Writing Programs

Sept 13

Algorithms, variables, inputs, outputs, data types

Algorithms

- Algorithms are a precise statement of how to solve a problem
  - NOT a program
  - NOT written using a PL

  - Write in a way that is easy for you
  - Use a pencil
    - draw circles and arrows
  - Be very precise

Compute area of triangle

- Algorithm?

- Now translate it into Java code
  - How get the base and height into the program?
  - How to do the calculation in Java?
  - How to render the output?

Variables

- A thing in a program that holds a value

- Declaration -- the name and type of the variable
  - `String aString;`
  - Variables must be "declared" before they can be used
    - declaration occurs once
- Initialization / Assignment
  - `aString = "aaa";`
    - assignment my occur many times
- Read
  - Use the value that was initialized / assigned
  - variables must be initialized before they can be read

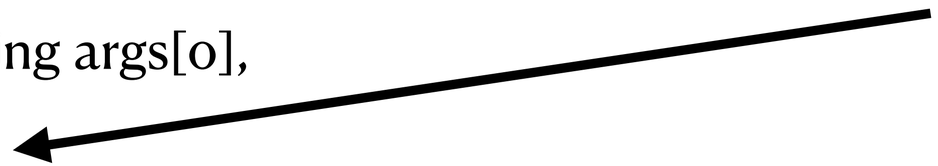
Compute Area of Triangle

1. Get Base and Height into program

- Use "Command Line Arguments"
  - args[0] is not memorable

- Programs need to:
  - be compilable into something runnable on computer
  - be readable by people

- So rather than using args[0],
  - base = args[0];
  - height = args[1];
  - area = base * height / 2;



Problem: Data Types

- Programs need to know the "type" of each data item
  - Consider computer memory
    - Just bits: 0 and 1
    - The TYPE tells computer how to interpret the 0 and 1.
- two simplest types in Java: char and byte
  - each use 8 bits
    - 01000001
      - if a char, then 'A'
        - ASCII table
      - if a byte then 65

Data Types

- Integer aka int
  - int base = 55;   //32 bits 00000000 00000000 00000000 00110111

- String   -- a sequence of chars
  - String base = "55"; //16 bits 00110101 00110101

Data Types "know"

- How to interpret bits
- What operations they are allowed to do
  - number types -- standard math operations between two number types
    - + - * / %
  - String
    - concatenation between two strings
      - +
      - Curiously, "string + int" works!!!

Using Integers

```
public class FunWithInts {
    public static void main(String[] args) {
1         int x;
2         int y = 4;
3         x = y;
4         y = 3;
5         System.out.println(x);
6         x = y + 11;
7         System.out.println("x is " + x);
8         x = x + 1;
9         //int x = 7; this line will not compile
10        //m = 3; this line will not compile
11        //x = 5.5; this line will not compile
12         int a = 5, b = 11;
13         int c = a - b;
14         c = a * 2;
15         c = 14;
16         int r = c % 3;
17         int m = 18;
18         int n = m / 3;
19         int k = 11 / 2;
20         k = 3 / 4;
    }
}
```

Fill in value of each variable for each line
If not initialized "-", not declared "x"

	x	y	m	c	r	n	k
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Rational numbers

7.1 rather than 7

- When programming "floating point numbers".
- Java floating point data type "double"
  - Usage
    - double rationalNumber = 7.1;

```
public class GTrand {
    public static void main(String[] args) {
        double rando = Math.random();
        System.out.println(rando);
    }
}
```

Type Conversion

- String to int
  - String baseString = "5";
  - int baseInt = Integer.parseInt(baseString);

- int to String
  - int anInt = 42;
  - String aString = Integer.valueOf(anInt).toString();
  - or much shorter: String aString = ""+ anInt;

- Sometimes it is much easier, Java does it for you.

Compute area of Triangle

1. Get Base and Height into program

- From "`public static void main(String[] args) {`"
  - know that the variable args holds strings
  - to compute area need numbers
- `int base = Integer.parseInt(args[0]);`
- `int height = Integer.parseInt(args[1]);`
  - Declaration and initialization in one step!!!

Compute area of Triangle

1.Compute Area

- from algorithm "area = (base * height) / 2"

- In Java Code?

Compute area of Triangle

3.Output

- Print to screen using System.out.println();