Announcements

Ch 5 Embedded problems due 10/5 (Mon) 10 AM

Programming Assignment 3 due Friday, 5 PM

Ch 4 OWL assignment due Thursday, 5 PM

Midterm posted- W evening 10/14. 7 - 8:15 PM, Thompson 102, 104. Old midterm at CourseAdmin link

TA Office hours:

M 1-4; TU 3:45-5; W 4-6 (4-5:15 until 10/10); TH 2 - 5; F 12:15 - 3:15; - LGRT 223
Arithmetic and Operator Precedence

Key features:
1) +, -, * behave in the standard way. Division / is different

2) \( \frac{5}{3} = 1 \) (but \( \frac{5.0}{3} = \frac{5}{3.0} = 1.6666 \)), \( \frac{10}{4} = ? \)

3) In the absence of parentheses, *, /, have higher precedence than +, - This means that \( (3 + 5 \times 2) = 13 \), \( (7 - 4 \div 2) = ? \)

4) The remainder operator is %: \( 10 \% 3 = 1 \), \( 10 \% 7 = ? \)

\( (3 + (7/2)) = ? \)
\( (2 \times 3 - 1 + 5 / 3) = ? \)
\( (20 \% (9 \% 4)) = ? \)
\( (5 \% 0) = ? \)
Conditional, Looping Statements in Java

Conditional statements and looping statements are flow of control constructions.

At a primitive level, Java programs are made up of statements, and it often makes sense to

1) have statements repeat in a systematic way; and
2) have statements execute conditionally.
Conditionals first - Consider:

```java
if (n % 2 == 0) System.out.println("n is even");
```

Lots going on here: statement says: “if the remainder after dividing n by 2 is equal to (==) 0, then report that n is an even number

```java
if (n % 2 != 0) System.out.println("n is odd");
else System.out.println("n is even");
```

An important point: (n % 2 == 0) is a boolean expression (returns a boolean value) -- a boolean must go into the test slot of an if stmt! Nothing else will do!!
Boolean connectives

&& (and)   || (or)   ! (not)

if ((n < 5) || (n > 10)) System.out.println("hi");
if((n == 7) && (k > 12)) System.out.println("bye");

boolean b = true;
for(int j = 0; j < 5; j = j + 1){
    b = !b;
    System.out.println(b);
}
The loop as scoreboard - a more complex generate & test.

How many numbers between 1 and 100 are divisible by 3 or 7?

```java
int counter = 0;
for(int i = 1; i <= 100; i = i+1){
    if ((i % 7) == 0 || (i % 3) == 0)
        counter = counter + 1;
}
System.out.println(counter);
```
Add up the numbers from 1 to 100 - accumulator pattern

```java
int counter = 0;
for(int i = 1; i <= 100; i = i+1){
    counter = counter + i;
}
System.out.println(counter);
```

How would you add numbers from variable first to last, where first, last, could be anything?
import java.util.Scanner;

public class AddUp{
    public static void main(String[] args){
        Scanner s = new Scanner(System.in);
        System.out.println("Enter start,stop nums");
        int first = s.nextInt();
        int last = s.nextInt();
        int sum = 0;
        for (int n = first; n <= last; n=n+1){
            sum = sum + n;
        }
        System.out.println("sum from "+first+" to "+last);
        System.out.println(":	" + sum);
    }
}
What is the value of 

(int)'E'

??

Casting: reinterpreting data in a different form

Also: (int)3.14 → 3
for(char c = 'a'; c < 'f'; c = (char)(c + 1)) {
    System.out.print(c);
}

Comparing chars: chars come in a fixed order, and each char has a position in the order.

What is ('a' + 1) (ans: 98) / ('a' < 50) is false

What is (char)98 (ans: 'b')

What is ('B' - 'b') (ans: 32) – huh??

If arithmetic operators appear in expressions involving chars, the chars are treats as ints!
for(char ch = 'A'; ch < 'z'; ch = (char)(ch + 1)){
    System.out.print(ch);
}

Output:
ABCDEFGHIJKLMNOPQRSTUVWXYZ\^_`a
bcdefghijklmnopqrstuvwxyz
Some syntax:
for(
    init;
    test;
    increment
)

    stmt;

Or

for(
    ...
    ...
    ...
)

    stmt1;
    stmt2;
    ...
    stmtn;

}
Some syntax:

if (boolean)
    stmt;

Or

if(boolean){
    stmt1;
    stmt2;
    ...
    stmtn;
}

A Block
More problems..

Enter a string - how many digits?

Enter a string - how many a’s and b’s?
public class AnyTest {

    // counts # of digits in String s
    public static void main(String[] args) {
        String s = "12rtgrf49q%";
        int count = 0;
        for(int j = 0; j < s.length(); j++) {
            char ch = s.charAt(j);
            if ((ch >= '0') && (ch <= '9')) count++;
        }
        System.out.println(count);
    }
}
Binary conversion - b a binary string

10011

16s  8s  4s  2s  1s - these are powers of 2

Decimal value: 16 + 2 + 1 = 19
```java
int pow = 1;
int total = 0;
for(int j = b.length()-1; j >= 0; j--){
    if (b.charAt(j) == '1') total = total + pow;
    pow = 2*pow;
}

At the end, total holds decimal integer representation of b
```
Write a complete program that reads in a String, then reports if there are strictly more a’s (or A’s) than b’s.

“abbaAAaaAabbbB” -> true (7/5)

“monkeybusiness” -> false (0/1)

“junkie“ -> false (0/0)
The Math class and static methods

• Not all methods are invoked by objects.
• The Math class, for example
• Doesn’t make sense to attach a funcion like sqrt or max to an object
• All Math fns are static, Math.sqrt() etc.
double r = Math.max(3.5, 7.1);

double r = Math.sqrt(2.0);

double r = Math.sin(0.7);

double r = Math.min(3.5, 7.1);

double r = Math.pow(2, 5); // 2^5 returned as double
An unusual function in the Math class:

Math.random()

Gives a random value \( r, 0 \leq r < 1 \)

What does random mean? Basically: generating many in a row will reveal no pattern...
A preliminary problem:

Out of 100 random numbers, how many are less than 0.5?
More ambitious:
Create an application that considers some large number of random numbers and checks to see if the average of those numbers is 1/2 (0.5).
Random numbers to estimate pi

(aside: Math.PI)

If a circle has radius 1.0, what is its area?

Suppose the surface of the earth is 78% water, 22% land, and a meteor hitting earth is equally likely to hit anywhere.

If 100 hit earth in the last decade, how many would you expect to land on water?
Area of quarter circle = \(\pi/4\)

Length = 1.0 - the unit square

Area of circle = \(\pi \times 1.0 \times 1.0 = \pi = 3.14159\)
public class RandomPi{
    public static void main(String[] args){
        Scanner s = new Scanner(System.in);
        int trials = 0; int inside = 0;
        System.out.println("Enter number of trials");
        trials = s.nextInt();
        System.out.println("Trials:" + trials);
        double x,y;
        for(int j = 0; j < trials; j++){
            x = Math.random(); y = Math.random();
            if (Math.sqrt((x*x + y*y)) < 1) inside++;
        }
        System.out.println("pi guess: " +
            (double)(4*inside)/trials);
    }
}
Enter number of trials
Trials: 100000
pi guess: 3.14116

Enter number of trials
Trials: 10000000
pi guess: 3.1415424