Lecture 8

Math and Making Decisions

Review: Inheritance and Polymorphism Summary

- **Inheritance** models very similar classes
  - factor out all similar capabilities into a generic superclass
  - superclasses can
    - declare and define methods
    - declare abstract methods
  - subclasses can
    - inherit methods from a superclass
    - define their own specialized methods
    - completely/partially override an inherited method
- **Polymorphism** allows programmers to reference instances of a subclass as their superclass
- Inheritance, Interfaces, and Polymorphism take generic programming to the max – more in later lecture

Outline

- Abstract Methods and Classes
- Arithmetic operations – java.lang.Math
- Static methods and static variables
- Constants – values that never change
- Decision making: boolean algebra, if-else statements and the switch statement

`abstract` Methods and Classes (1/6)

- What if we wanted to seat all of the passengers in the car?
- `CS15Mobile`, `Convertible`, and `Van` all have different numbers of seats
    - they will all have different implementations of the same method

abstract Methods and Classes (2/6)

- We declare a method abstract in a superclass when the subclasses can't really re-use any implementation the superclass might provide – no code-reuse
- In this case, we know that all Cars should loadPassengers, but each subclass will loadPassengers very differently
- abstract method is declared in superclass, but not defined – it is up to subclasses farther down hierarchy to provide their own implementations
- Thus superclass specifies a contractual obligation to its subclasses – just like an interface does to its implementors

abstract Methods and Classes (3/6)

- Here, we've modified Car to make it an abstract class: a class with at least one abstract method
- We declare both Car and its loadPassengers method abstract: if one of a class's methods is abstract, the class itself must also be declared abstract
- An abstract method is only **declared** by the superclass, not **defined** – thus use semicolon after declaration instead of curly braces

```
public abstract class Car {

    private Racer driver;

    public Car(Racer myDriver) {
        this.driver = myDriver;
    }

    public abstract void loadPassengers();

}
```

abstract Methods and Classes (4/6)

- How do you load Passengers?
  - every Passenger must be told to sit in a specific Seat in a physical Car
  - SeatGenerator has methods that returns a Seat in a specific logical position

```
public class Passenger {

    public Passenger() { //code elided }
    public void sit(Seat st) { //code elided }
}
```

```
public class SeatGenerator {

    public SeatGenerator () {//code elided }
    public Seat getShotgun() {//code elided }
    public Seat getBackLeft() {//code elided }
    public Seat getBackCenter() {//code elided }
    public Seat getBackRight() {//code elided }
    public Seat getMiddleLeft() {//code elided }
    public Seat getMiddleRight() {//code elided }
}
```

abstract Methods and Classes (5/6)

```
public class Convertible extends Car{
    @Override
    public void loadPassengers(){
        SeatGenerator seatGen = new
        SeatGenerator();
        this.passenger1.sit(
        seatGen.getShotgun());
    }
}
```

```
public class CS15Mobile extends Car{
   @Override
   public void loadPassengers(){
       SeatGenerator seatGen = new
SeatGenerator();
       this.passenger1.sit(seatGen.getShotgun());
       this.passenger2.sit(seatGen.getBackLeft());
       this.passenger3.sit(seatGen.getBackCenter());
   }
}
```

```
public class Van extends Car{
    @Override
    public void loadPassengers(){
       SeatGenerator seatGen = new SeatGenerator();
       this.passenger1.sit(seatGen.getMiddleLeft());
       this.passenger2.sit(seatGen.getMiddleRight());
       this.passenger3.sit(seatGen.getBackLeft());
     //more code elided
    }
}
```

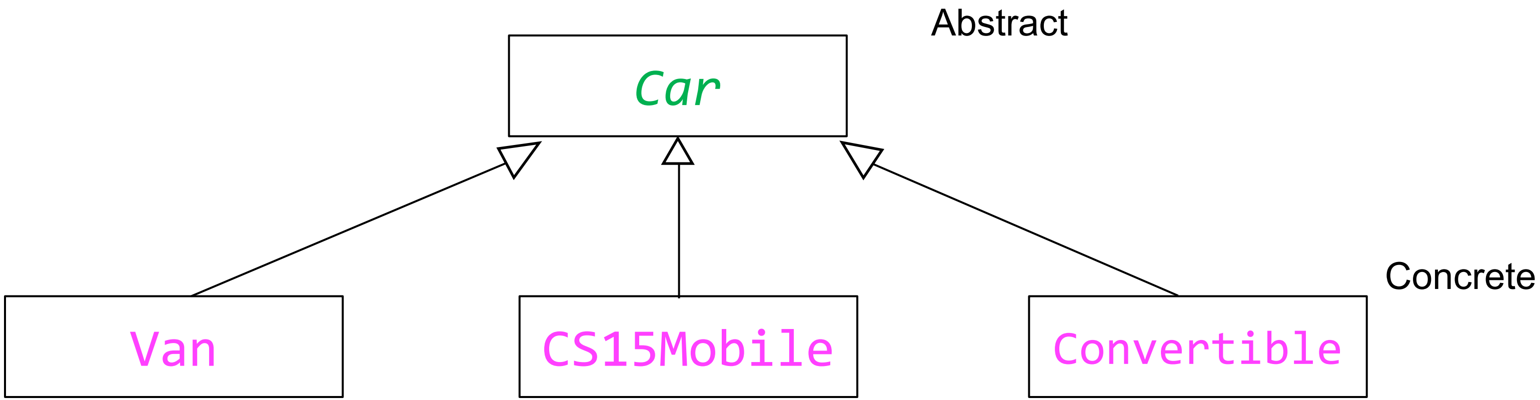
- All concrete subclasses of `Car` override by providing a concrete implementation for `Car`’s abstract `loadPassengers()` method
- As usual, method signature and return type must match the one that `Car` declared

abstract Methods and Classes (6/6)

- abstract classes **cannot be instantiated**!
  - this makes sense – shouldn't be able to just instantiate a generic Car, since it has no code to loadPassengers()
  - instead, provide implementation of loadPassengers() in concrete subclass, and instantiate subclass
- Subclass at any level in inheritance hierarchy can make an abstract method concrete by providing implementation
  - it's common to have multiple consecutive levels of abstract classes before reaching a concrete class
- Even though an abstract class can't be instantiated, its constructor must still be invoked via super() by a subclass
  - because only the superclass knows about (and therefore only it can initialize) its own instance variables

Abstract Methods & Classes

- Abstract classes have 1 or more abstract methods
- An abstract method simply specifies a contractual application for a child class (at any level below parent) to provide a concrete implementation
- A class can NOT be instantiated if it is abstract
- An interface is simply an abstract class with NO code to inherit



So.. What's the difference?

- You might be wondering: what's the difference between `abstract` classes and interfaces?
- `abstract` classes:
    - can define instance variables
    - can define a mix of concrete and `abstract` methods
    - you can only inherit from one class
- Interfaces:
    - cannot define any instance variables/concrete methods
    - has only undefined methods (no instance variables)
    - you can implement multiple interfaces

Note: Java, like most programming languages, is evolving. In Java 8, interfaces and `abstract` classes are even closer in that you can have concrete methods in interfaces. We will not make use of this in CS15.

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- Abstract Methods and Classes
- Arithmetic operations – java.lang.Math
- Static methods and static variables
- Constants – values that never change
- Decision making: boolean algebra, if-else statements and the switch statement

Review: Basic Arithmetic Operators

Operator	Meaning
+	addition
-	subtraction
*	multiplication
/	division
%	remainder

Basic Arithmetic Operators: Shorthand

Operator	Meaning	Example	Equivalent Operation
`+=`	add and reassign	`a += 5;`	`a = a + 5;`
`-=`	subtract and reassign	`a -= 5;`	`a = a - 5;`
`*=`	multiply and reassign	`a *= 5;`	`a  = a * 5;`
`/=`	divide and reassign	`a /= 5;`	`a = a / 5;`
`%=`	take remainder and reassign	`a %= 5;`	`a = a % 5;`

Unary Operators

Operator	Meaning	Example
`-`	negate	`b = -b;  // negates b`
`++`	increment	`b++; // equivalent to: b = b + 1;`
`--`	decrement	`b--; // equivalent to: b = b - 1;`

Increment and Decrement Operators

- `++` and `--` can be applied before (prefix) or after (postfix) the operand
  - `i++` and `++i` will both increment variable `i`
  - `i++` assigns, then increments
  - `++i` increments, then assigns

Postfix example:

```
int i = 10;
int j = i++; // j becomes 10, i becomes 11
```

Prefix example:

```
int i = 10;
int j = ++i; // i becomes 11, j becomes 11
```

`java.lang.Math`

- Extremely useful "utility" class, part of core Java libraries
- Provides methods for basic numeric operations
    - absolute value: `abs(double a)`
    - exponential: `pow(double a, double b)`
    - natural and base 10 logarithm: `log(double a)`, `log10(double a)`
    - square root: `sqrt(double a)`
    - trigonometric functions: `cos(double a)`, `sin(double a)`…
    - random number generation: `random()` returns random number from 0.0(inclusive) to 1.0(exclusive)
    - for more check out: https://docs.oracle.com/javase/8/docs/api/java/lang/Math.html

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`static` Methods

- All of `java.lang.Math`'s methods are declared `static`
- Example: the method that returns the absolute value of an integer is declared below
  - `public static int abs(int a) {...}`
- A **static method** belongs to a class, rather than an instance of the class
  - it cannot access instance variables, whose values may differ from instance to instance
    - but can have local variables, e.g., temps

Calling a `static` Method

- `static` methods are invoked on the class, not on an instance:

```
int absoluteValue = Math.abs(-7);
```

- That means we can use all of `Math`'s `static` methods without ever instantiating it

Note: You won't need to write any `static` methods of your own in CS15, but you'll be using `Math`'s `static` methods in future assignments

TopHat Question   Join Code: 504547

`tributeCounter` is an instance of the `HungerGames` class. Which is the correct way to call this static method of the `HungerGames` class:
`public static int numAlive(){…}`?

A. `int tributesRemaining = Instance.numAlive();`

B. `int tributesRemaining = HungerGames.numAlive(static);`

C. `int tributesRemaining = HungerGamesInstance.numAlive(static);`

D. `int tributesRemaining = HungerGames.numAlive();`

E. `int tributesRemaining = tributeCounter.numAlive();`

`static` Variables

- Progression in scope:
  - **local** variables are known in a single method
  - **instance** variables are known to all methods of a class
  - `static` instance variables are known to all instances of a class
- Each instance of a class has the same instance variables but typically with **different** values for those properties
- If instead you want all instances of a class to share the **same** value for a variable, declare it `static` – this is not very common (and probably not used in CS15)
- Each time any instance changes the value of a `static` variable, all instances have access to that new value

static Variables: Simple Example

- tributes starts out with a value of 0
- Each time a new instance of Tribute is created, tributes is incremented by 1
- Get current value at any point by calling: Tribute.getNumTributes();
    - each instance of Tribute will have and know the same value of tributes
- static methods can use static and local variables – but not instance variables

```
public class Tribute {

    private static int tributes = 0;

    public Tribute () {
        this.tributes++;
    }

    public static int getNumTributes () {
        return this.tributes;
    }
}
```

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Constants

- **Constants** are used to represent values which never change (e.g. Pi, speed of light, etc.) – very common!
- Keywords used when defining a constant:
  - `public`: value should be available for use by anyone (unlike `private` instance variables and local variables)
  - `static`: all instances of the class share one value
  - `final`: value cannot be reassigned
  - naming convention for constants is **all caps** with underscores between words: `LIGHT_SPEED`

Constants: Example (1/2)

- Useful to bundle a bunch of constants for your application in a “utility” class (like `Math`), with useful methods using those constants; both constants and methods will be then declared static

```
public abstract class Physics {

    // speed of light (Units: hundred million m/s)
    public static final double LIGHT_SPEED = 2.998;

    // constructor elided

    public static double getDistanceTraveled(double numSeconds) {
        return (LIGHT_SPEED * numSeconds);
    }
}
```

Constants: Example (2/2)

- Always use constants when possible
  - literal numbers, except for 0 and 1, should rarely appear in your code
  - makes code readable, easier to alter
- Also called **symbolic** constants – should have descriptive names
- If many classes use same constants, make separate utility class, like `Physics`
- A constants utility class should never be instantiated, so it should be declared `abstract`

```
public abstract class Physics {

    //speed of light (Units: hundred million m/s)
    public static final double LIGHT_SPEED = 2.998;

    // we can add more constants if we want
}
```

We can access this constant from a method in another class in our program like this:

`Physics.LIGHT_SPEED`

(another use of dot notation!)

Example:

`spaceShip.setSpeed(Physics.LIGHT_SPEED)`

TopHat Question

Join Code: 504547

Which of the following constants is defined correctly?

A. `public static final int TRIBUTE_AGE;`

B. `public static final int TRIBUTE_AGE = 17;`

C. `public static int final TRIBUTE_AGE = 17;`

D. `private static final int TRIBUTE_AGE = 17;`

Bread Makers (1/6)

- Peeta has entered a competition to see who can sell the most loaves of bread!
    - (don’t take this example too literally)
- Depending on the amount of dough and time to bake it, he will be able to make a certain amount of loaves
- Our Head TAs calculated that his number of loaves made is the amount dough times his baking time
- Loaves sold equals one half of the square root of his baked loaves

Bread Makers (2/6)

- `BreadMakerConstants` class keeps track of important constants in our calculation

```
public abstract class BreadMakerConstants {

    // Already sold 10 loaves
    public static final double START_LOAVES = 10;


    // Number of loaves sold to win the competition
    public static final double MAX_LOAVES= 200;
}
```

Bread Makers (3/6)

- `Peeta` keeps track of instance variable `loavesSold`

- `loavesSold` initialized in constructor to `START_LOAVES` defined in `BreadMakerConstants`

```
import java.lang.Math;

public class Peeta {

    private double loavesSold;

    public Peeta() {
        this.loavesSold = BreadMakerConstants.START_LOAVES;

    }
}
```

Bread Makers (4/6)

- Peeta's bake method changes his number of loaves sold depending on the amount of dough he has and the time he has to bake

```
import java.lang.Math;

public class Peeta {

    private double loavesSold;

    public Peeta() {

        this.loavesSold = BreadMakerConstants.START_LOAVES;

    }

    public void bake(double dough, double bakeTime) {
        // code elided

    }
}
```

Bread Makers (5/6)

- First, `loavesMade` is computed
- Second, `anotherLoafSold` is calculated according to the formula
- `Math.sqrt` is a static method from `java.lang.Math` that computes the square root of a value
- Increment the total loaves sold

```
import java.lang.Math;
public class Peeta {

    private double loavesSold;

    public Peeta() {

        this.loavesSold = BreadMakerConstants.START_LOAVES;

    }

    public void bake(double dough, double bakeTime) {

        double loavesMade = dough * bakeTime;
        double anotherLoafSold = (1/2) * Math.sqrt(loavesMade);
        this.loavesSold += anotherLoafSold;
    }
}
```

Bread Makers (6/6)

- Now fill in `sellBread()`
- Peeta will only bake & sell bread until he wins the competition
- How can we check if condition is met?
- **Introducing… `boolean`'s and `if`'s!**
    - seen `booleans` in Pong assignment but let's formally introduce them

```
import java.lang.Math;

public class Peeta {

    private double loavesSold;

    public Peeta() {

        this.loavesSold = BreadMakerConstants.START_LOAVES;

    }

    public void bake(double dough, double bakeTime) {

        double loavesMade = dough * bakeTime;
        double anotherLoafSold = (1/2) * Math.sqrt(loavesMade);
        this.loavesSold += anotherLoafSold;
    }

    public void sellBread() {
        // decision-making logic that calls bake()!
    }
}
```

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`booleans`

- British logician George Boole (1815-1864) wanted to improve on Aristotelian (formal) logic, e.g., modus ponens, rule of inference:
    - "All men are mortal, Socrates is a man, therefore…"

- `boolean` (named after Boole) is simplest Java base type
    - You've seen this in Pong!

- A `boolean` variable can have value `true` or `false`

- Example initialization:

```
boolean foo = true;

boolean bar = false;
```

The terms `foo`, `bar`, etc. are often used as placeholder names in computer programming or computer-related documentation: derived from FUBAR, WWII slang

Relational Operators

- Can compare numerical expressions with **relational operators**
- Full expression evaluates to a `boolean`: either `true` or `false`
- Examples:

```
boolean b1 = (3 > 2);
boolean b2 = (5 <= 5);
int x = 8;
boolean b3 = (x == 6);
```

- `b1` and `b2` are `true`, `b3` is `false`

Operator	Meaning
==	is equal to
!=	is not equal to
>	is greater than
<	is less than
>=	is greater than or equal to
<=	is less than or equal to

Comparing References

- Can use `==` and `!=` to see if two references point to the same instance, or not
- What three values are printed to the console in this example?
    - Assume these three examples are run in order

1. `false`: `d1` and `d2` are not equal
2. `true`: `d1` and `d2` refer to the same instance
3. `true`: `d1` != `d2` is false, so foo is true (since foo = !(false))

```java
public class DogPark {

    //constructor elided

    public void compareReferences() {
        //Dog class defined elsewhere in code
        Dog d1 = new Dog();
        Dog d2 = new Dog();


      1 boolean foo = (d1 == d2);
        System.out.println(foo);

        d2 = d1;
      2 foo = (d1 == d2);
        System.out.println(foo);

      3 foo = !(d1 != d2);
        System.out.println(foo);

    }
}
```

TopHat Question Join Code: 504547

Which of the following will print `false`?

```
public class TestClass {

   //constructor elided

   public void compareReferences() {
      Student s1 = new Student();
      Student s2 = new Student();

      boolean sameStudent = (s1 == s2);
A.    System.out.println(sameStudent);

      s2 = s1;
      sameStudent = (s1 == s2);
B.    System.out.println(sameStudent);

      boolean student1Exists = (s1 != null);
C.    System.out.println(student1Exists);

   }
}
```

`if` Statements

- `if` statements allow us to make decisions based on value of a **boolean expression**

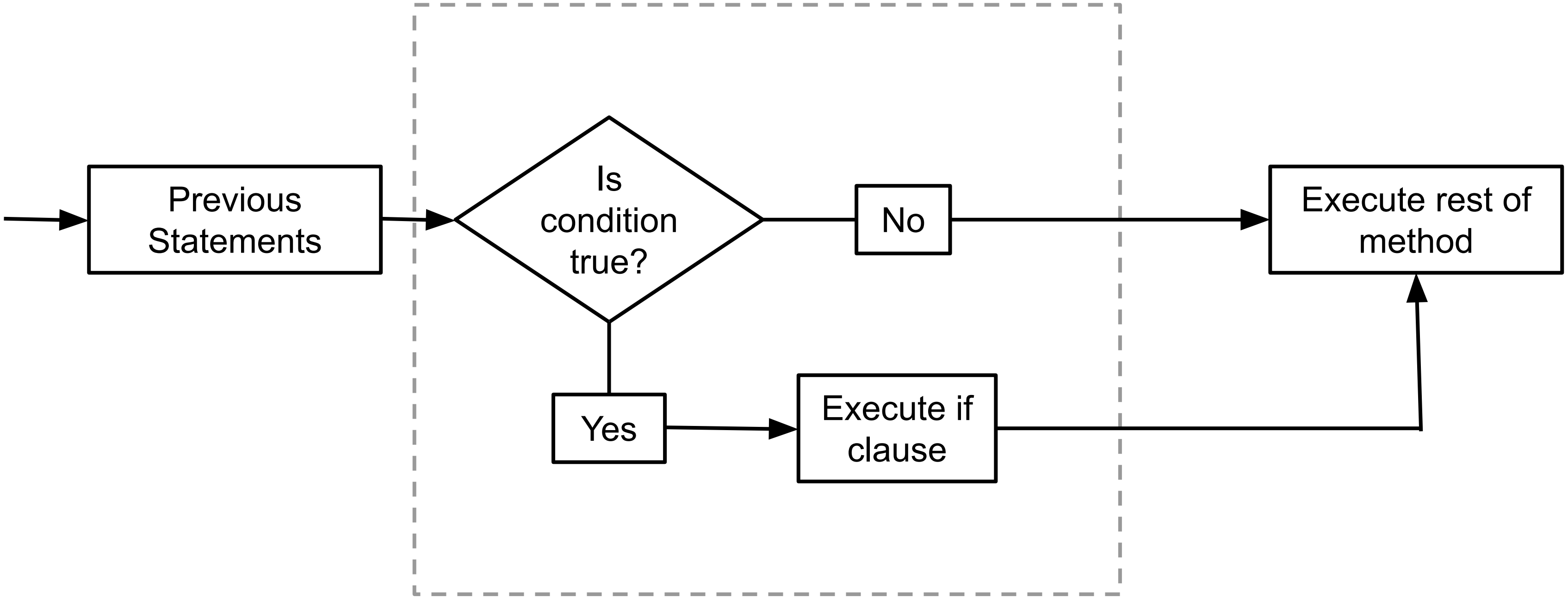
- **Syntax**:

```
if (<boolean expression>) {
        // code to be executed if expression is true
}
```

- If boolean expression is true, code in body of `if` statement is executed. If false, code in body skipped

- Either way, Java compiler continues on with rest of method

`if` Statement: Flow Chart



`if` Statements: Examples

```
int x = 6;
if (x == 5) {
    // code to execute if x is 5
}
```

Not executed

```
if (myBoolean) {
    // code to execute if myBoolean is true
}
```

```
int y = 9;
//more code elided – y is not reassigned
if (y > 7) {
    // code to execute if y is greater than 7
}
```

Executed

Logical Operators: And, Or, Not (1/2)

- Logical operators `&&` ("and") and `||` ("or") can be used to combine two boolean expressions
  - `<expression a> && <expression b>` evaluates to true only if **both** expressions are true
  - `<expression a> || <expression b>` evaluates to true if **at least one** expression is true
- Logical operator `!` ("not") negates a boolean expression
- Logical operator `^` ("exclusive or") returns true if either `a` or `b` is true but not both

Logical Operators: And, Or, Not (2/2)

- To represent the values a logical operator may take, a **truth table** is used

A	B	A && B	A || B	A^B	!A
false	false	false	false	false	true
false	true	false	true	true	true
true	false	false	true	true	false
true	true	true	true	false	false

TopHat Question

Join Code: 504547

Which `if` clause statement will run if the game has started and the tools have been gathered? (The variables below are of type `boolean`)

A. `if(!gameStarted && !toolsGathered){…}`

B. `if(!gameStarted && toolsGathered){…}`

C. `if(gameStarted && !toolsGathered){…}`

D. `if(gameStarted && tools Gathered){…}`

`if` Statements: More Examples

- Should always take one of two forms:
  - `if (<boolean expression>)`
  - `if (!<boolean expression>)`
- **Never do this (inefficient):**
  - `if (<boolean expression> == true)`
  - `if (<boolean expression> == false)`
- **Be careful!** It's easy to mistakenly use `=` (assignment operator) instead of `==` (comparator)

```
int x = 6;
if (x == 5) {
    // code to execute if x
    // is 5
}
```

```
if (!myBoolean) {
    // code to execute if
    // myBoolean is false
}
```

inefficient

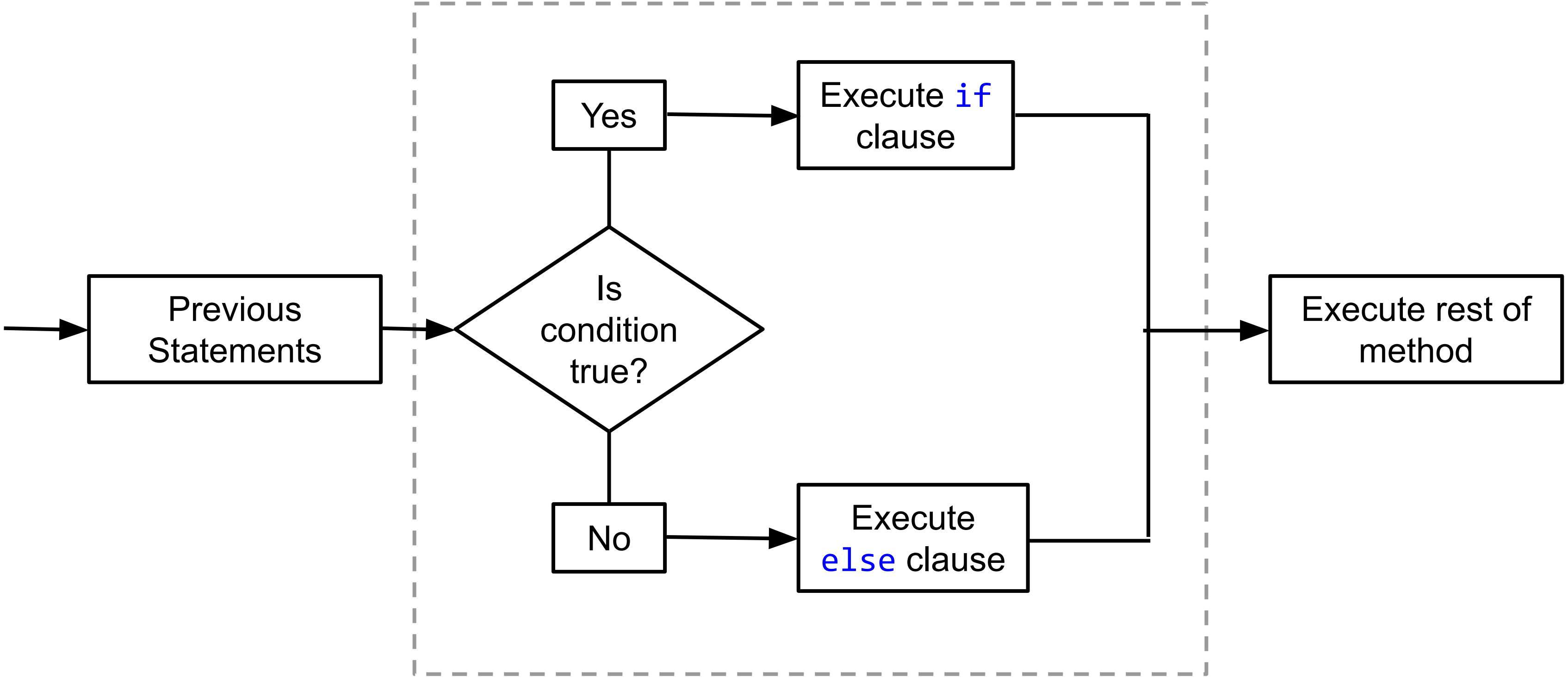
```
if (myBoolean == false) {
    // code to execute if
    // myBoolean is false
    // code is inefficient
}
```

`if-else` (1/2)

- If we want to do two different things depending on whether the `boolean` expression is `true` or `false`, we can use an `else` clause
- Syntax:

```
if (<boolean expression>) {
    // code executed if expression is true
} else {
    // code executed if expression is false
}
```

`if-else`: Flow Chart



if-else (2/2)

- Can use if-else to fill in the sellBread method
- If Peeta's loaves sold are less than amount needed when method is called, he makes bread
- Otherwise, he stops and wins the competition!
- Does this code limit the final number of loaves sold to MAX_LOAVES?

```
import java.lang.Math;

public class Peeta {

    private double loavesSold;

    // constructor elided

    public void bake(double dough, double bakeTime) {
        double loavesMade = dough * bakeTime;
        double anotherLoafSold = (1/2) * Math.sqrt(loavesMade);
        this.loavesSold += anotherLoafSold;
    }
    public void sellBread() {
        if (this.loavesSold < BreadMakerConstants.MAX_LOAVES) {
      //bake 120 units of dough for 5 hours!
      this.bake(120.0, 5.0);
        } else {
       // this method defined elsewhere in the code
           this.winCompetition();
        }
    }
}
```

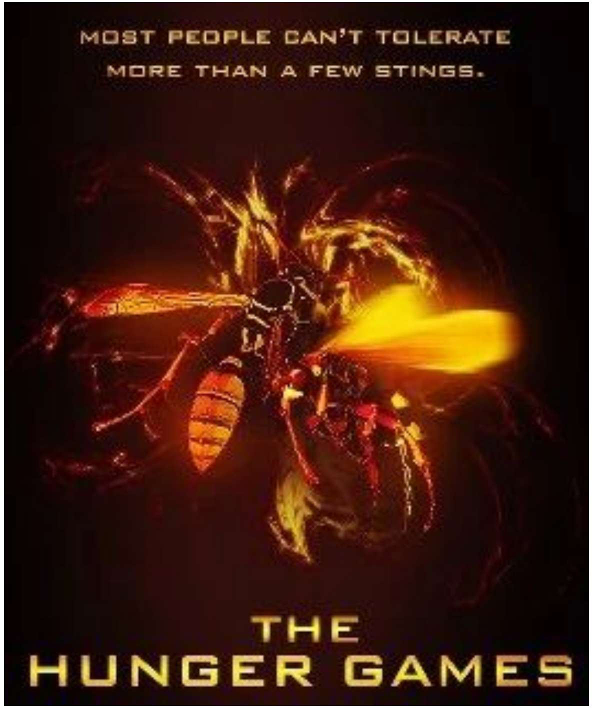
Complex `if-else` Statements

- If `<boolean expression 1>` is true, block 1 is executed and blocks 2 and 3 are skipped
- If `<boolean expression 1>` is false and `<boolean expression 2>` is true, block 2 is executed and blocks 1 and 3 are skipped
- If both expressions are false, block 3 is executed and blocks 1 and 2 are skipped

```
if (<boolean expression 1>) {
    // block 1

} else if (<boolean expression 2>) {
    // block 2

} else {
    // block 3
}
```

Nested `if` Statements

```
// variables and methods defined elsewhere

if (cs15Student.hasBug()) {

    if (cs15Student.hasInitiative()) {
        cs15Student.debug();
    } else {
        cs15Student.giveUp();
    }
}
```



TopHat Question Join Code: 504547

Which print statement will be printed out?

A →
B →
C →
D →
E →

```
int x = 10;
if (x < 10) {
    if ((x+10) > 15) {
        System.out.println("case A");
    } else {
        System.out.println("case B");
    }
} else if (x <= 15) {
    if ((x+2) > 13) {
         System.out.println("case C");
    } else {
         System.out.println("case D");
    }
} else {
    System.out.println("case E");
}
```

Short-Circuiting (1/2)

- What is the value of n after the code to the right has executed?
- n is still 1
- Why?

```
int n = 1;
if ((n < 0) && (n++ == 2)) {
    // code to be executed if
    // expression is true
}

System.out.println(n);
```

Short-Circuiting (2/2)

- Beware of **short-circuiting!**
- If Java already knows what the full expression will evaluate to after evaluating left argument, no need to evaluate right argument
  - `&&`: if left argument of conditional evaluates to `false`, right argument not evaluated
  - `||`: if left argument evaluates to `true`, right argument not evaluated

```
int n = 1;
if ((n < 0) && (n++ == 2)) {
    // code to be executed if
    // expression is true
}
```

```
int n = 1;
if ((n == 1) || (n == 2)) {
    // code to be executed if
    // expression is true
}
```

“Side-effect”ing

- Updating a variable inside a conditional is **not good coding style**; it makes code confusing and hard to read
- Keep in mind short-circuiting if you ever call a method that might have a “**side effect**” inside a conditional – here the first `if` will leave `n` incremented, second not

```
int n = 1;
if ((n++ == 2) && false) {
    // code to be executed if
    // expression is true
}
System.out.println(n);
//system output: 2
```

```
int n = 1;
if (false && (n++ == 2)) {
    // code to be executed if
    // expression is true
}
System.out.println(n);
//system output: 1
```

`switch` Statements (1/2)

- To do something different for every possible value of an integer variable, have two options:
  - use a lot of `else-if`s:

```
if (myInteger == 0) {
        // do something...
    } else if (myInteger == 1) {
        //do something else...
} else if (myInteger == 2) {
    // do something else...
} else if (myInteger == 3) {
    // etc…
}
...
else {
    // last case
}
```

  - better solution: use a `switch` statement!

switch Statements (2/2)

Syntax:

```
switch (<variable>) {
    case <value>:
        // do something
        break;
    case <other value>:
        // do something else
        break;
    default:
        // take default action
        break;
}
```

Rules:

- `<variable>` usually an `integer` – `char` and `enum` (discussed later) also possible
- `values` have to be mutually exclusive
- If `default` is not specified, Java compiler will not do anything for unspecified `values`
- `break` indicates the end of a `case` – skips to end of switch statement (**if you forget `break`, the code in next case will execute**)

switch Example (1/6)

- Let's make a `ScarfCreator` class that produces different colored scarves for our players using a switch statement
- The scarf is chosen by weighted distribution (more orange, red, brown, and fewer blue, green, yellow)
- `ScarfCreator` generates random values using `Math`
- Based on random value, creates and returns a `Scarf` of a particular type

```
// imports elided – Math and Color
public class ScarfCreator{
    // constructor elided
    public Scarf generateScarf() {
```

```
    }
}
```

This is an example of the "factory" pattern in object-oriented programming: it is a method that has more complicated logic than a simple assignment statement for each instance variable.

switch Example (2/6)

- To generate a random value, we use static method random from java.lang.Math
- random returns a double between 0.0 (inclusive) and 1.0 (exclusive)
- This line returns a random int 0-9 by multiplying the value returned by random by 10 and **casting** the result to an int
- Casting is a way of changing the type of an object to another specified type. Casting from a double to int truncates your double!

```
// imports elided - Math and Color
public class ScarfCreater{
    // constructor elided
    public Scarf generateScarf() {
        int randInt = (int) (Math.random() * 10);




    }
}
```

switch Example (3/6)

- We initialize mySCarf to null, and switch on the random value we've generated

```
// imports elided - Math and Color
public class ScarfCreator{
    // constructor elided
    public Scarf generateScarf() {
        int randInt = (int) (Math.random() * 10);
        Scarf myScarf = null;
        switch (randInt) {








        }
    }
}
```

switch Example (4/6)

- Scarf takes in an instance of javafx.scene.paint.Color as a parameter of its constructor (needs to know what color it is)
- Once you import javafx.scene.paint.Color, you only need to say, for example, Color.ORANGE to name a color of type Color
- If random value turns out to be 0 or 1, instantiate an orange Scarf and assign it to myScarf
- break breaks us out of switch statement

```
// imports elided - Math and Color
public class ScarfCreator{
    // constructor elided
    public Scarf generateScarf() {
        int randInt = (int) (Math.random() * 10);
        Scarf myScarf = null;
        switch (randInt) {
            case 0: case 1:
                myScarf = new Scarf(Color.ORANGE);
                break;




        }
    }
}
```

switch Example (5/6)

- If our random value is 2, 3, or 4, we instantiate a yellow `Scarf` and assign it to `myScarf`
- `Color.YELLOW` is another constant of type `Color` – check out Javadocs for `javafx.scene.paint.Color`!

```
public class ScarfCreator{
    // constructor elided
    public Scarf generateScarf() {
        int randInt = (int) (Math.random() * 10);
        Scarf myScarf = null;
        switch (randInt) {
            case 0: case 1:
                myScarf = new Scarf(Color.ORANGE);
                break;
            case 2: case 3: case 4:
                myScarf = new Scarf(Color.YELLOW);
                break;



        }
    }
}
```

switch Example (6/6)

- We skipped over the cases for values of 5, 6, and 7; assume they create green, blue, and red Scarfs, respectively
- Our default case (if random value is 8 or 9) creates a brown Scarf
- Last, we return myScarf, which was initialized in this switch with a color depending on the value of randInt

```
public class ScarfCreator{
    // constructor elided
    public Scarf generateScarf() {
        int randInt = (int) (Math.random() * 10);
        Scarf myScarf = null;
        switch (randInt) {
            case 0: case 1:
                myScarf = new Scarf(Color.ORANGE);
                break;
            case 2: case 3: case 4:
                myScarf = new Scarf(Color.YELLOW);
                break;
            // cases 5, 6, and 7 elided.
            // they are green, blue, red.
             default:
                 myScarf = new Scarf(Color.BROWN);
                 break;
        }
        return myScarf;
    }
}
```

TopHat Question

Join Code: 504547

Which of the following `switch` statements is correct?

- In the constructor for `Weapon`, the parameter is a string.

A.

```
int rand = (int) (Math.random() * 10);
Weapon weapon = null;

switch (rand) {
    case 0: case 1: case 2: case 3:
        weapon = new Weapon(“Axe”);

    case 4: case 5: case 6: case 7:
        weapon = new Weapon(“Poison”);

     default:
        weapon = new Weapon(“Knife”);
        break;
}
```

B.

```
int rand = (int) (Math.random() * 10);
Weapon weapon = null;

switch (rand) {
    case 0: case 1: case 2: case 3:
        weapon = new Weapon(“Axe”);
        break;

    case 4: case 5: case 6: case 7:
        weapon = new Weapon(“Poison”);
        break;

    default:
        weapon = new Weapon(“Knife”);
        break;
}
```

C.

```
WeaponType type = type.random();
Weapon weapon = null;

switch (type) {
    case Axe:
        weapon = new Weapon(“Axe”);
        break;

    case Bali:
        weapon = new Weapon(“Poison”);
        break;

    default:
        weapon = new Weapon(“Knife”);
        break;
}
```

That's It!

Important Concepts:

- `static` methods and `static` variables
- Constants
- `boolean`s
- Making decisions with `if`, `if-else`, `switch`

Announcements

- FruitNinja (handout and help slides) released today
  - **Early handin: 10/8** (+2 bonus points)
  - **On-time handin: 10/10**
  - **Late handin: 10/12** (-8 for late handin, but 4 late days to use throughout semester)
- Debugging Hours start **<u>Thursday, October 5</u>**
  - More information on the course website
- Polymorphism section this week
  - email your section TAs mini-assignment on time
- SNC Deadline today at 5pm!! (Not CS15 enforced, University Policy)

SRC: Ethics and Labor Practices in Big Tech

CS15 Fall 2023

The Power of Big Tech

As of 2022…

- 50% of global online ad spending goes through Meta or Alphabet
- Amazon takes in more than 40% of online spending in the US
- In search, Google has more than a 60% share in the US
- Microsoft is a top-three vendor to 84% of businesses

Source: Harvard Business Review (2022)

How Big Tech Does Ethics: Internal Guidelines

- Internal advisory teams that create guidelines for responsible use of AI and other technologies
- Reports with established ethical principles for teams to follow

Program overview

We built our compliance and ethics program on three pillars: Prevention, Detection, and Remediation. We continually evolve our programs to meet these goals.

Prevention

Detection

Remediation

How Big Tech Does Ethics: Google's "AI Applications We Will Not Pursue"

1. Technologies that cause or are likely to cause overall harm. Where there is a material risk of harm, we will proceed only where we believe that the benefits substantially outweigh the risks, and will incorporate appropriate safety constraints.

2. Weapons or other technologies whose principal purpose or implementation is to cause or directly facilitate injury to people.

3. Technologies that gather or use information for surveillance violating internationally accepted norms.

4. Technologies whose purpose contravenes widely accepted principles of international law and human rights.

As our experience in this space deepens, this list may evolve.

The Technology Facebook and Google Didn’t Dare Release

Engineers at the tech giants built tools years ago that could put a name to any face but, for once, Silicon Valley did not want to move fast and break things.

‘We decided to stop’

Source: NYT (2023)

Abuse of Power in Big Tech

WILL KNIGHT BUSINESS NOV 4, 2022 12:20 PM

Elon Musk Has Fired Twitter's 'Ethical AI' Team

As part of a wave of layoffs, the new CEO disbanded a group working to make Twitter's algorithms more transparent and fair.

FUTURE PERFECT TECHNOLOGY

Exclusive: Google cancels AI ethics board in response to outcry

The controversial panel lasted just a little over a week.

By Kelsey Piper | Apr 4, 2019, 7:00pm EDT

PLATFORMER / MICROSOFT / TECH

Microsoft lays off team that taught employees how to make AI tools responsibly

European watchdog fines Meta $1.3 billion over privacy violations

May 22, 2023 · 1:38 PM ET

By Mary Yang, Eleanor Beardsley

Microsoft Agrees to Pay $20 Million Civil Penalty for Alleged Violations of Children's Privacy Laws

TikTok Fined $370 Million for Mishandling Child Data

Source: Wired (2022), Justice Dept. (2023), The Verge (2023), CNN (2023), NPR (2023), NYT (2023)

Working Conditions

MONEYWATCH ›

Workers at Apple iPhone factory in China beaten in COVID protest

MONEY WATCH

NOVEMBER 23, 2022 / 7:33 AM / AP

Forbes

CAREERS

A Hard-Hitting Investigative Report Into Amazon Shows That Workers' Needs Were Neglected In Favor Of Getting Goods Delivered Quickly

Jack Kelly Senior Contributor

I write actionable interview, career and salary advice.

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TECH • ARTIFICIAL INTELLIGENCE

Gig Workers Behind AI Face 'Unfair Working Conditions,' Oxford Report Finds

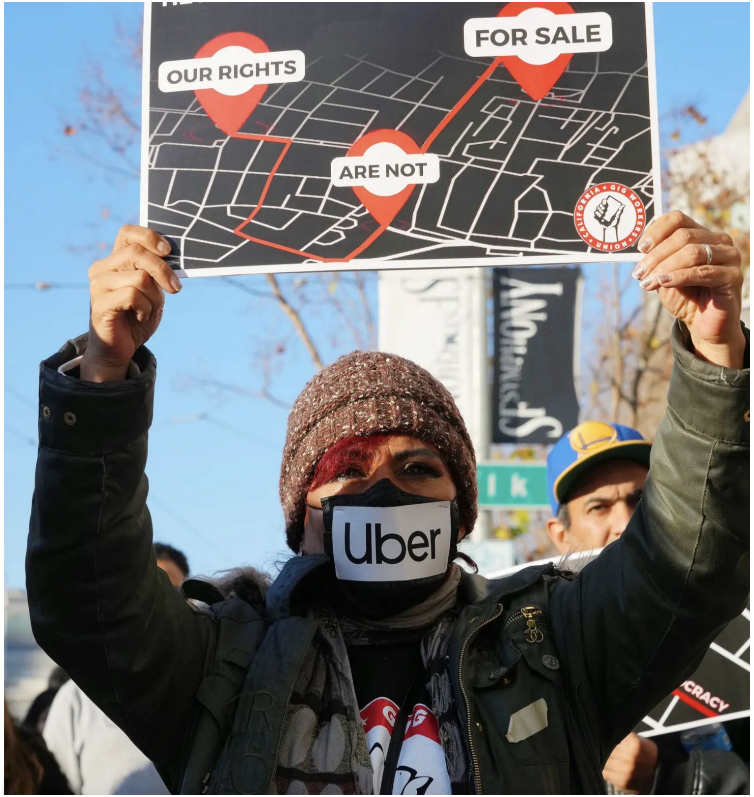
Sources: CBS (2022), Forbes (2021), Time (2022)

Proposition 22

- Classifies Uber/Lyft drivers as independent contractors, not as employees

- Reduces benefits like insurance, saving companies money

- Gig companies spent >$200 million pushing for Proposition 22



Source: NYT (2023)

Next lecture…

U.S. Accuses Amazon of Illegally Protecting Monopoly in Online Retail

The Federal Trade Commission and 17 states sued Amazon, saying its conduct in its online store and services to merchants illegally stifled competition.

Source: NYT (2023)

Next lecture… antitrust laws!

Designed to increase consumer welfare

Involves breaking up firms that get “too big”, or preventing mergers and acquisitions (M&A)

Highly debated subject