Java Continued and Nim

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Control Flow and Loops

Two versions of a loop

```
Random rng = new Random();
int flip = rng.nextInt(2);
int count = 1;
while (flip == 0) {
   //count flips until "heads"
   flip = rng.nextInt(2);
   count++;
}
```

```
Random rng = new Random();
int flip = rng.nextInt(2);
for(int count=1; flip==0; count++){
   flip = rng.nextInt(2);
}
```

One more version of the loop

```
Random rng = new Random();
int flip = rng.nextInt(2), count =
    1;
while (flip == 0) {
   // count flips until "heads"
   flip = rng.nextInt(2);
   count++;
}
```

```
int flip, count = 0;
do {
   //count flips until "heads"
    flip = rng.nextInt(2);
   count++;
} while (flip == 0);
```

Control Structures

- Select next statement to execute based on value of a boolean expression. Two flavors:
- Looping structures: while, do/while, for
  - Repeatedly execute same statement (block)
- Branching structures: if, if/else, switch
  - Select one of several possible statements (blocks)
  - Special: break/continue: exit a looping structure
    - break: exits loop completely
    - continue: proceeds to next iteration of loop
    - break and continue are *to be avoided* unless it greatly simplifies or clarifies your code

If/else

```
if (x > 0)    // There is exactly 1 "if" clause
   y = 1 / x;
else if (x < 0) { // 0 or more "else if" clauses
   x = - x;
   y = 1 / x;
}
else       // at most 1 "else" clause
   System.out.println("Can't divide by 0!");
```

switch

```
int x = myCard.getSuit(); // a fictional method
//0 is spades; 1 is diamonds; 2 is hearts; 3 is clubs
switch (x) {
   case 1: case 2:
      System.out.println("Your card is red");
      break;
   case 0: case 3:
      System.out.println("Your card is black");
      break;
   default:
      System.out.println("Illegal suit code!");
      break;
}
```

For & for-each

Here's a typical **for** loop example

```
int[] grades = { 100, 78, 92, 87, 89, 90 };
int sum = 0;
for( int i = 0; i < grades.length; i++ )
   sum += grades[i];
```

This **for** construct is equivalent to

```
int[] grades = { 100, 78, 92, 87, 89, 90 };
int sum = 0;
int i = 0;
while ( i < grades.length ) {
   sum += grades[i];
   i++;
}
```

For & for-each

Here's a typical **for** loop example

```
int[] grades = { 100, 78, 92, 87, 89, 90 };
int sum = 0;
for( int i = 0; i < grades.length; i++ )
   sum += grades[i];
```

Can also write (*for-each* construct; will see more later)

```
int[] grades = { 100, 78, 92, 87, 89, 90 };
int sum = 0;
for (int g : grades )
   sum += g;
```

Loop Construct Notes

- The body of a **while** loop may not ever be executed
- The body of a **do – while** loop always executes at least once
- **For** loops are typically used when number of iterations desired is known in advance. E.g.
  - Execute loop exactly `100` times
  - Execute loop for each element of an array
- The **for-each** construct is often used to access array (and other collection type) values when *no updating* of the array is required
  - We'll explore this construct more later in the course

Methods in Java

Why methods?

- Used to group together code
  - Well-organized code is often *superior* to well-documented, poorly-organized code.
- A method should do *one task*
- Methods allow us to reuse code as well as use techniques like recursion.

Creating and using methods

- We can create a method as follows:

```
public static int getSum(int a, int b){
   return a+b;
}
```

- (We'll talk about `public` and `static` next week.)
- We can call a method as follows (this prints the sum of 3 and *x*):

```
System.out.println("The sum is " + getSum(3, x));
```

The String & Scanner Classes

The String Class

- String is not a primitive type in Java, it is a *class type*
- However, Java provides language level support for Strings
  - String literals: “Bob was here!”, “-11.3”, “A”, “ ”
- A single character can be accessed using charAt()
  - As with arrays, indexing starts at position 0
  - String s = “computer”;
  - char c = s.charAt(5); // c gets value ‘t’
  - c = “oops”.charAt(4); // run-time error!
- String provides a length method
  - int len = s.length(); // len gets value 8
  - len = “ “.length(); // len gets value 0

Scanner class

- A way to get interactive input from a user!
- Not built-in; need to import in order to use:
  - `import java.util.Scanner;`
- First, instantiate a `Scanner`:
  - `Scanner sc = new Scanner(System.in);`
- Then, can use it to read in lines of text:
  - `System.out.println("Enter your name:");`
  - `String name = sc.nextLine();`
- Let's look at an example: `GuessNumber.java`

Object Oriented Programming

The Plan

- I want to *briefly mention* objects today
- We'll be filling in details starting on Friday!
- OK if you don't completely get it—just some foundational concepts and vocab

Objects

- Primitive types are just data in Java: an int just stores a number; a char just stores a character
- And nothing else!
- An object is fancier. It may store extra data, or multiple pieces of data. It may even store some *methods* along with the data
- For example:
  - An array doesn't just store the data—it also stores the `length`
  - A String has a `.length()` method
  - A Random object has a `.nextInt()` method, and stores data to help generate random numbers

Objects and Primitive Types

- Objects need to be instantiated with `new`

- You'll be making your own types of objects very soon! But for lab 1, only need to use the kinds of objects we've already discussed (String, Scanner, Random, etc.)

Nim

This section

- Let’s talk about a game
- And then code it up!
- Goals:
  - Java practice and…
  - Maybe some useful ideas for lab 1?

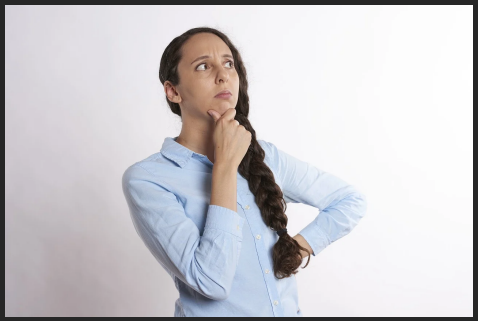
Nim

At the game's start, there are one or more piles of matchsticks.

- Players take turns.
- The player whose turn it is must choose one pile and remove one or more matchsticks from that pile.
- The player who cannot remove a matchstick loses (i.e., the winner removes the very last matchstick from the gameboard).

Let's play a quick game of Nim

How can we code this up?



- How should we store the piles?
- How do we create the board?
- What is a legal move?
- How do we have it play the game?

Let’s Code up Nim!

Design Documents

- Example on website
- Idea: read through the lab
- Describe how you will implement it
  - How will you store the data?
  - What methods will you use?
  - Etc.
- We'll be collecting them in lab (so remember to bring them)!