THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

COMP 110
Introduction to Programming

Fall 2015

Time: TR 9:30 – 10:45

Room: AR 121 (Hanes Art Center)

Jay Aikat

FB 314, *aikat@cs.unc.edu*

Previous Class

- What did we discuss?

Today

- Announcements
  - Lab 1 will be announced later today
  - Lab1: **due Tue, Sep 8 at 11:55 PM**

- More on variables and operators
- Binary representation
- Keyboard input

More Operators – Increment and Decrement

- Increment (++)
  – adds 1 to any integer or floating point

```
count++;
count = count + 1;
```

- Decrement (--)
  – subtracts 1 from any integer or floating point

```
count--;
count = count - 1;
```

Increment and Decrement

- Prefix (`++count or --count`)
  - value used in a larger expression is the new value of **`count`** (after the increment/decrement)
- Postfix (`count++ or count--`)
  - value used in a larger expression is the original value of **`count`** (before the increment/decrement)
  - increment/decrement is the last operation performed (even after assignment)

Increment and Decrement

- If **`count`** currently contains 45, then the statement

```
total = count++;
```

assigns 45 to **`total`** and 46 to **`count`**

- If **`count`** currently contains 45, then the statement

```
total = ++count;
```

assigns the value 46 to both **`total`** and **`count`**

Questions

- What is stored in **`total`** and **`count`** in the following statements?

```
double total = 15.5;
total++;
```

total
16.5

```
int total = 10, count = 5;
total = total + count++;
```

total	count
15	6

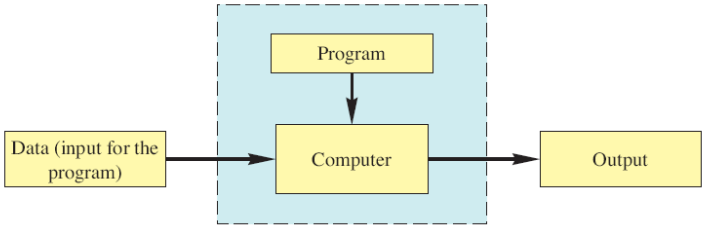
```
int total = 20, count = 3;
total = total / --count;
```

total	count
10	2

Input and Output

- Normally, a computer receives two kinds of input:
  - The program
  - The *data* needed by the program.
- The output is the result(s) produced by following the instructions in the program.

Running a Program



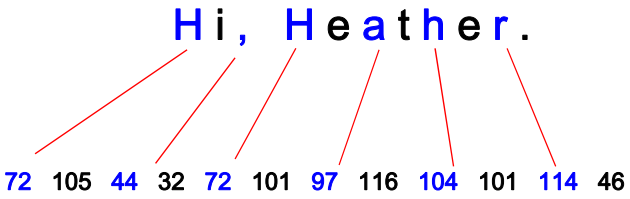
- Sometimes the computer and the program are considered to be one unit.
  - Programmers typically find this view to be more convenient.

It's all About Data

- Software is data
  - numbers, characters
  - instructions, programs
- Hardware stores and processes data
  - read, write
  - add, subtract, multiply, divide

Representing Text Digitally

- All information in a computer is *digitized*, broken down and represented as numbers.



Corresponding upper and lower case letters are separate characters.

Language of a Computer

- **Machine language**: the most basic language of a computer
- A sequence of 0s and 1s
  - binary digit, or *bit*
  - sequence of 8 bits is called a *byte*
- Every computer directly understands its own machine language
  - why can't Windows programs run on Apple computers?

Bit Permutations

1 bit	2 bits	3 bits	4 bits	
0	00	000	0000	1000
1	01	001	0001	1001
	10	010	0010	1010
	11	011	0011	1011
		100	0100	1100
		101	0101	1101
		110	0110	1110
		111	0111	1111

Each additional bit doubles the number of possible permutations

Bit Permutations

- Each permutation can represent a particular item
- There are 2^N permutations of N bits
  - N bits are needed to represent 2^N unique items

How many items can be represented by

- **1 bit ?** $2^1 = 2$ **items**
- **2 bits ?** $2^2 = 4$ **items**
- **3 bits ?** $2^3 = 8$ **items**
- **4 bits ?** $2^4 = 16$ **items**
- **5 bits ?** $2^5 = 32$ **items**

Binary Numbers

- *N* bits to represent 2^N values
- *N* bits represent values 0 to 2^N-1
- Example: 5 bits
  - 32 unique values (0-31)
  - 00000 = 0
  - 11111 = 31

Decimal to Binary

114 → 1 1 1 0 0 1 0

Number	Place Value	Digit
114	$2^6 = 64$	1
50	$2^5 = 32$	1
18	$2^4 = 16$	1
2	$2^3 = 8$	0
2	$2^2 = 4$	0
2	$2^1 = 2$	1
0	$2^0 = 1$	0

Questions: Binary Numbers

- What's the maximum value a 6-bit number can represent? 63
- What's the decimal representation of 111010? 58 = 32+16+8+2
- What's the binary representation of 35? 100011

Teaching Assistants and Office hours

http://comp110.com/team

http://comp110.com/support

Keyboard Input

- Java has reasonable facilities for handling keyboard input.
- These facilities are provided by the `Scanner` class in the `java.util` package.
  - A *package* is a library of classes.

Simple Input

- Data can be entered from the keyboard using

```
Scanner keyboard =
    new Scanner(System.in);
```

followed, for example, by

```
eggsPerBasket = keyboard.nextInt();
```

which reads one `int` value from the keyboard and assigns it to `eggsPerBasket`.

Simple Screen Output

```
System.out.println("The count is " + count);
```

- Outputs the sting literal `"the count is "`
- Followed by the current value of the variable `count`.

Using the Scanner Class

- Near the beginning of your program, insert

```
import java.util.Scanner;
```

- Create an object of the `Scanner` class

```
Scanner keyboard =
   new Scanner (System.in)
```

- Read data (an `int` or a `double`, for example)

```
int n1 = keyboard.nextInt();
double d1 = keyboard,nextDouble();
```

Next class (Tue, Sep 1)

- Binary representation
- More programming in class

→ Reading Assignment: Chapter 1