Review of Assignments

• Sudoku – subsquares

• More compile errors than previous assignments

• Many logic errors - pseudocode, trace variables

• Several errors in output

Object Oriented Programming

Chapter 8
November 8, 2010

Array variables are references

Homogeneous Collections
Heterogeneous Collections

With arrays, we could refer to an element of the array by an index.

How can we refer to the variables inside an object?

http://muppet.wikia.com/wiki/Big_Bird

Heterogeneous Collections

String name = "Big Bird";
int age = 6;
double height = 8.167;
String color = "yellow";

myObject.name
myObject.age
myObject.height
myObject.color

Class Definition (Version 1)

```
BigBird.java
public class BigBird{
    String name = "Big Bird";
    int age = 6;
    double height = 8.167;
    String color = "yellow";
}
```

Instatiate

BigBird bb = new BigBird();
Instantiate Objects

```
new BigBird();
```

```
new BigBird();
```

```
new BigBird();
```

```
bb1
```

```
bb2
```

```
bb3
```

```
Muppet.java
```

```java
class Muppet{
    String name;
    int age;
    double height;
    String color;

    public Muppet(String n, int a, double h, String c){
        name = n;
        age = a;
        height = h;
        color = c;
    }
}
```

Class Definition (Version 2)

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Muppet
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```
Mupp...
Access to Fields

```
bb
  name
    "Big Bird"
  age
    6
  height
    8.167
  color
    "yellow"
```

bb.name

bb.age

bb.height

bb.color

Direct Access to Fields

(Not good Object Oriented Design!)

```
Muppet bb = new Muppet("Big Bird", 6, 8.167, "yellow");
System.out.println(bb.name + " is "+
               bb.age+" years old.");
System.out.println(bb.name+" is a "+
               bb.color+" muppet that is "+
               bb.height+" inches tall.");
```

Big Bird is 6 years old.
Big Bird is a yellow muppet that is 8.167 inches tall.

Object Oriented Design

“Object-oriented design is the process of planning a system of interacting objects for the purpose of solving a software problem.”

(http://en.wikipedia.org/wiki/Object-oriented_design)

- Collection of heterogeneous objects
- Collection of state and behavior
- Encapsulation

Class Definition (Version 3)

```
Muppet.java
class Muppet{
  String name;
  int age;
  double height;
  String color;
  public Muppet(String n, int a, double h, String c){
    name = n;
    age = a;
    height = h;
    color = c;
  }
  public String getName(){
    return name;
  }
}
```
Indirect Access to Fields
(Closer, but still not good Object Oriented Design!)

Muppet bb = new Muppet("Big Bird",
6, 8.167, "yellow");

System.out.println(bb.getName() +" is "+
bb.age +" years old.");

System.out.println(bb.getName() +" is a "+
bb.color +" muppet that is "+
bb.height +" inches tall.");

Variable Access
(Halfway there)

Muppet bb = new Muppet("Big Bird",
6, 8.167, "yellow");

System.out.println(bb.ageToString());

System.out.println(bb.getName() +" is a "+
bb.color +" muppet that is "+
bb.height +" inches tall.");

Class Definition (Version 4)

Muppet.java

class Muppet{
    String name;
    int age;
    double height;
    String color;

    public Muppet(String n, int a, double h, String c){
        name = n;
        age = a;
        height = h;
        color = c;
    }

    public String ageToString(){
        return name + " is "+
                 age +" years old.";
    }
}

Class Definition (Version 5)

class Muppet{
    String name;
    int age;
    double height;
    String color;

    public Muppet(String n, int a, double h, String c){
        name = n;
        age = a;
        height = h;
        color = c;
    }

    public String ageToString(){
        return name + " is "+
                 age +" years old.";
    }

    public String descriptionString(){
        return name + " is a "+color+" muppet that is "+
                 height +" inches tall.";
    }
}
Access to Fields through Methods

Muppet bb = new Muppet("Big Bird", 6, 8.167, "yellow");
System.out.println(bb.ageToString());
System.out.println(bb.descriptionString());

Change to the output format

Instead, let's say "The <color> muppet, <name>, is <height> inches tall."

Muppet bb = new Muppet("Big Bird", 6, 8.167, "yellow");
System.out.println(bb.name + " is " + bb.age + " years old.");
System.out.println(bb.name + " is a " + bb.color + " muppet that is " + bb.height + " inches tall.");

Encapsulation

class Muppet{
    private String name;
    private int age;
    private double height;
    private String color;

    public Muppet(String n, int a, double h, String c){
        name = n;
        age = a;
        height = h;
        color = c;
    }

    public String descriptionString(){
        return "The "+color+" muppet, "+name+", is "+height+" inches tall."
    }
}
Access to Private Variables

Muppet oscar = new Muppet("Oscar", 43, 3.85, "green");
System.out.println(oscar.name + " is " +
   oscar.age + " years old.");

Keyword this

class Muppet{
    String name;
    
    public Muppet(String name){
        this.name = name;
    }
}

Variable that belongs to the object Parameter from the method call

Mutators

public void setColor(String c){
    color = c;
}

    public void incrementAge(){
        age = age + 1;
    }