

Programs



- ❖ Write a program that reads in the user's first and last names and prints out a greeting message

- ❖ Write a program that reads in last week's and this week's gas prices and prints out the difference



What's the output?

```
cout << "Enter two numbers: ";  
cin >> a >> b;  
a = a + 5.0;  
b = 3.0 * b;  
cout << "a = " << a << endl;  
cout << "b = " << b << endl;
```

- ❖ Assume 5.0 and 7.0 are entered for a & b



What's the output?

```
cout << "My name is: ";  
cout << "Doe, Jane." << endl;  
cout << "I live in ";  
cout << "Ann Arbor, MI ";  
cout << "and my zip code is "  
    << 48109 << ". " << endl;
```

- ❖ How would we add a blank line between sentences?



What is the Output?

- ❖ Assume $x = 2, y = 3$
- ❖ `cout << x;`
- ❖ `cout << x + x;`
- ❖ `cout << "x=";`
- ❖ `cout << x + y << " = " << y + x;`
- ❖ `z = x + y;`
- ❖ `cin >> x >> y;`
- ❖ `// cout << "x + y = " << x + y;`
- ❖ `cout << "\n";`

General Form of a C++ Program



```
// Programmer: John Doe
// Instructor: Shereen Khoja
// Date: Aug 30, 2003

// Purpose: converts distances from miles to
//           kilometers

compiler directives
using namespace std;

int main()
{
    declaration statements
    executable statements
}
```

Arithmetic Expressions



- ❖ Arithmetic expressions manipulate numeric data
- ❖ We've seen simple ones
- ❖ We'll learn all the rules for using expressions

Arithmetic Operators



- ❖ + addition
- ❖ - subtraction
- ❖ * multiplication
- ❖ / division
- ❖ % remainder (modulus)

Division



- ❖ The division operator can be used with both integers and floats
- ❖ If the operands are both **floats**, the result is a **float**
 - Example: `7.0/2.0 is 3.5`
- ❖ If the operands are both **ints**, the result is an **int**
 - Example: `7/2 is 3`
- ❖ If mixed, the **int** operand is converted to a **float** and the result is a **float**
 - Example: `5/2.5 is 2.0`

Division Continued



- ❖ Divisor (second operand) cannot be 0
- ❖ Division with negative integers may or may not be allowed



Modulus

- ❖ % returns the integer remainder of integer division
- ❖ Both operands must be integers
- ❖ If second operand is negative, results will vary from system to system
- ❖ The value of $m\%n$ must be less than divisor n

- ❖ Examples

$$3\%5 =$$

$$5\%3 =$$

$$4\%5 =$$

$$5\%4 =$$

$$5\%5 =$$

$$15\%5 =$$

$$6\%5 =$$

$$15\%6 =$$

$$7\%5 =$$

$$8\%0 \text{ undefined}$$

$$15\%-7 \text{ system dependent}$$

Assignment Statements and Expressions



- ❖ When assignment statement is executed, expression is evaluated and result is assigned to variable on left.
- ❖ Example: if `a` is a `float`
 - `a = 10;`
 - `a = 10/3;`
- ❖ What happens when types are mixed?

Mixed-type assignments



❖ `a = 10/3;`

❖ `n = 10.5 + 3.7;`

❖ `a` is a `float` and `n` is an `int`

Unary and Binary Operators



- ❖ Unary: One operand
 - Unary + and -
 - Example: $x = -y$; $y = +x$;

- ❖ Binary: Two operands
 - Example: $x = y+x$;

Expressions with Multiple Operators



❖ Example:

```
x = 5 + 3 * 2 - 1;
```

❖ What's the value of x?

❖ There are rules for the order of evaluation so every computer will calculate the same expression the same way every time



Order of Evaluation

- ❖ Anything in parentheses is evaluated first.
 - Innermost first.
 - Any with the same level are evaluated left to right.

- ❖ Operator precedence
 - Unary + and -
 - Operators *, /, %
 - Binary +, -

- ❖ Binary operators evaluated left to right and unary right to left.

Example



❖ Put in parentheses to indicate order of evaluation

❖ $x * y * z + a / b - c * d$

Program



- ❖ Design and write a program to calculate how much money your little sister has in nickels and pennies.