
cin >> number;

// use an if/else statement here
```

if/else/if statements (4.4)

- What if there are more than two alternatives?

```
cout << "Enter two numbers: ";
cin >> num1 >> num2;

if(num1 > num2)
{
  cout << num1 << "is greater" << endl;
}
else if(num2 > num1)
{
  cout << num2 << "is greater" << endl;
}
else
{
  cout << "Numbers are equal" << endl;
}
```

Logical Operators (4.7)

- There are three logical operators

&&	And
||	Or
!	Not

Evaluating Expressions: And &&

- **`expr1 && expr2`**
- For the complete expression to be true, both expr1 and expr2 have to be true
- Example:

```
temp > HOT && humidity > STICKY
```

  - These are unbearable heat and humidity conditions
  - Both must be true for the entire expression to be true

Evaluating Expressions: Or ||

- **`expr1 || expr2`**
- The complete expression is true if either expr1 or expr2 is true
- Examples:

```
salary < MIN_SALARY || MARRIED == status
```

  - To qualify for financial aid, salary has to be less than some minimum salary or you must be married
  - Only one condition has to be true

Evaluating Expressions: Not !

- **`!expr`**
- Unary operator: Negation
- Examples:

```
!(salary < MIN_SALARY)
```

  - What makes this true? False?

Precedence

Precedence Operators (Highest to Lowest)

`- (negation)  ! (Logical NOT)`
`* / %`
`- +`

`<= => > <` `== !=`
`&&` `||`
`= += -= *= /= %=`

Expression Evaluation

- According to the operator precedence and associativity rules given on the previous slide, how will the following expressions be evaluated?

```
x < min + max

min <= x && x <= max

!x == y + 2

x = a + b % 7 * 2
```

Practice

- Are these two code snippets equivalent?

```
int x, y;
if(x > y)
{
   x += y;
}
if(y < x)
{
   y += x;
}
```

```
int x, y;
if(x > y)
{
   x += y;
}
else
{
   y += x;
}
```

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

```
int posCount=0, negCount=0, zeroCount=0;
```

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

```
double examGrade;
cin >> examGrade;
```

Nested if Statements (4.6)

- Note the indentation of the inner if

```
if (actual > expected)
{
   if (MAX == actual)
   {
   }
   else
   {
   }
}
else
{
}
```

Example

- Write nested if statements that set the correct value in the **`wage`** variable:

  If your status is full time, and you worked more than 10 years, your wage is $25. All other full time workers have a wage of $15. If your status is part time, you have a wage of $10.

```
const int FULLTIME=0, PARTTIME=1;
double wage;
int yearsWorked, status;
```

Example

- Your local bookstore has asked you to write a program to help them determine the cost of shipping of customers orders. If the order is $30 or less then shipping will cost $5, if the order is over $30 then shipping will be $3

Problem

- The bookstore has now changed its shipping policy so that
  - If the order is $30 or less, shipping is $5
  - If the order is over $30 but less than $50, shipping is $3
  - If the order is over $50 then shipping is $2

Practice

- Write these with nested ifs and without nested ifs
  - An Isosceles triangle has two sides of equal length
    - A Golden Isosceles triangle is a triangle where the ratio of the long side to the short side is the Golden Ratio, ½ * (1+√5) or approximately 1.6180339887…..
  - An Equilateral triangle has all sides of equal length
  - Write code to ask for three sides of a triangle and determine if the triangle is Isosceles, Golden Isosceles, Equilateral, or neither.
  - If the triangle is Isosceles or neither, determine if it is also a right triangle.

Practice

- Write these with nested ifs and without nested ifs
  - Determine if a number entered by a user is even or odd
  - For odd numbers, determine if the number is a multiple of 3, 5, or neither.
  - For even numbers, determine if the number is a multiple of 4, 10, or neither.

Practice

- Write these with nested ifs and without nested ifs
  - Determine if a decimal number entered by a user is even or odd in the hundredths place
    - 1.233342341
    - If it is odd, determine if the thousandths place is a multiple of the hundredths place
    - If it is even, determine if the hundredths place is a multiple of the thousandths place