CS 302: INTRODUCTION TO PROGRAMMING IN JAVA

Lecture 16

REVIEW

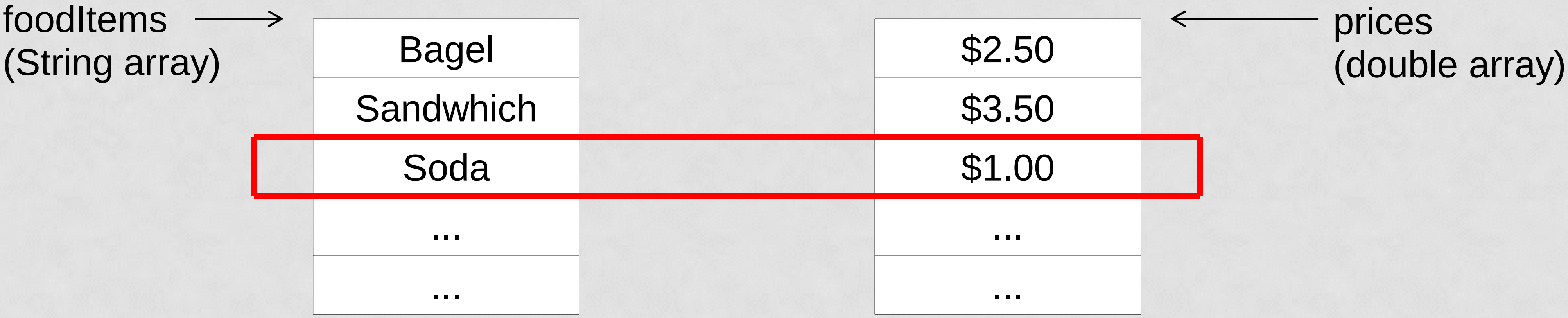
- What is aggregation?
- Object variables are what type of variables?
- What does null mean?
- How do you test for null?
- How is a toString() method useful?
- What does the "this" keyword refer to?
- Predicate method means?

ENCAPSULATION

- Use a public interface to hide implementation details
- Use a public interface to ensure data protection
  - Don't let a balance in a BankAccount go negative
  - Make sure a Date object has a valid year/month/day
  - etc.

PARALLEL ARRAYS

- Sometimes you have 2 (or more) part data (ex. a list of food items and their prices)
- One way to solve: use 2 parrallel arrays, one for the food items and one for their prices



foodItems
(String array)

Bagel	$2.50
Sandwhich	$3.50
Soda	$1.00
...	...
...	...

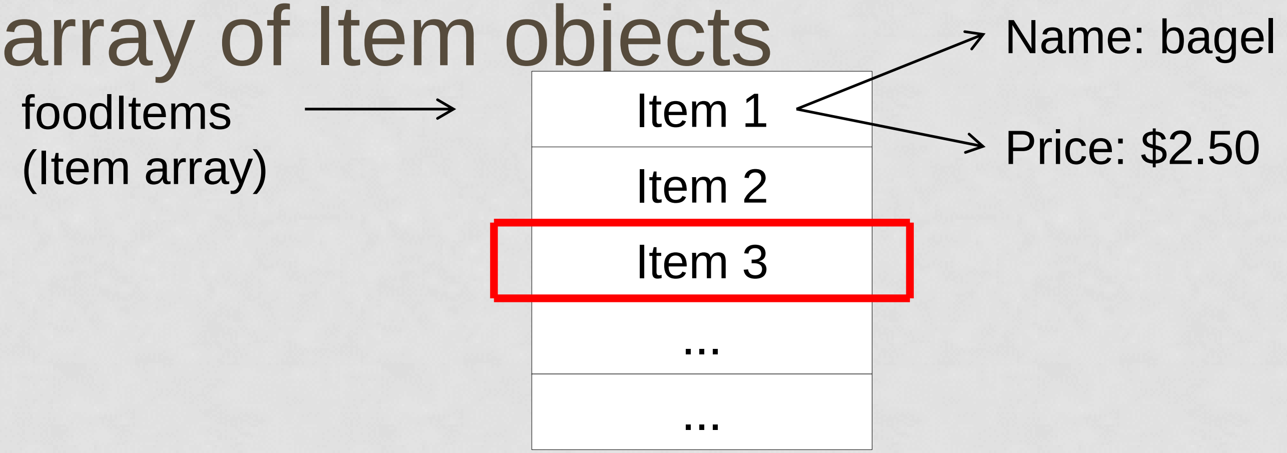
prices
(double array)

- It can be difficult to keep them in sync
- Code is annoying:

```
System.out.println(“Name: “ + foodItems[i] + “price:“
+  prices[i]);
```

SOLUTION: USE AN OBJECT

- Each slice of the 2 individual arrays represents 1 thing (an Item object) that has 2 properties (a name and a price)
- Create an Item object with name and price as instance data and then you only need one array of Item objects



foodItems
(Item array)

Item 1

Item 2

Item 3

...

...

Name: bagel

Price: $2.50

To get the name of item 3 the call would be:
foodItems[2].getName()

STATIC VARIABLES

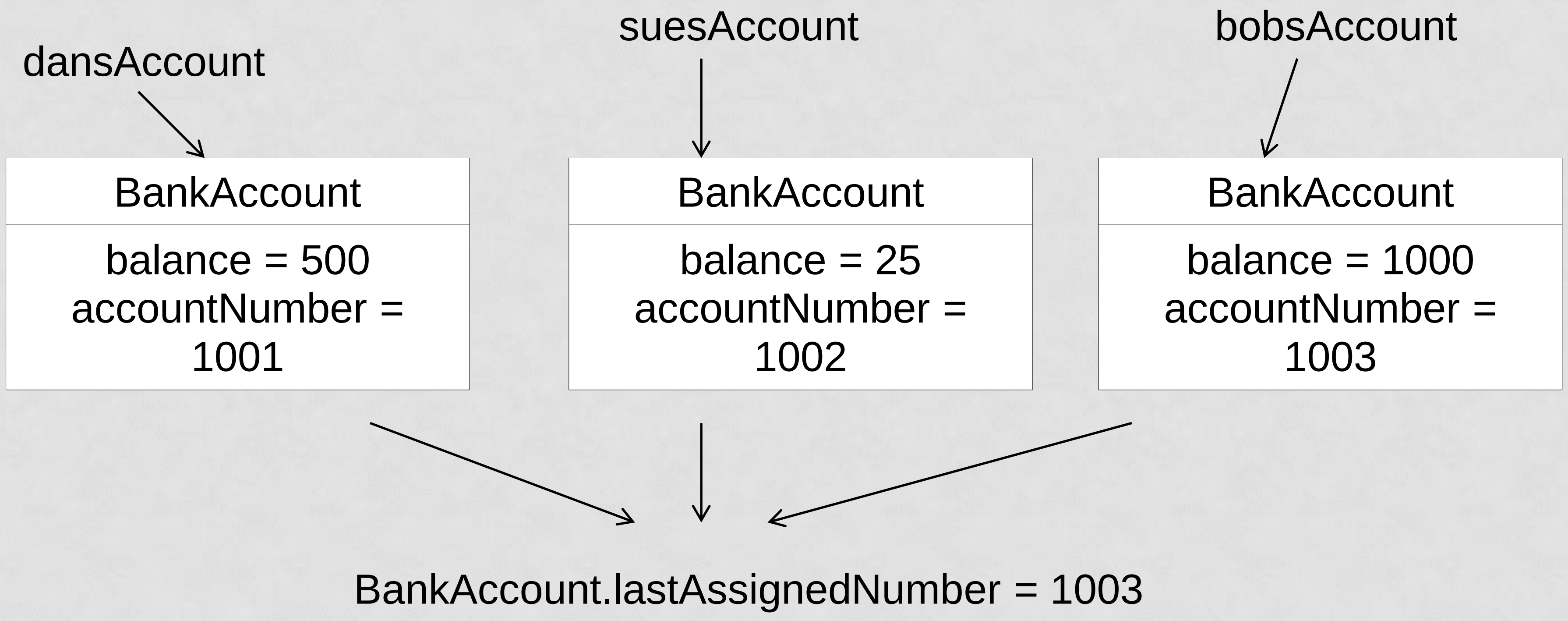
- What if we want a variable that is shared amongst all objects of a class?
- Ex. A BankAccount might have an account number and each additional account should have a sequential account number (i.e. The first BankAccount will have account number = 1001, the second will have account number 1002, etc.)
- Solution: use static variable
- How do we access static fields?

STATIC VARIABLES (CONT.)

```
public class BankAccount
{
  private double balance;
  private int accountNumber;
  private static int lastAssignedNumber = 1000;
  public BankAccount()
  {
      balance = 0; //do we need this line?
      BankAccount.lastAssignedNumber++;
      accountNumber = lastAssignedNumber;
}
```

STATIC VARIABLES (CONT.)

- Each new BankAccount will have its own balance and accountNumber, but all have the same lastAssignedNumber (accessed with BankAccount.lastAssignedNumber)



STATIC VARIABLES AS CONSTANTS

- Static variables, like instance variables, should be declared private
- Exception: if the static variable is a constant it can be declared public
- Ex. A BankAccount might have an overdraft fee common to every account (that never changes)

```
public BankAccount
{
   public static final double OVERDRAFT_FEE = 29.95;
   ...
}
```

To Access: BankAccount.OVERDRAFT_FEE

STATIC METHODS

- Static Methods = methods that are NOT invoked on an object
- Ex. Math.sqrt(), Math.pow – there is no instance of a "Math" object that is changing or doing anything (we never say Math whatever = new Math())
- Ex. you might want a calcArea method in a Circle class

```
public static double calcArea(int radius)
{
  return radius*radius*PI;
}
```

- Call would be Circle.calcArea(x);
- Cannot directly interact with instance data (why?)

PACKAGES

- A Package is a set of related classes
- Ex. java.util – utility classes such as Scanner, Random
- To put a class in a package:
  - package packageName; //goes above class definition
- Ex. Put BankAccount in a Financial package

```
package financial;
public class BankAccount {
```

IMPORTING PACKAGES

- Already know how to do
  - import java.util.Scanner; //import specific class within a package
  - import java.util.*; //import all classes within package
- Why don't we need to import anything to use the Math class?
  - Math class is in java.lang package
  - Every java source file automatically does a import java.lang.*

CUMULATIVE PRACTICE FOR OBJECTS AND INSTANTIABLE CLASSES

- Design a program that detects course conflicts for students since you are working in IT division at Registrar’s Office
- Create a package called courseConflicts for 3 instantiable classes called Course, Student, TimeSlot.
- A course has a name and a few time slots, users can 1) add slot to the course and 2) check it this course conflicts with another one
- A student can have many courses, he/she can 1) be enrolled in some course and 2). Get all course conflicts he/she has
- A TimeSlot have day, starting time and length, it can also check if it conflicts with another TimeSlot.