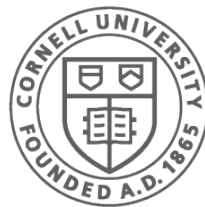


<http://www.cs.cornell.edu/courses/cs1110/2019sp>

Lecture 22: GUI Applications

CS 1110

Introduction to Computing Using Python



Cornell CIS
COMPUTING AND INFORMATION SCIENCE

[E. Andersen, A. Bracy, D. Gries, L. Lee, S. Marschner, C. Van Loan, W. White]

Relevant modules (see schedule page)

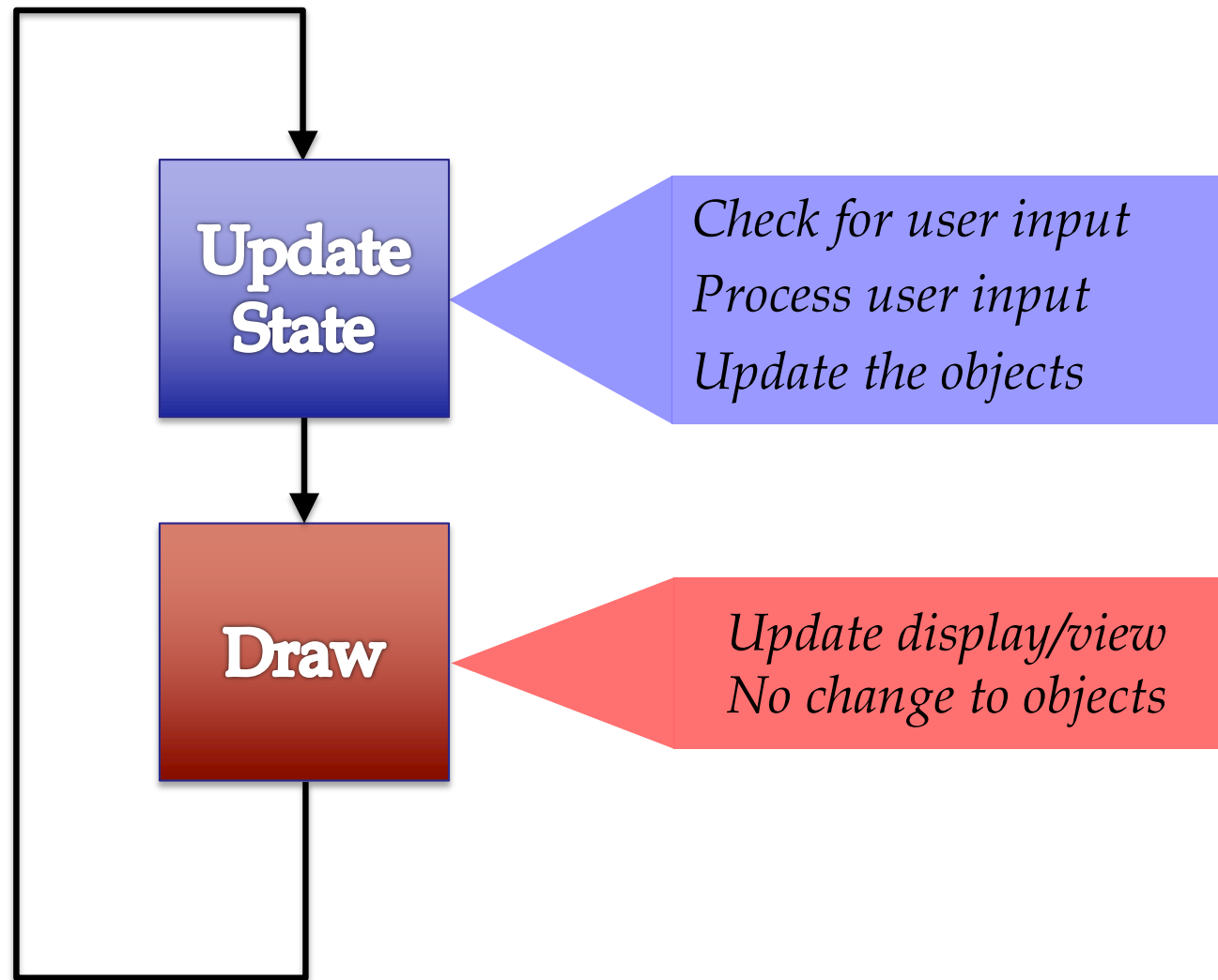
- [animation.py](#)
- [arrows.py](#)
- [pyro.py](#)
- [state.py](#)
- [subcontroller.py](#)
- [game2d.zip](#) (unzip)

Try them out!

```
>>> python arrows.py
```

A Standard GUI Application

Animates the
application,
like a movie



```
while program_is_running:
```

```
# Get keyboard info ← Handled by OS/GUI libraries
```

```
# Your code goes here
```

```
application.update() ← Custom application class
```

```
# Draw stuff to screen ← Handled by OS/GUI libraries
```

See animation.py

Example: Animation

```
class Animation(game2d.GameApp):
```

← Parent class that does hard stuff

```
    """App to animate an ellipse in a circle."""
```

```
    def start(self):
        """Initializes the game loop."""
        ...
```

Loop initialization
Do NOT use `__init__`

```
    def update(self,dt):
        """Changes the ellipse position."""
        ...
```

Loop body

```
    def draw(self):
        """Draws the ellipse"""
        ...
```

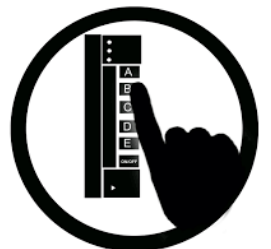
Use method `draw()`
defined in `GObject`

See animation.py

Does update() respond to the user?

```
def update(self, dt):  
    """  
    Animates the ellipse.  
    Parameter dt: The time since the last animation frame.  
    Precondition: dt is a float.  
    """  
    # Change the angle  
    self.angle = self.angle + ANIMATION_STEP % (2 * math.pi)  
    pos = self._polar_to_coord(ANIMATION_RADIUS, self.angle)  
    self.ellipse.x = pos[0]  
    self.ellipse.y = pos[1]
```

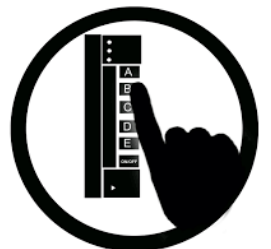
- A) Yes, any key changes the animation
- B) Yes, certain keys select certain animations
- C) No
- D) I don't know



See state.py

Does update() respond to the user?

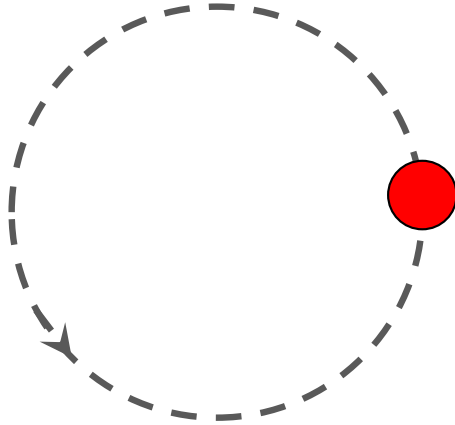
- A) Yes, any key changes the animation
- B) Yes, certain keys select certain animations
- C) No
- D) I don't know



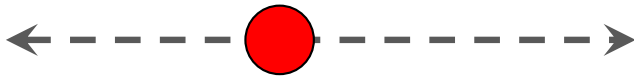
See `state.py`

Changing the Loop Activity

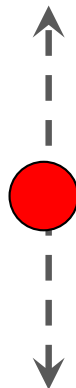
State **STATE_CIRCLE**



State **STATE_HORIZONTAL**



State **STATE_VERTICAL**



- **State**: Current loop activity
 - Playing game vs. pausing
 - Ball countdown vs. serve
- Add an attribute **state**
 - Method `update()` checks state
 - Executes correct helper
- How do we store state?
 - State is an *enumeration*; one of several fixed values
 - Implemented as an int
 - Global **constants** are values

Need rules for when we switch states

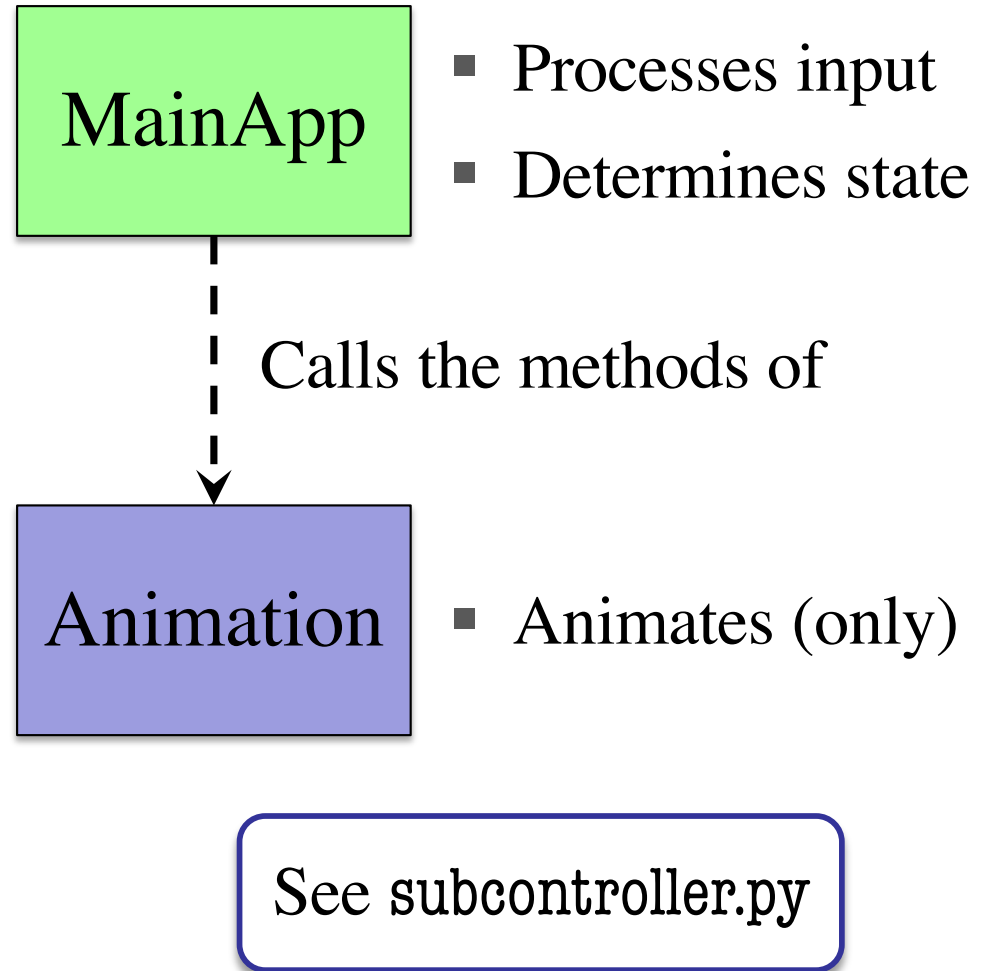
- Attribute `key_count` in `GInput`
 - How many keys are pressed?
 - 0, 1, 2, ...
 - `curr_keys = self.input.key_count`
- Is this a *new* key press?
 - Need current `curr_keys`, and key count from last time:
`lastkeys`

`change = curr_keys > 0 and self.lastkeys == 0`
- When we're done, `curr_keys` becomes the new `lastkeys`
`self.lastkeys = curr_keys`

See
`_determineState(self):`
in `state.py`

Designing Complex Applications

- Applications can become extremely complex
 - Large classes doing a lot
 - Many states & invariants
 - Specification unreadable
- **Idea:** Break application up into several classes
 - Start with a “main” class
 - Other classes have roles
 - Main class delegates work

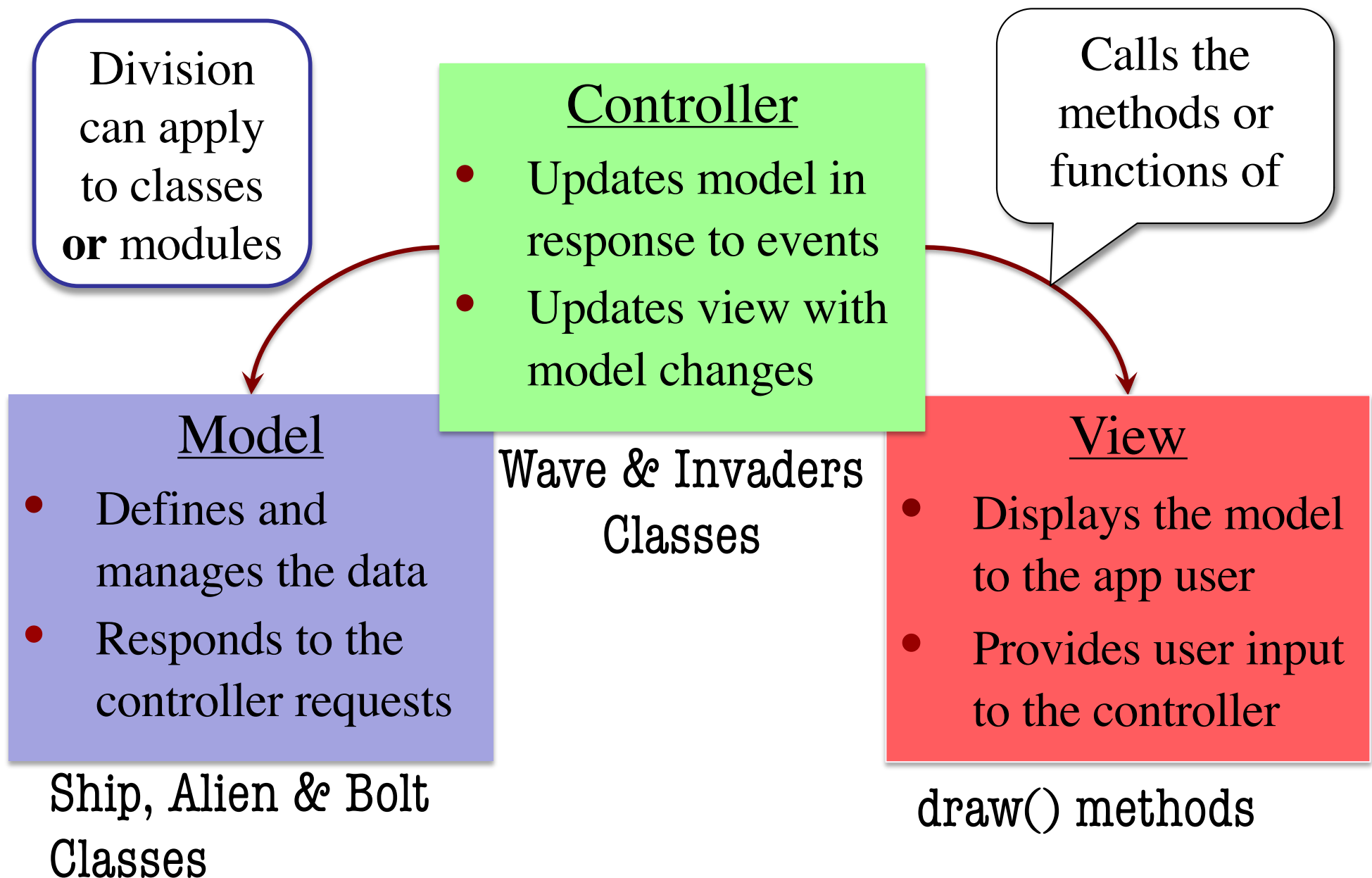


How to Break Up: Software Patterns

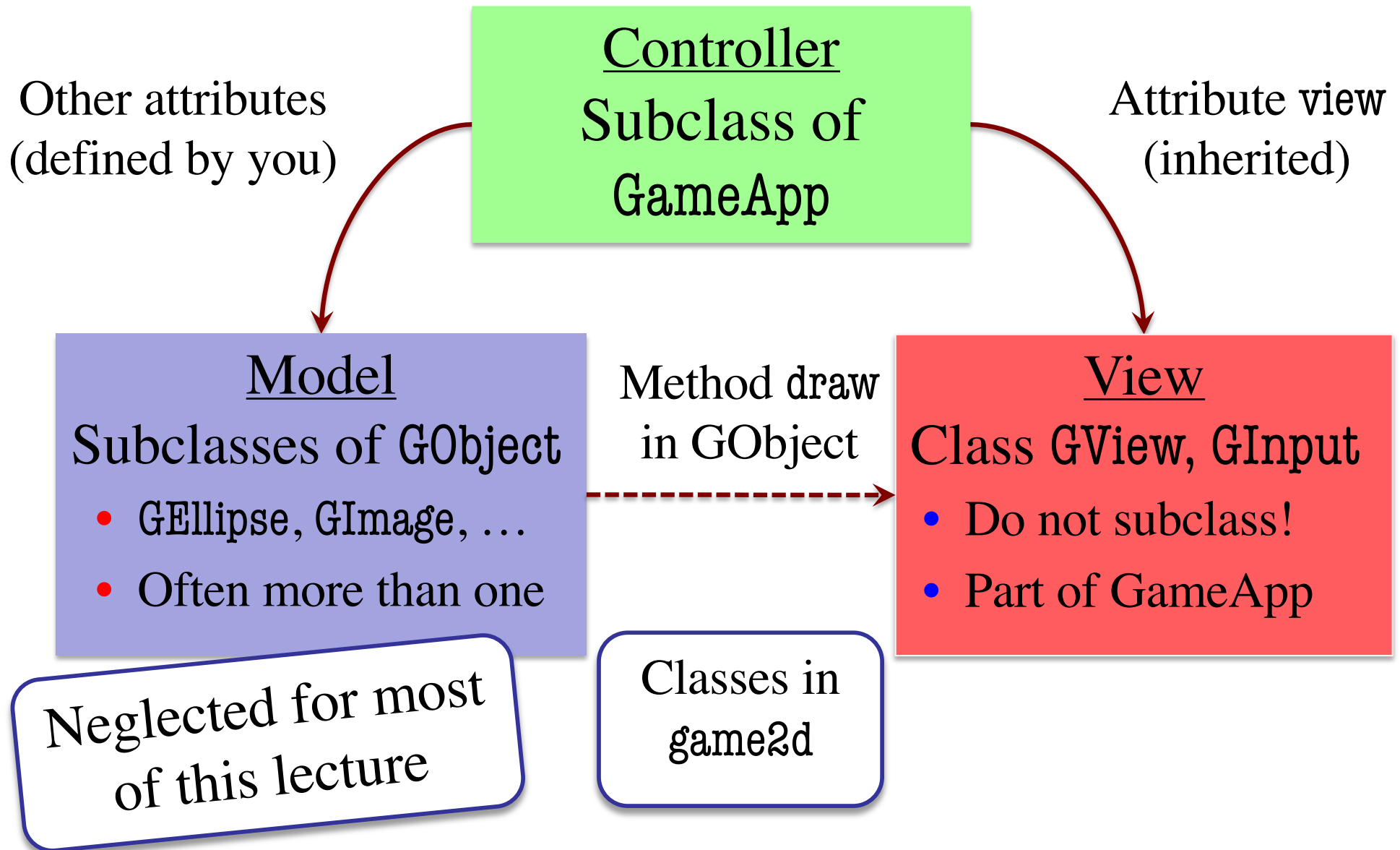
- **Pattern:** reusable solution to a common problem
 - Template, not a single program
 - Tells you how to design your code
 - Made by someone who ran into problem first
- In many cases, a pattern gives you the **interface**
 - List of headers for non-hidden methods
 - Specification for non-hidden methods
 - Only thing missing is the implementation

Just like
this course!

Model-View-Controller Pattern

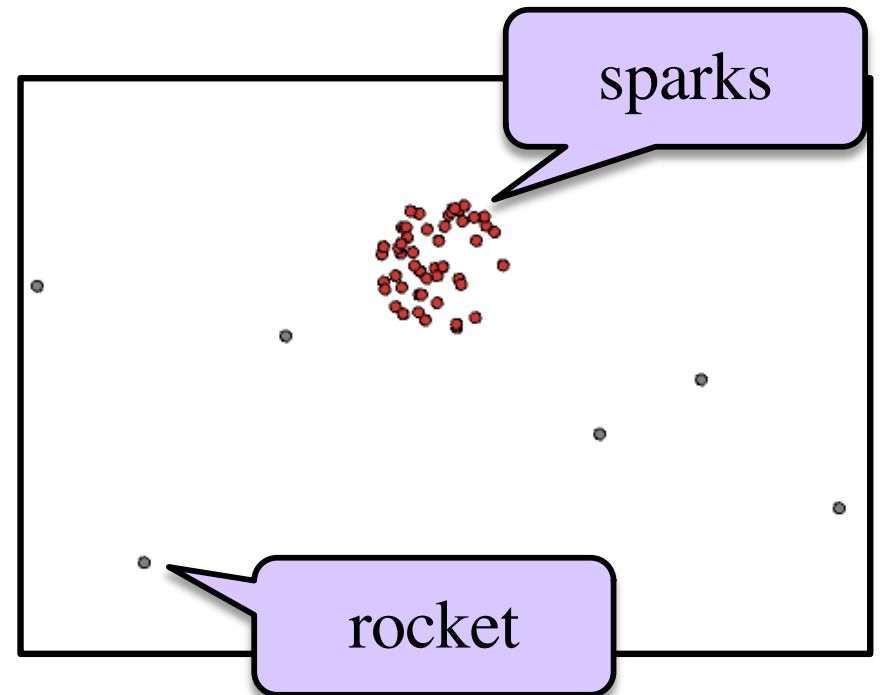


Model-View-Controller in CS 1110



Models in Assignment 7

- Often subclass of GObject
 - Has built-in draw method
 - See documentation in A7
- Includes groups of models
 - **Example:** rockets in pyro.py
 - Each rocket is a model
 - But so is the entire list!
 - `update()` will change both
- **A7:** Several model classes
 - Ship to animate the player
 - Alien to represent an alien



See pyro.py