Current Assignments

- Homework 1 due in 4 days (June 16th)

  Variables, mathematical and logical operators, input/output, and the "if" operator.

- Project 1 Due in 11 days (June 23rd)

  Write a binomial root solver using the quadratic equation.

- Homework 2 will be assigned on Monday and will be due Thursday.

Last Time

- Whitespace and Input/Output Revisited
- Boolean Operators
- The Programming Cycle
- The if control structure
- Lab: We wrote the parity program

This Time

- Homework 1
- The “if … else” control structure
- Nested “if” and “if … else” statements
- Project 1
- LAB

Homework 1

- Problem 1, Example 1
- Assume int x = 2; and int y = 3;
- cout << x << “+” << y;

- The answer should look like this:

2+3

Homework 1

- Problem 1, Example 2
- Assume int x = 2; and int y = 3;
- cout << x + y;

- The answer should look like this:

5

Homework 1

- Problem 1, Example 3
- Assume int x = 2; and int y = 3;
- cout << x << + << y;

- The answer should look like this:

Invalid C++ syntax

Homework 1

- Problem 2, Example 1
- Is the following statement a valid C++ representation of the equation $y = ax^3 + 7$.
- y = a*x* (x * x) + 7;

- The answer should look like this:

  Valid

Homework 1

- Problem 2, Example 1
- Is the following statement a valid C++ representation of the equation $y = ax^3 + 7$.
- y = axxx + 7;

- The answer should look like this:

  Invalid

Homework 1

- Problem 3, Example 1
- x = 7 + 2/8 * 10 * 6 * (6 + 7* (3 + 4));

- The answer should look like this:

  +*+/***+=, x = 7

Homework 1

- Problem 3, Example 2
- x = 7 + 10 * 2/8 * 6 * (6 + 7 * (3 + 4)));

- The answer should look like this:

+*+*/**+=, x = 667

Homework 1

- Problem 3, Example 3
- x = 7 + 10 * 2/8 ** 6 * (6 + 7 * (3 + 4)));

- The answer should look like this:

  invalid C++ syntax

Homework 1

- Problem 4, Example 1
- Write a single C++ statement to do the following:
  - Declare two floating point variables and call them foo and bar.
- The answer should look something like one of the following:

```
float foo, bar;
double foo = 0.0, bar = 0.0;
```

Homework 1

- Problem 4, Example 2
- Write a single C++ statement to do the following:
  - Print the values of foo and bar;
- The answer should look something like one of the following:

cout << foo << “ ” << bar;

cout << foo << “,” << bar << endl;

If… else…

Syntax:

```
if ( boolean_expression )
{
   statements 1…
}
else
{
   statements 2…
}
   statements 3…
```

boolean_expression is true? Then statement block 1 is executed

boolean_expression is false? Then statement block 2 is executed

Statement block 3 executed after the if… else…

If… else…, example 1

```
int x = 10;
if ( x % 2 == 0 )
{
   cout << “x is even”;
}
else
{
   cout << “x is odd”;
}
   cout << “, done” << endl;
```

x is even, done

If… else…, example 2

```
int x = 9;
if ( x % 2 == 0 )
{
   cout << “x is even”;
}
else
{
   cout << “x is odd”;
}
   cout << “, done” << endl;
```

x is odd, done

If… else…, example 3

```
int foo = 10, bar = 15;
if ( (foo < bar) && ((bar % 2) == 0) )
{
   foo = 2*bar;
}
else
{
   bar = 2*foo;
}
   cout << foo << “, ” << bar << endl;
```

10,30

If… else…, example 4

```
int foo = 10, bar = 12;
if ( (foo < bar) && ((bar % 2) == 0) )
{
   foo = 2*bar;
}
else
{
   bar = 2*foo;
}
   cout << foo << “, ” << bar << endl;
```

24, 12

Nested If statements

Syntax:

```
if ( bool_expr_1 )
{
   if ( bool_expr_2 )
   {
        statements …
   }
}
```

Same as:

```
if ( bool_expr_1 &&
     bool_expr_2)
{
        statements …
}
```

Nested If statements

Syntax:

```
if ( bool_expr_1 )
{
    statements…
    if ( bool_expr_2 )
    {
        statements…
    }
    statements…
}
```

Not the same as bool_expr_1 && bool_expr_2

Nested If statements

```
int x = 2, y = 5;
if ( x < y)
{
   cout << "x is smaller than y";

   if ( (x % 2) == 0)
   {
        cout << " and even";
   }
}
cout << ", done" << endl;
```

x is smaller than y and even, done

Nested If statements

```
int x = 3, y = 5;
if ( x < y)
{
   cout << "x is smaller than y";

   if ((x % 2) == 0)
   {
        cout << " and even";
   }
}
cout << ", done" << endl;
```

x is smaller than y, done

Nested If … else statements

Syntax:

```
if ( bool_expr_1 )
{
   statements…
}
else if ( bool_expr_2 )
{
   statements …
}
else
{
   statements …
}
```

Nested If … else statements, example 1

```
int grade = 82;
if ( grade > 90 )
{
    cout << “A”;
}
else if ( grade > 80 )
{
    cout << “B”;
}
else if ( grade > 70 )
{
    cout << “C”;
}
else
{
    cout << “D or F”;
}
```

Nested If … else statements, example 1

```
int grade = 10;
if ( grade > 90 )
{
    cout << “A”;
}
else if ( grade > 80 )
{
    cout << “B”;
}
else if ( grade > 70 )
{
    cout << “C”;
}
else
{
    cout << “D or F”;
}
```

Nested If … else statements, use braces

It is legal to leave out braces if you only execute one statement.

```
if( x > y)
   cout << “x greater than y”;

if( x > y )
    cout << “x greater than y”;
else if
    cout << “x less than y”;
```

Nested If … else statements, use braces

What about this?

```
int x = 5, y = 10;


if ( x > y)
        if ( x > 0 )
                cout << “x positive and x > y”;
        else if ( x < 0)
                cout << “x negative and x > y”;
        else if ( x == 0)
                cout << “cout << “x negative and x > y”;
else
        cout << “x less than y”;
```

Nested If … else statements, use braces

```
int x = 5, y = 10;

if ( x > y)
{
        if ( x > 0 )
        {
                cout << "x positive and > y";
        }
        else if ( x < 0)
        {
                cout << "x negative and > y";
        }
        else if ( x == 0)
        {
                cout << "x negative and > y";
        }
else
{
        cout << "x less than y";
}
```

Project 1

Write a root solver using the quadratic equation.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

There are four cases. The cases are determined by the value of the discriminant (b^2 - 4ac).

You are going to use multiple nested "if" or "if … else" control structures to execute the appropriate code based on the value of the discriminant.

Project 1, example run

SOLVING QUADRATIC EQUATIONS

For an equation of the form ax^2 + bx + c = 0

enter the coefficients a, b, c (separated by spaces): **5 1 -1**

There **are two irrational solutions** to the quadratic equation **5**x^2 + **1**x + **-1** = 0

they are:

-0.558258 and 0.358258

Project 1, hints

- **I have given two hints**
  - **This boolean expression will return true when x is a perfect square: (floor(sqrt(x)) == sqrt(x))**

  sqrt() in C++ won't take negative numbers.
  - **In the case where the discriminant is negative (yielding complex numbers as our roots) break the quadratic equation into $\pm\sqrt{(b^2 - 4ac)}/2a$ and (-b/2a).**
  - Factor the **$\sqrt{(-1)}$ out of $\pm\sqrt{(b^2 - 4ac)}/2a$ to give $\pm\sqrt{(-(b^2 - 4ac))}/2a$ i**
  - **Now you can take the sqrt(-(b² - 4ac)/2a)**

LAB

- Use if … else… to write a program which takes two floating point numbers and prints whether the second number is a square root of the first one.
- If the first number entered is negative print "Error: enter a positive number."
- You may use only one return statement in your program and no exit() statements.