CSCI 1370

JANUARY 25, 2016

A BRIEF REFRESHER...

C++ OPERATORS

To tell the computer to do something, we can use something called an **operator**.

There are a number of operators, with each specifying a particular operation...
Addition operator (+): *add two things*.
Subtraction operator (−): *subtract one thing from another*.
Multiplication operator (∗): *multiply two things*.
...

THE PRINT STATEMENT

A handy operator to know: <<

This is the **insertion operator**. This instructs the computer to print something, somewhere. For example:

```
cout << “Hello!”;
```

EXPRESSIONS

Alternatively, instead of “`cout << 5;`”, we could write:

```
cout << 2 + 3;
```

COMBINING OPERATIONS

Given the following statement, what will the computer do?

```
cout << 1 + 2 + 3 - 4;
```

VARIABLES

Before a program stores a piece of data, it must allocate space in memory. This involves reserving space at some location in memory and giving that location a *name*.

A **variable** is just that – a named, reserved address in memory.

VARIABLE DECLARATIONS

To reserve space in memory for a piece of data, we make a **variable declaration** statement.

Variable declarations are comprised of a **type** and a name (**identifier**).
For example:

DATA TYPES

In C++, every variable must have a type (it tells the computer how much space to reserve and how to process the data).

Some C++ data types:

`int`: integer (e.g., 1)
float: real number (e.g., 1.0)
`char`: character (e.g., `h')
`string`: string of characters (e.g., "hello")

IDENTIFIERS (VARIABLE NAMES)

There are some rules about naming our variables...Identifiers can consist of letters, digits, and the underscore character (_). However, they must begin with a letter or underscore.

For example:
`first`, `First`, `_1st`, and `f_1_r_s_t` are all valid identifiers

THE READ STATEMENT

Another handy operator to know: `>>`

This is the **extraction operator**. This instructs the computer to extract some data from somewhere and to save it in memory. For example:

```
string s;
cin >> s;
```

A SIMPLE PROGRAM

```
string s;
cout << “Hello! What is your name?”;
cin >> s;
cout << “Nice to meet you, “ << s;
```

VARIABLES (CONT.)

ASSIGNMENT

Another handy operator: =

This is the **assignment operator**. This tells the computer to store some data somewhere. For example:

```
int x;
x = 5;
```

ASSIGNMENT (SYNTAX INTERLUDE)

Another handy operator: =

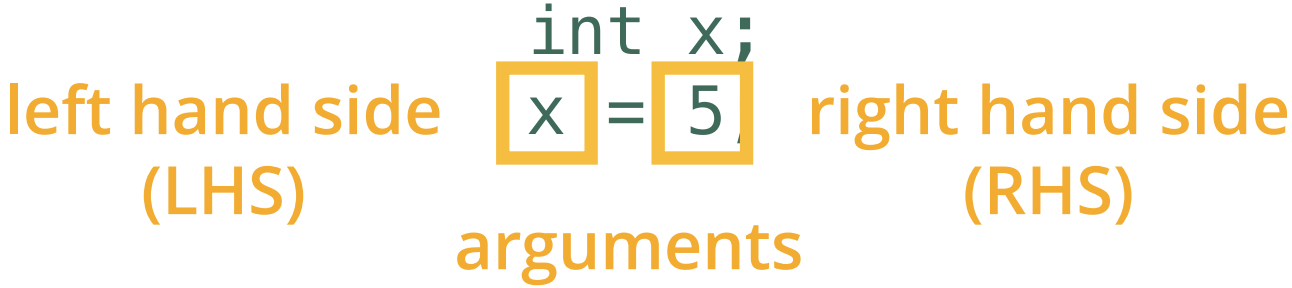
This is the **assignment operator**. This tells the computer to store some data somewhere. For example:

```
int x = 5;
```

OPERATORS (TERMINOLOGY INTERLUDE)

Another handy operator `=`

This is the **assignment operator**. This tells the computer to store some data somewhere. For example:



ASSIGNMENT (CONT.)

An **operand** can be any expression that evaluates to the right type of data. For example, the RHS of an assignment can be an expression:

```
int x;
x = 5 + 10;
```

So what gets saved in memory at x's location? 15

A SIMPLE PROGRAM

```
int x;
cout << “Hello! Please enter a number”;
cin >> x;
cout << “The value of x is: ” << x;
```

ANOTHER SIMPLE PROGRAM

```
int x;
x = 5;
```

```
cout << “The value of x is: ” << x;
```

USING STORED DATA

Note: **variables are reusable**. Each assignment stores a new value and overwrites any prior data. For example:

```
int x;
x = 5;
cout << x;
```

```
x = 1;
cout << x;
```

```
x = x + 10;
cout << x;
```

EXERCISE

With a partner, determine what gets printed to the console when the following code is run.

```
int x;
int y;
cout << “Hello”;
x = 1 + 4 – 3;
cout << x;
y = x – 1;
y = y + 5;
cout << y;
```

EXERCISE (FORMATTING INTERLUDE)

With a partner, determine what gets printed to the console when the following code is run.

```
int x;
int y;
cout << “Hello\n”;
x = 1 + 4 - 3;
cout << x << endl;
y = x - 1;
y = y + 5;
cout << y;
```

EXERCISE

With a partner, write C++ statements to do the following and determine what happens when they are run.

Declare an integer variable called `banana`.
Declare an integer variable called `hamster`.
Assign banana the value `29`.
Assign `hamster` the value of: `17` added to the value of `banana`.
Print out the value of `hamster`.
On a new line, print out the value of: `banana - hamster`.

DATA TYPES (CONT.)

COMPUTER MEMORY

A **bit** is the smallest piece of memory. It is short for **b**inary dig**it** (as it can have values of 0 or 1).

A **byte** is eight consecutive bits (e.g., 0000 0001).

DATA STORAGE

All data is stored as bits in main memory. The meaning of a set of bits depends on the *encoding*.

BINARY REPRESENTATION	INTEGER	CHARACTER
1000 0001	65	’A’
1000 0010	66	‘B’
1000 0011	67	‘C’

The **type** assigned to a variable tells the computer how much space in memory to reserve (in response to a variable declaration) and subsequently, how it is/should be *encoded* (in retrieval).

DATA TYPE: `int`

Declaration of a variable of type `int` tells the computer to reserve ~**4 bytes** of space. And when using that stored information, it cues the computer to interpret the data as an *integer*.

For example, running the following code –

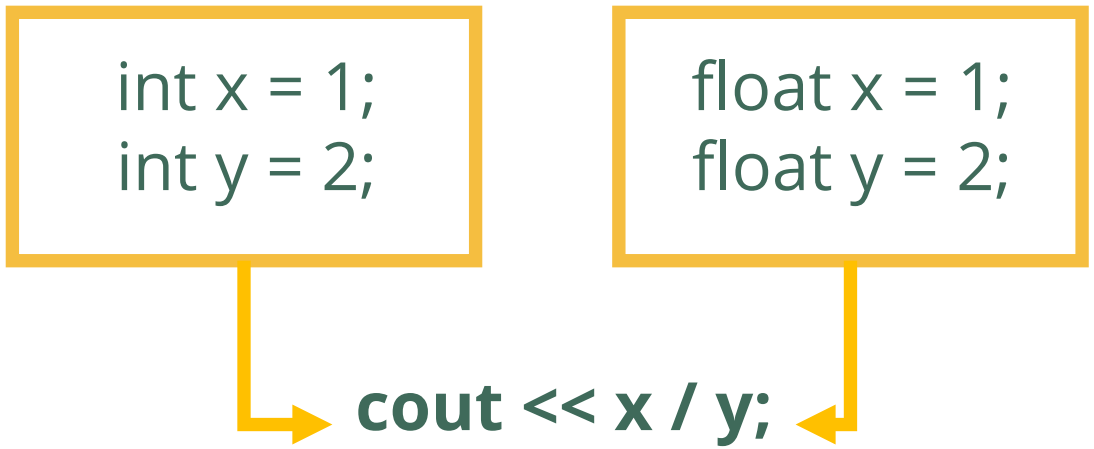
```
int x = 1.0;
cout << x;
```

– prints ‘1’ to the console.

DATA TYPE: `float`

Declaration of a `float` similarly reserves ~**4 bytes** of space. Where it differs from the `int` type is in how the computer interprets the data...

COMPARISON: `int` vs. `float`



DATA TYPE: `char`

Declaration of a variable of type `char` tells the computer to reserve **1 byte** of space. This type is used for *characters*: letters, digits, and special symbols.

Note: character data must be enclosed in single quotes. For example:

```
char x = '1';
```

DATA TYPE: `string`

To store a *set of ordered characters*, we need to declare a variable of type string.
Strings use as many bytes as there are characters, *plus one*...

Note: string data must be enclosed in double quotes. For example:

string x = “1”;

GROUP EXERCISE

In computer memory, what does...

...the integer, 0, look like?
...the character, '0', look like?
...the string, "0", look like?