CS 213 : Software Methodology
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OOP
Inheritance/Static & Dynamic Types

Inheritance – Fields and Methods

```
package geometry;

public class Point {
   int x,y;
   public Point(int x, int y) {
      this.x = x; this.y = y;
   }
   public int getX() {
      return x;
   }
   public int getY() {
      return y;
   }
   public String toString() {
      return x + "," + y;
   }
}
```

```
package geometry;

public class ColoredPoint
extends Point {
   int x,y;

   String color;
   public ColoredPoint(
    int x, int y, String color) {
      super(x,y);
    this.color = color;
   }

   public int getX() { return x; }
   public int getY() { return y; }

   public String toString() {
       return x + "," + y;
   }
}
```

Constructor inherited?

NO

WHY NOT?

Are we ok with using this as is?

NO. Color should be included.

Inheritance – Overriding Method

```
package geometry;

public class ColoredPoint
extends Point {
   int x,y;

   String color;
   public ColoredPoint(
    int x, int y, String color) {
      super(x,y);
      this.color = color;
   }

   public int getX() { return x; }
   public int getY() { return y; }

   public String toString() {
   public String toString() {
       return x + "," + y;
   }
   }
}
```

This implementation overrides the inherited code

```
      return x + "," y + "," + color;
```

Inheritance – Reusing inherited method code in overriding Method

```
package geometry;

public class ColoredPoint
extends Point {
   int x,y;

   String color;
   public ColoredPoint(
    int x, int y, String color) {
      super(x,y);
      this.color = color;
   }

   public int getX() { return x; }
   public int getY() { return y; }

   public String toString() {
       return x + "," + y + "," + color;
   }          super.toString()
}
```

Reusing inherited method code in overriding method is good programming practice

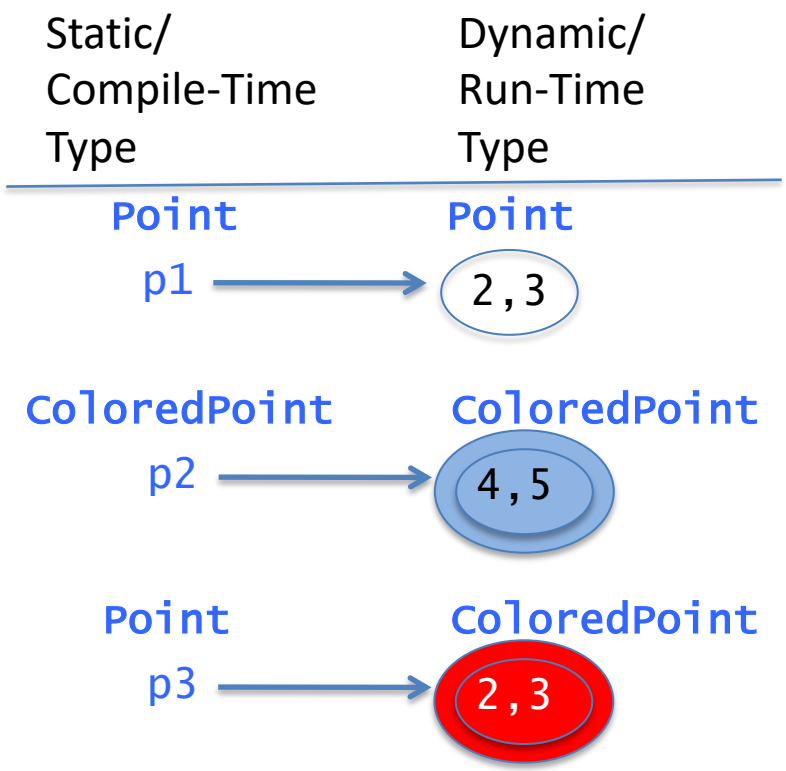
Static and Dynamic Types

```
public class PointApp {
   public static void
   main(String[] args) {

     Point p1 = new Point(2,3);


     ColoredPoint p2 =
       new ColoredPoint(4,5,"blue");


     Point p3 =
       new ColoredPoint(2,3,"red");
}
```



Every `ColoredPoint` is a `Point` (just like every Student is a Person) – so any `ColoredPoint` instance (dynamic type) can be referred to by a `Point` variable (static type)

Dynamic Binding

```
public class PointApp {
   public static void
   main(String[] args) {
      Point p1 = new Point(2,3);
      ColoredPoint p2 = new ColoredPoint(4,5,"blue");
      Point p3 = new ColoredPoint(2,3,"red");
      System.out.println(p2.getColor()); // ? "blue"
      System.out.println(p3.getX()); // ? 2
      System.out.println("p3 = " + p3); // ? "p3 = 2,3,red"
}
```

Dynamic Binding

Static type of p3 is `Point`, but dynamic type (type of instance it points to) is `ColoredPoint`.

So, the `p3.toString()` static call is bound to the dynamic type, `ColoredPoint`.

This results in the overridding version of `toString()` in `ColoredPoint` being executed.

Static and Dynamic Types

```
public class PointApp {
   public static void
   main(String[] args) {

      ColoredPoint p4 = new Point(5,6); // ?

}
```

WILL NOT COMPILE
Every `Point` (RHS) is NOT a `ColoredPoint` (LHS), so a `Point` instance cannot be referenced by a `ColoredPoint` variable

Static and Dynamic Types

```
public class PointApp {
   public static void
   main(String[] args)

      Point p5 = new ColoredPoint(1,2,green);

      System.out.println(p5.getColor());  // ?

}
```

WILL NOT COMPILE
Because the static type of `p5` is `Point`, ONLY members of `Point` class can be syntactically referenced by `p5`. Since `getColor` is not in the Point class, compiler flags error