CSE 115/503

March 1-5, 2010

Announcements

- Lab 4 due this week
- Lab 5 started this week – due after spring break
- Exam 3 after spring break.

Composition [Whole-Part Relationship]

- One object (source) takes responsibility for creating the other (target)
- use instance variable to hold onto the "part"

```
public class Source {
    private Target _part;
    public Source() {
        _part = new Target();
    }
}
```

Association

"Knows a" relationship

Two objects that do work together

Source has an instance variable of type target to communicate with.

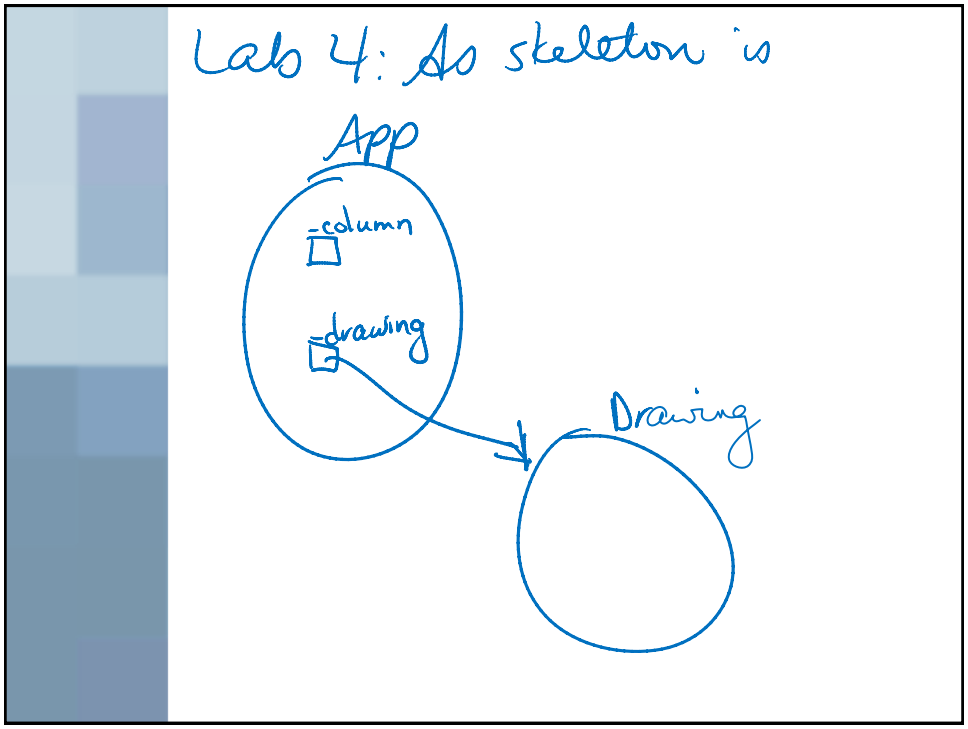
```
public class Source {
    private Target _associate;

    public Source(Target target){
        _associate = target;
    }
```

GraphicsExample4

- Creates a shape that can be controlled by the button on the screen
- An example of using action listeners as well as the association relationship

NullPointerException

- Occurs when your code calls a method on a null reference
- A null reference is a reference that is declared, but never assigned an object



Lab 4

- Notice that the reference for _column does not refer to any object
- That is why if you run the program without creating an object for the reference, a NullPointerException is thrown and the program doesn't work

Changes to Lab 4

- Took the skeleton and moved the setUpButtons() method from App to Drawing
- Makes Lab 4 code look closer to what Lab 5 code would look like

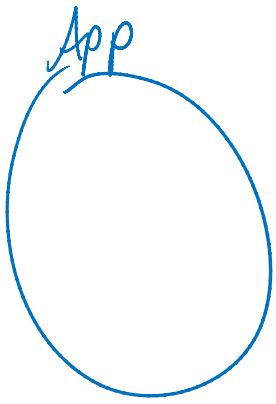
Object Diagrams

- Let's trace through the object diagrams for the GraphicsExample4 program the way it is currently.

GraphicsExample4

- When we select Run As-> Java Application, the method main is executed.
- In main, there is only one line of code

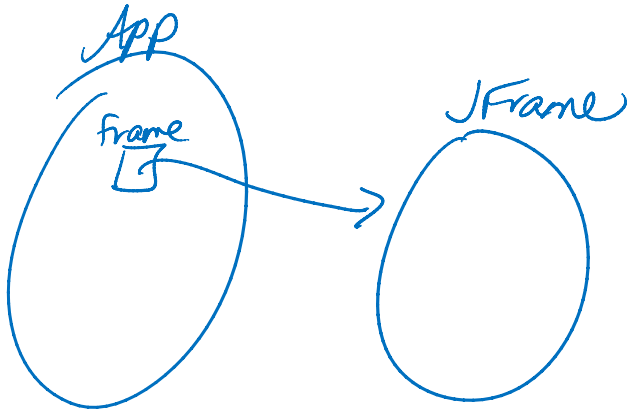
```
new App();
```



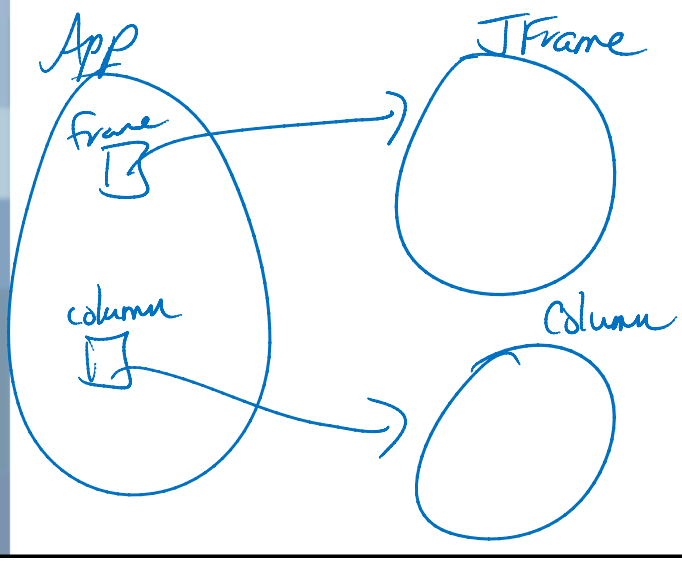
There is no reference to the App object created, just the object.

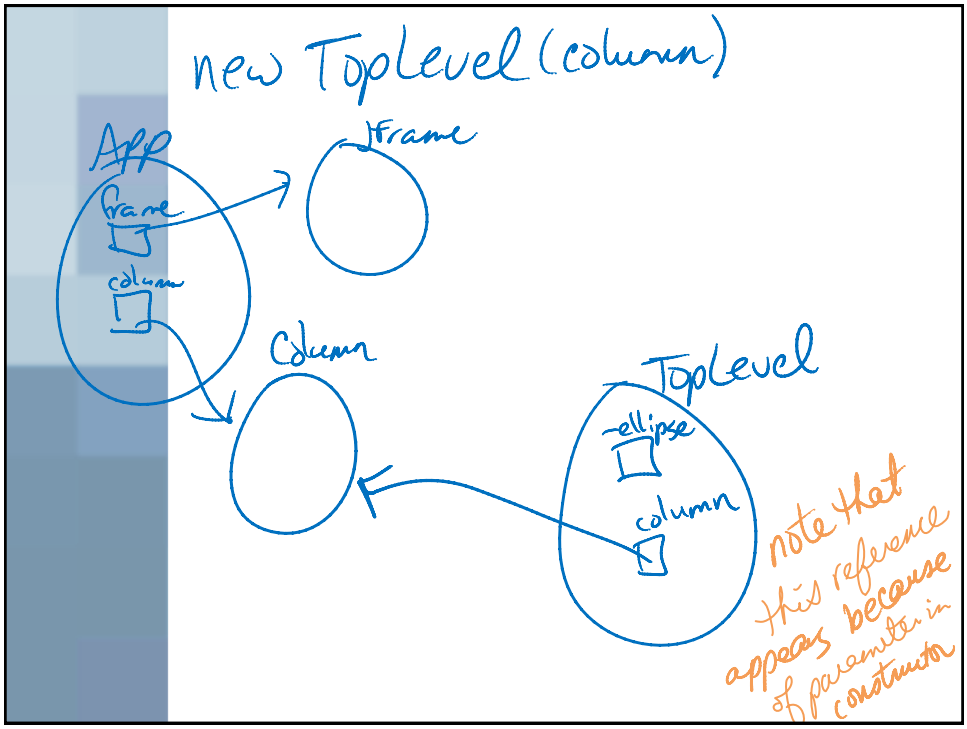
App has no instance variables, but as the App constructor is executed, various local variables are created.

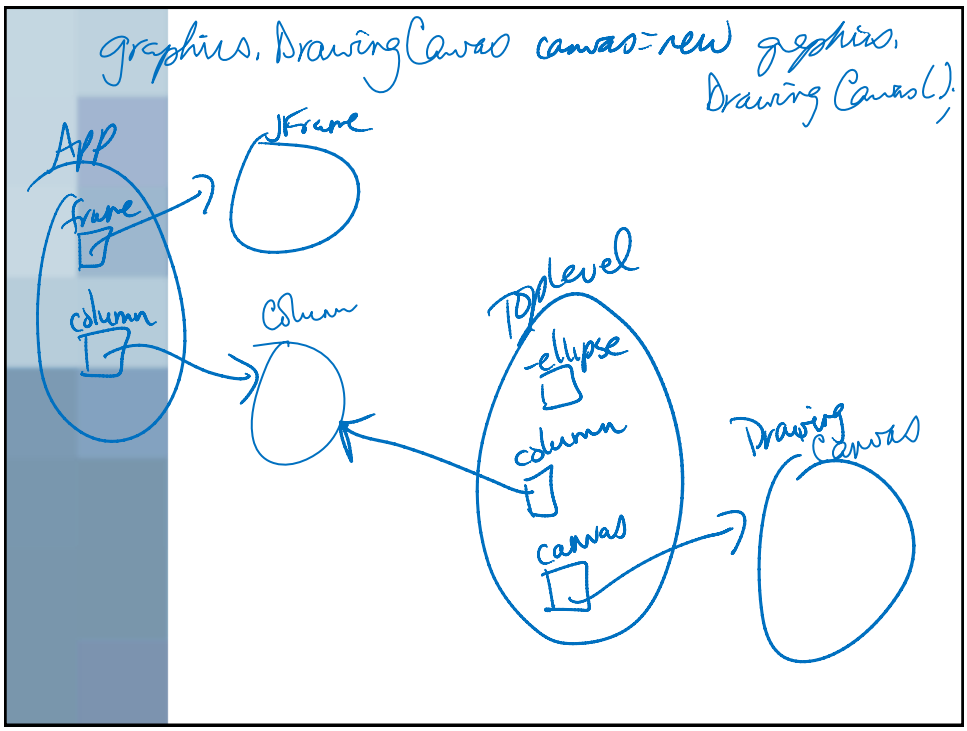
JFrame frame = new JFrame();

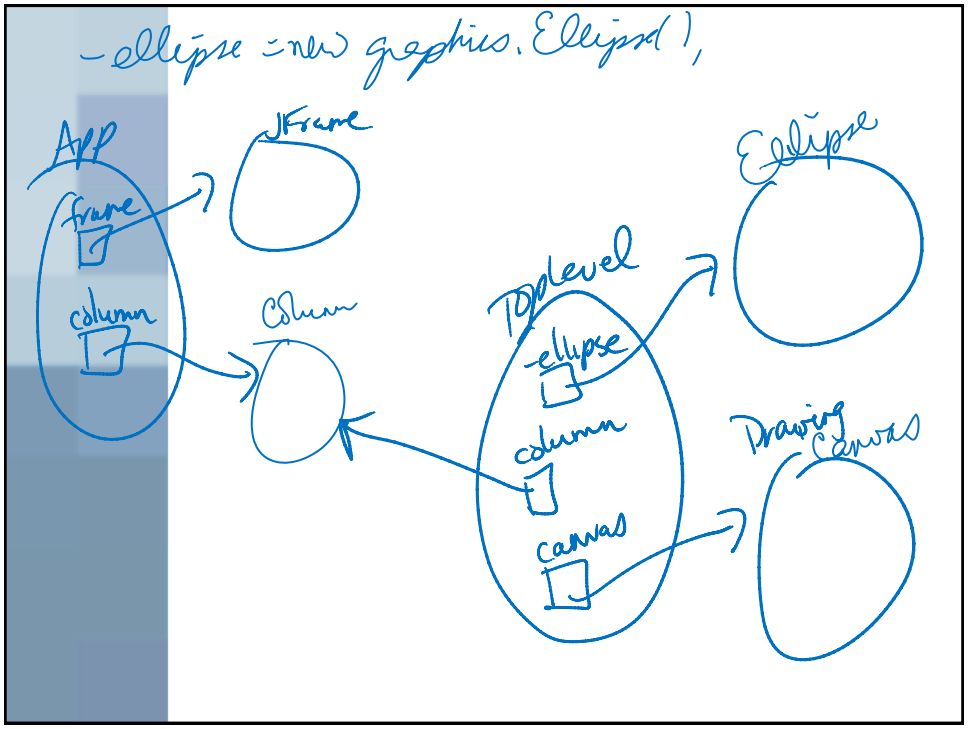


Container.Column column = new Container.Column();

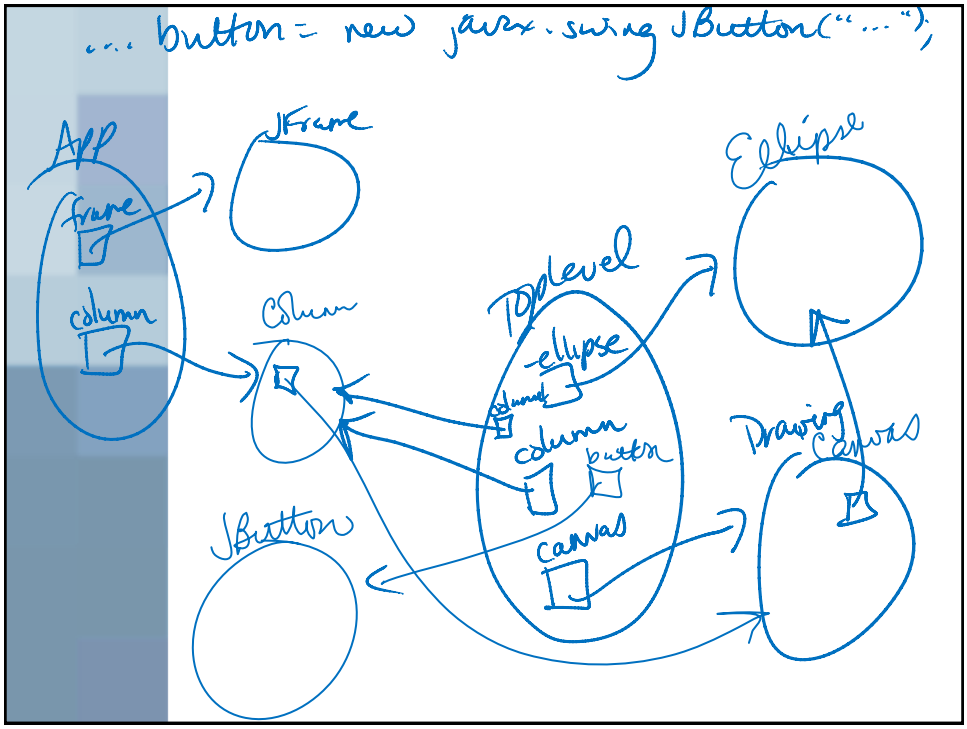


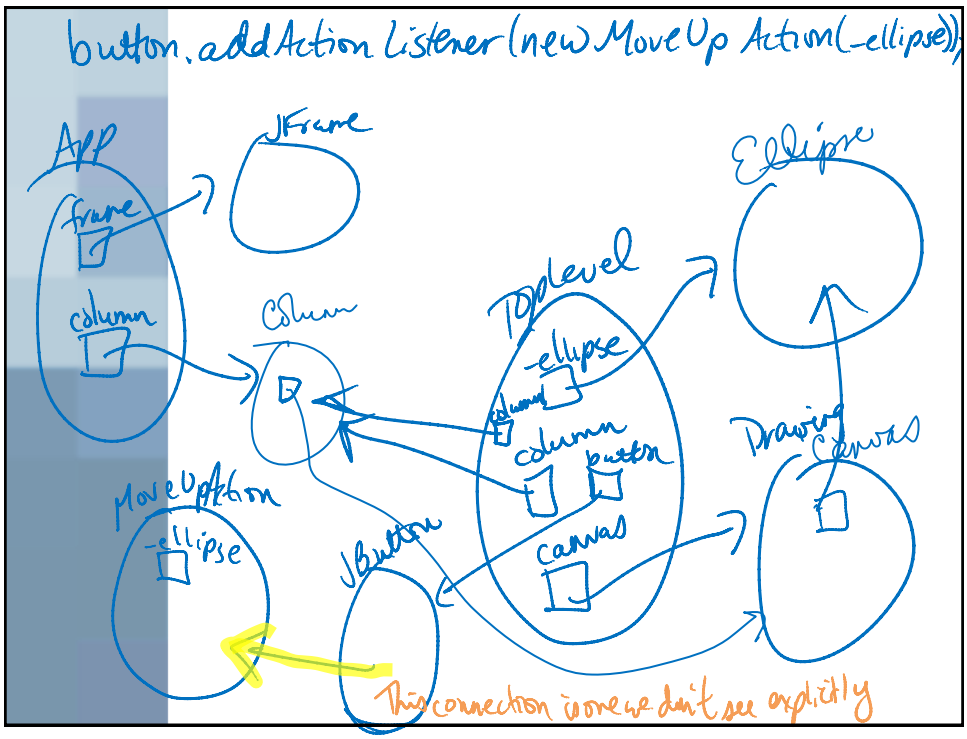

new Toplevel(column)
App
frame
column
JFrame
Column
Toplevel
ellipse
column
note that this reference appears because of parameter in constructor

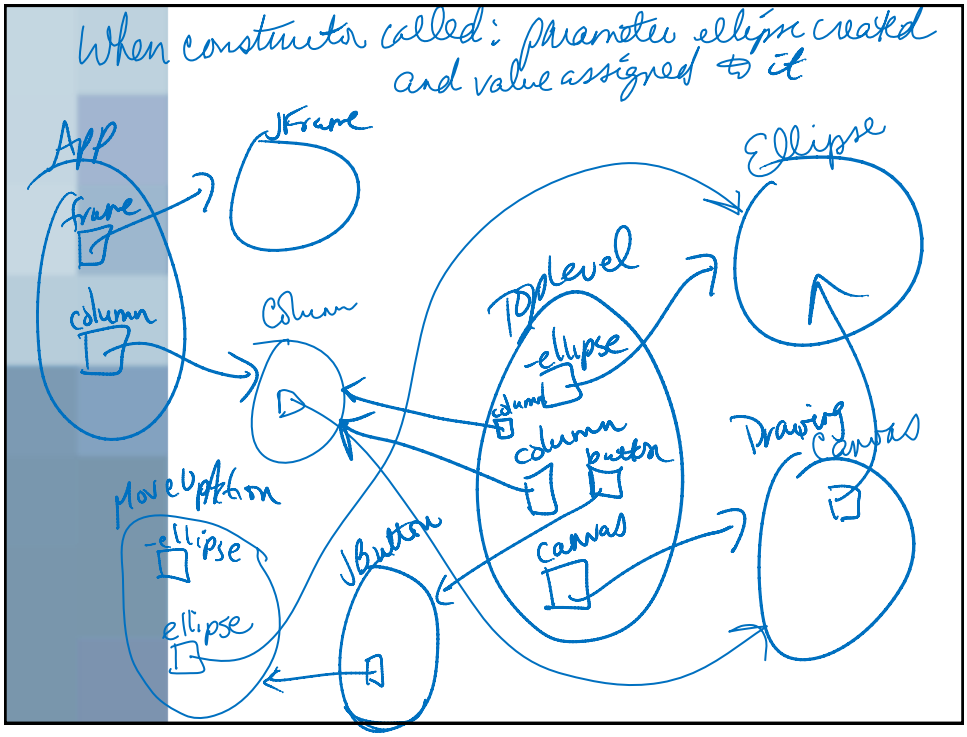

graphics.DrawingCanvas canvas=new graphics.DrawingCanvas();
App
frame
column
JFrame
Column
Toplevel
ellipse
column
canvas
DrawingCanvas

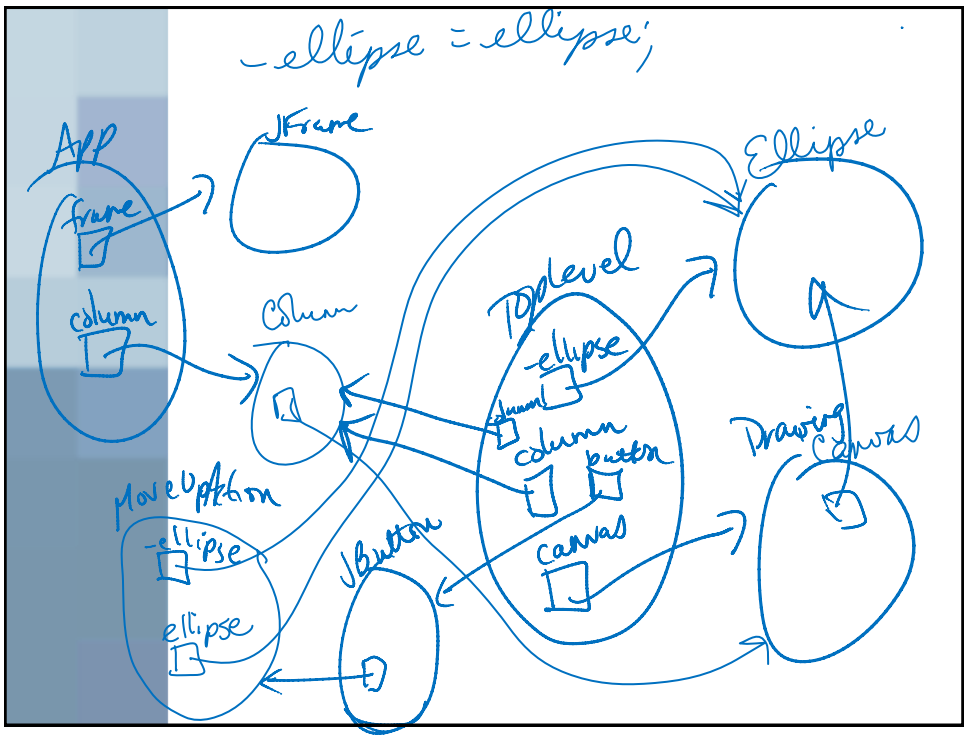


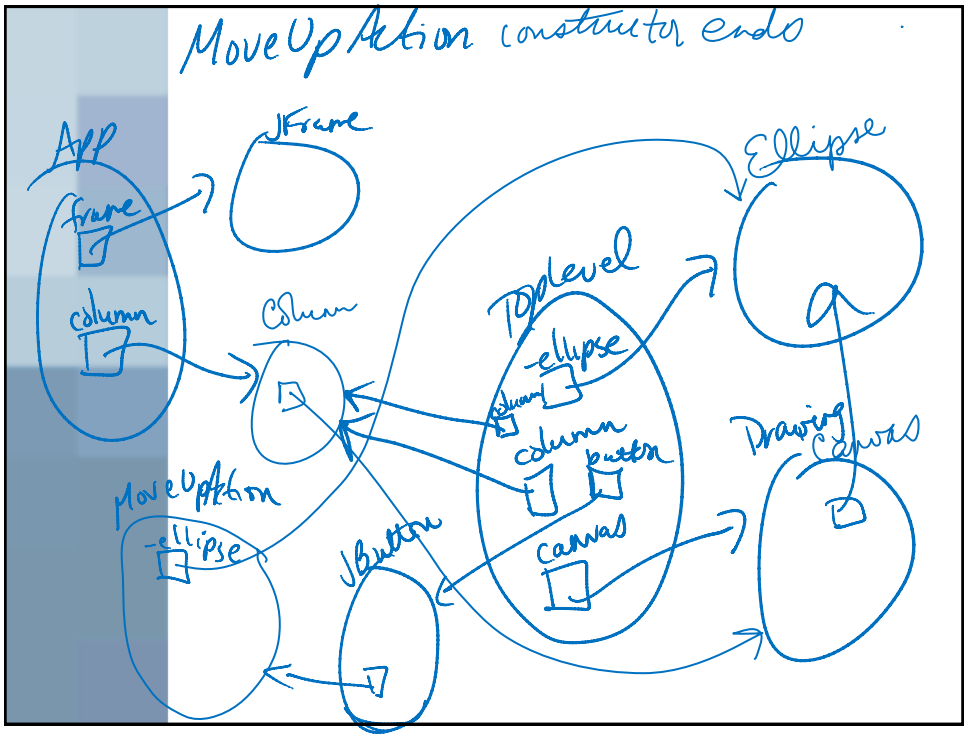
- _ellipse's characteristics are set
- this.setUpButtons(column) is called

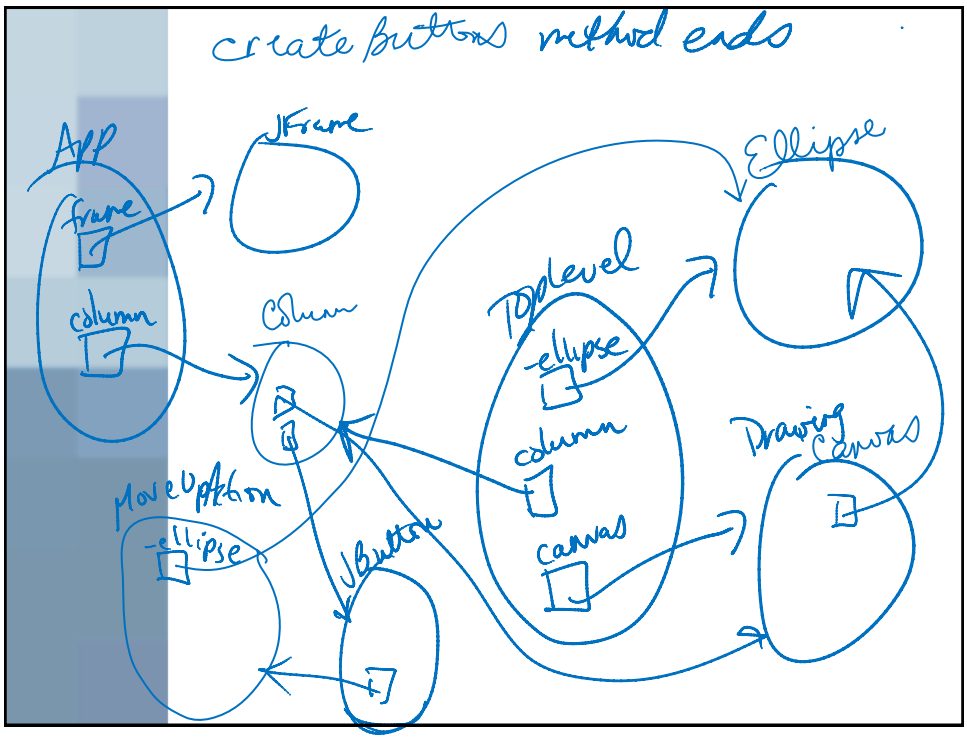

... button = new javax.swing.JButton("...");
App
frame
column
JFrame
Column
Ellipse
Toplevel
ellipse
column
button
canvas
Drawing Canvas
JButton

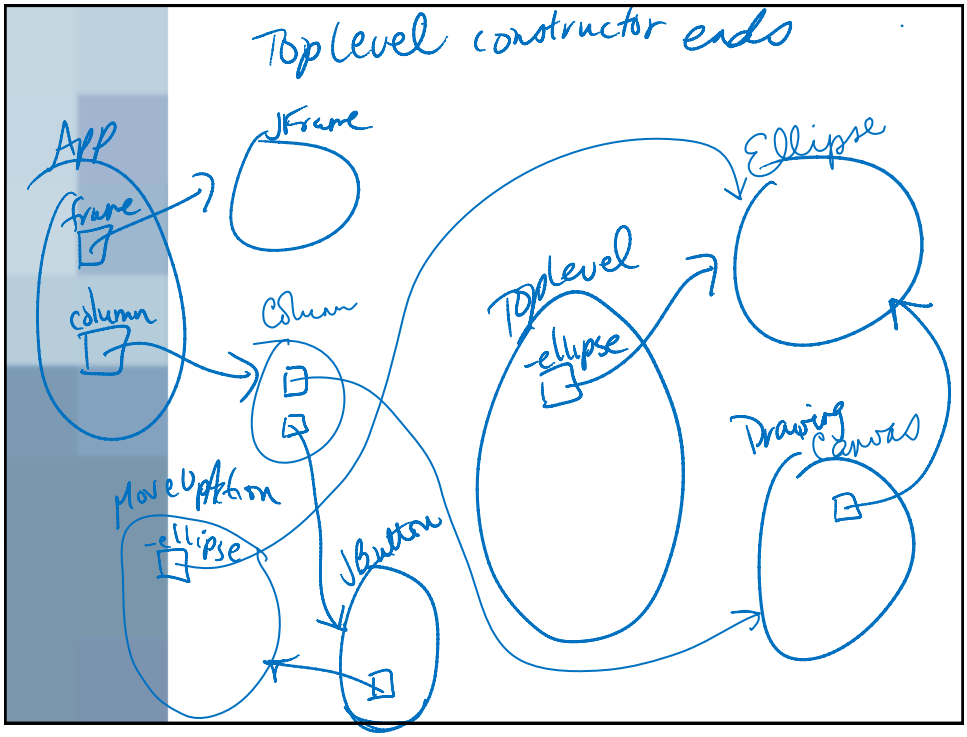

button.addActionListener(new MoveUpAction(ellipse));
App
frame
column
JFrame
Column
Ellipse
Toplevel
ellipse
column
button
canvas
Drawing Canvas
MoveUpAction
ellipse
JButton
This connection is one we don't see explicitly

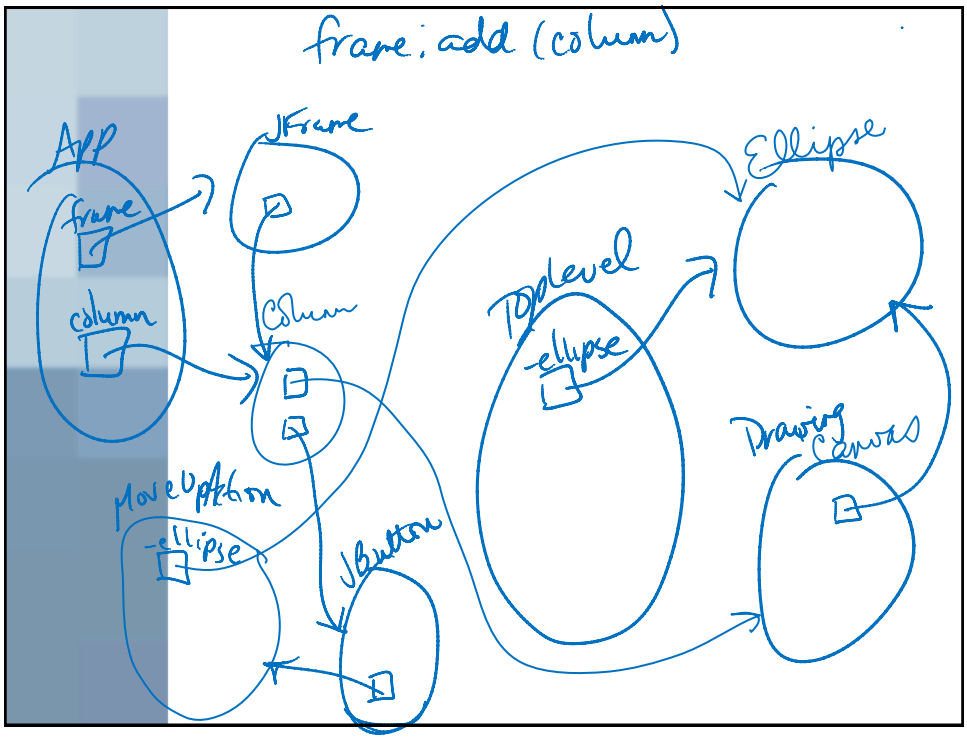

When constructor called: parameter ellipse created and value assigned to it
App
frame
column
JFrame
Column
Ellipse
Toplevel
ellipse
column
paint
canvas
Drawing Canvas
moveUpAction
ellipse
ellipse
JButton

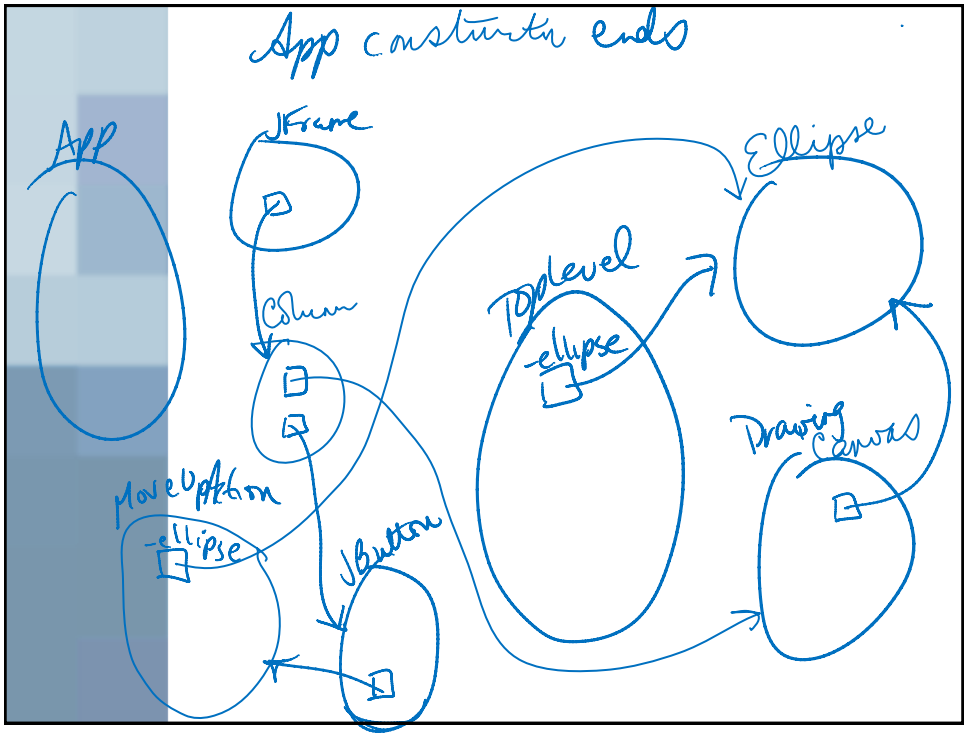

ellipse = ellipse;
App
frame
column
JFrame
Column
Ellipse
Toplevel
ellipse
column
paint
canvas
Drawing Canvas
moveUpAction
ellipse
ellipse
JButton


MoveUpAction constructor ends
App
frame
column
JFrame
Column
Ellipse
Toplevel
ellipse
column
button
canvas
Drawing Canvas
MoveUpAction
ellipse
JButton


createButtons method ends
App
frame
column
JFrame
Column
Ellipse
Toplevel
ellipse
column
canvas
Drawing Canvas
MoveUpAction
ellipse
JButton


Toplevel constructor ends
App
frame
column
JFrame
Column
Ellipse
Toplevel
ellipse
Drawing Canvas
moveUpFrom
ellipse
JButton


frame.add(column)
App
frame
column
JFrame
Column
Ellipse
Toplevel
ellipse
Drawing Canvas
moveUpFrom
ellipse
JButton



Changes to GraphicsExample4

- We want to add at least one more shape to the screen
- The user clicks on a shape and then the button will control the movement of the shape the user clicked upon

Changes to GraphicsExample4

- Then, we will implement a way for the user to add shapes to the screen and those to would be able to be clicked upon and moved by the button as well

What types of things do we need to add/change?

- Another shape
- A MouseListener for the shapes
- A way to keep track of which shape the user has clicked upon
  - That is probably similar to the holder for colors in Lab 5