Assignments

• How is everyone doing?
• Useful tips:
  – System.exit(0); vs return;
• Assignment #5
• Questions???

Encapsulation

• Hide implementation details from client
• Abstraction
  – Focus on big picture rather than details
• Examples:
  – Radio
  – Others?
Encapsulation in OOP

- **Public vs. Private**
  ```java
  public class Point {
      private int x = 10;
      private int y = 20;
  }
  public class MakePoints {
      public static void main(String[] args) {
          Point p1 = new Point();
          System.out.println(p1.x + " " + p1.y);
      }
  }
  ```

- **Create accessor methods**
  ```java
  public class Point {
      private int x = 10;
      private int y = 20;
      public int getX() { return x; }
      public int getY() { return y; }
  }
  public class MakePoints {
      public static void main(String[] args) {
          Point p1 = new Point();
          System.out.println(p1.getX() + " " + p1.getY());
      }
  }
  ```

- **Use accessor methods**
  ```java
  public class MakePoints {
      public static void main(String[] args) {
          Point p1 = new Point();
          System.out.println(p1.getX() + " " + p1.getY());
      }
  }
  ```
Encapsulation in OOP

• Private methods
  public class Point {
      private int x = 10;
      private int y = 20;
      public Point (int x, int y) {
          setLocation(x, y);
      }
      private setLocation(int newX, int newY) {
          x = newX;  y = newY;
      }
  }

Encapsulation in OOP

• Can we do this?
  public class MakePoints {
      public static void main(String[] args) {
          Point p1 = new Point(3, 8);
          ...;
          p1.setLocation(4, 10);
      }
  }

Full Template for Java Class

public class <class_name> {
    //class attributes
    private <type> <name> ;
    private <type> <name> ;
    ...
    //constructors
    public <class_name> (<type> <name>, <type> <name>, ...) {
        ...
    }
    //methods
    public <type> <name>[<type> <name>, <type> <name>, ...] {
        ...
    }
}
Benefits to Encapsulation

• Add error checking to methods
• Protected from internal changes

Checking Errors in a Method

```java
public class TimeSpan {
    private int hours;
    private int minutes;
    ...
    public void add(int hours, int minutes) {
        this.hours += hours;
        this.minutes += minutes;
    }
}
```

• What is wrong with this add method?

Throwing Exceptions in a Method

```java
public class TimeSpan {
    private int hours;
    private int minutes;
    ...
    public void add(int hours, int minutes) {
        if(hours < 0 || minutes < 0) {
            throw new IllegalArgumentException();
        }
        this.hours += hours;
        this.minutes += minutes;
        this.hours += this.minutes / 60;
        this.minutes += this.minutes % 60;
    }
}
```
Changing Internal Implementation

public class TimeSpan {
    private int totalMinutes;
    ...
    public void add(int hours, int minutes) {
        if(hours < 0 || minutes < 0) {
            throw new IllegalArgumentException();
        }
        totalMinutes += 60 * hours + minutes;
    }
    public String toString() {
        return (totalMinutes/60) + "h " + (totalMinutes%60) + "m";
    }
}