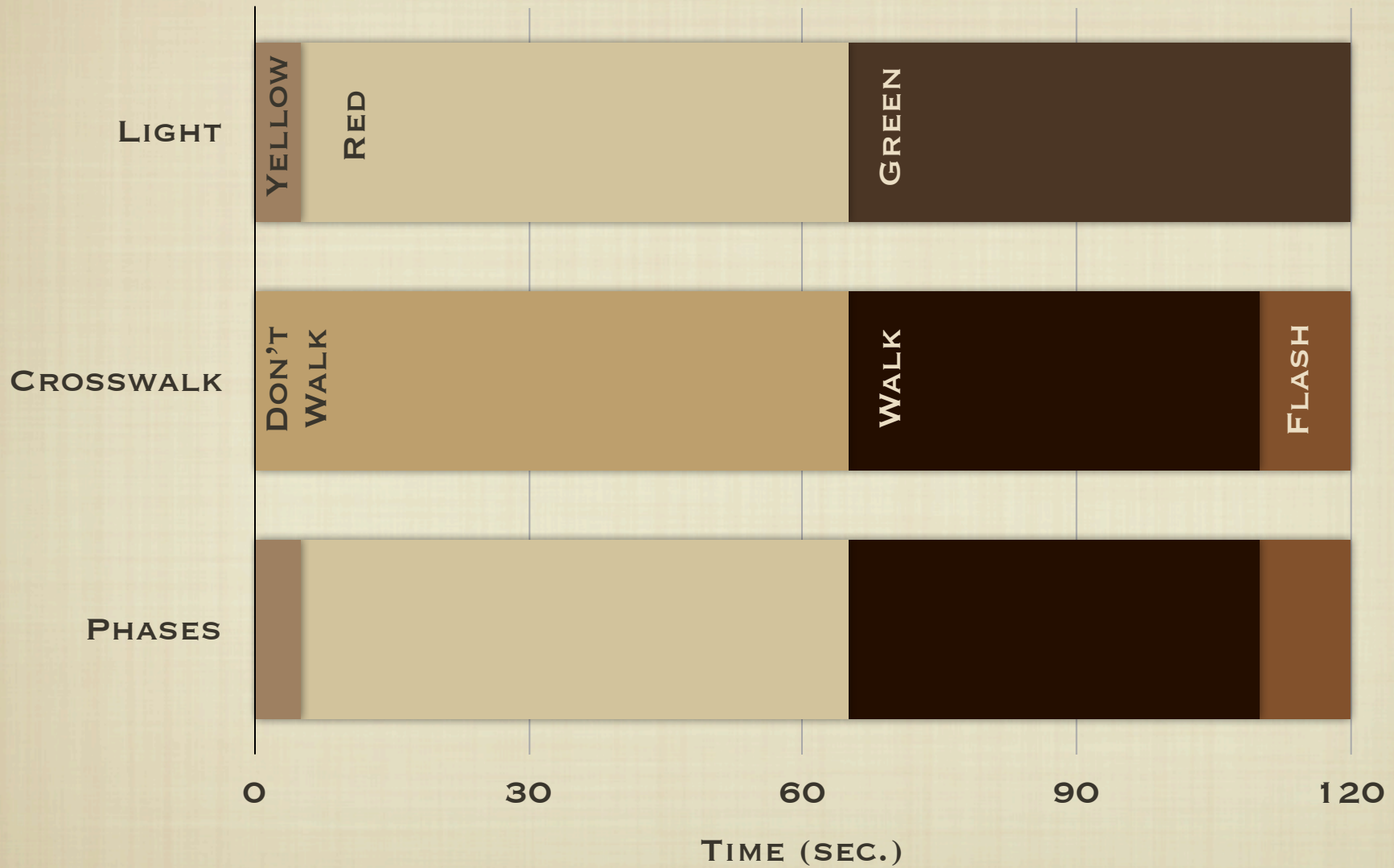


HIGHER-ORDER  
STATECHARTS

CURT CLIFTON

ROSE-HULMAN INSTITUTE OF TECHNOLOGY

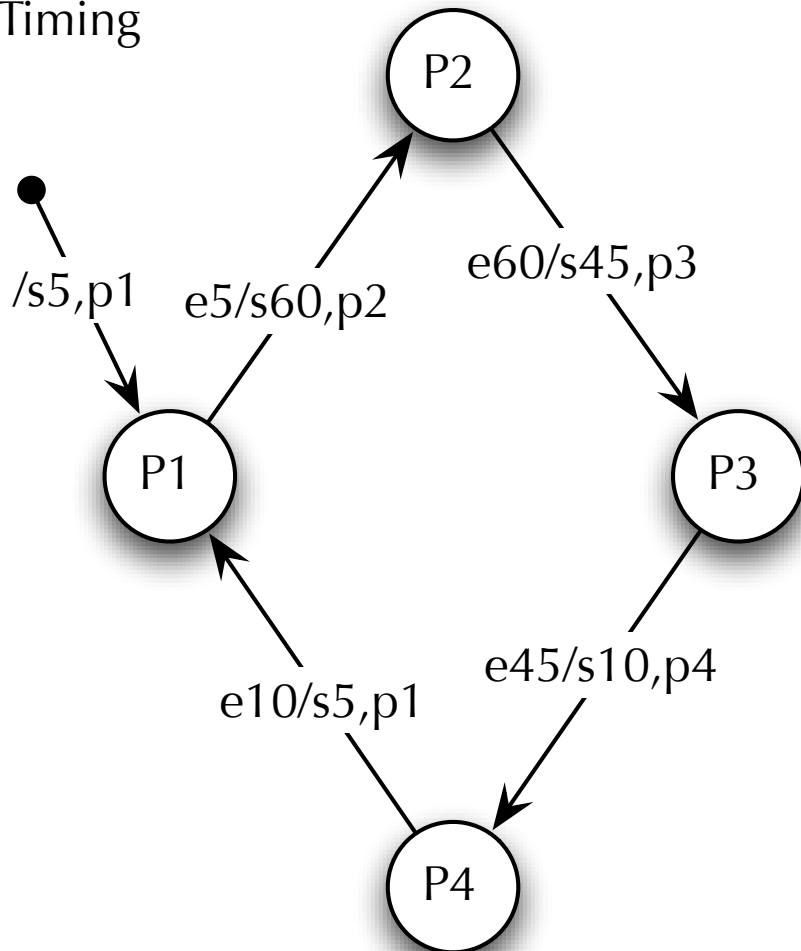
# QUIZ 20 SOLUTION-1/2



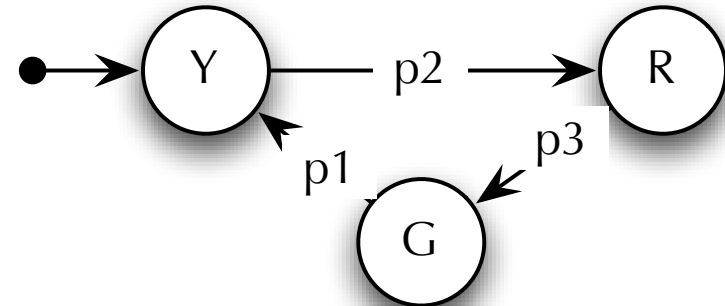
# QUIZ 20 SOLUTION-2/2

## Signals

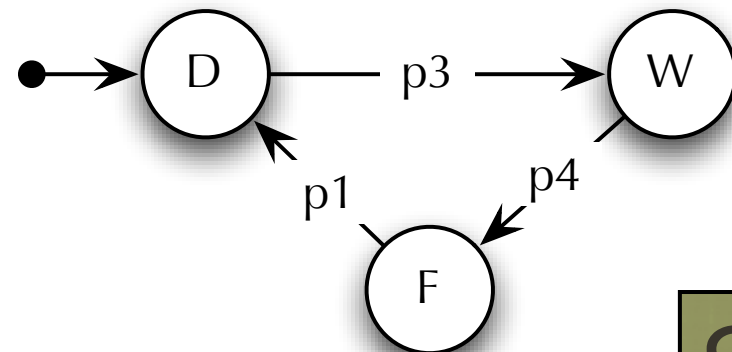
Timing



Light



Crosswalk



Q1

# COMMON ACTIONS

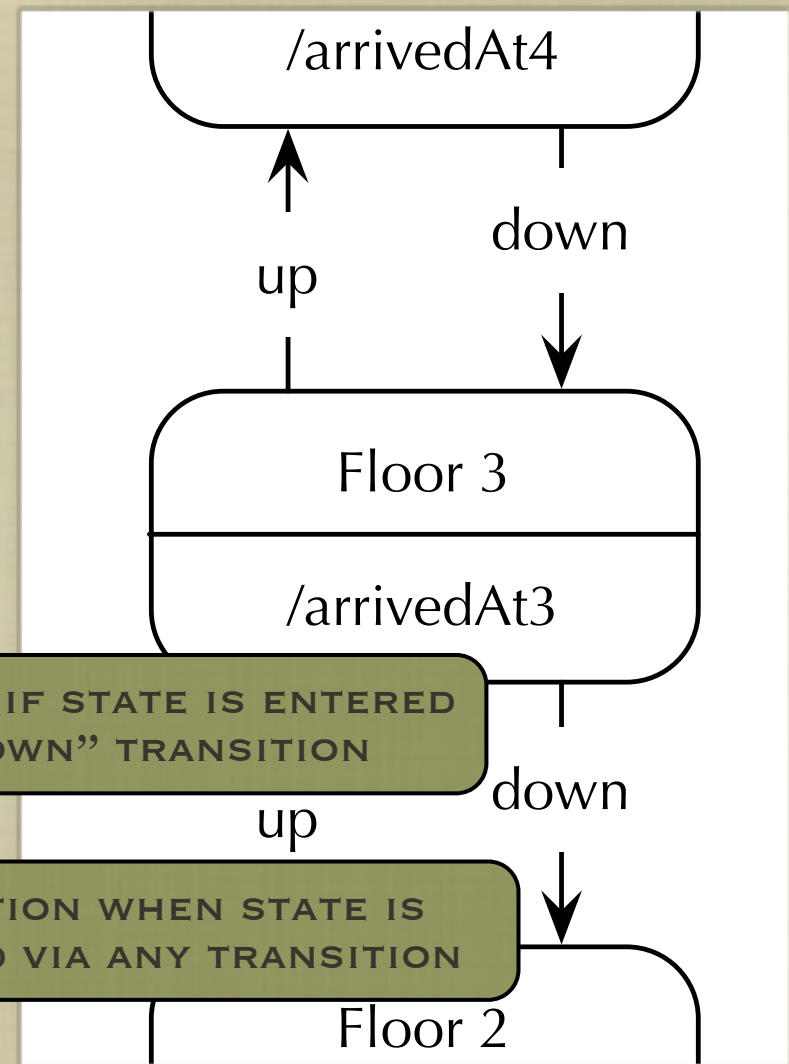
- WHAT IF MULTIPLE TRANSITIONS TO A STATE SHOULD HAVE COMMON ACTION?
- CAN LIST ACTIONS INSIDE STATE
- CAN ALSO QUALIFY THOSE ACTIONS:

- down/arrivedAt3

- entry/openDoors

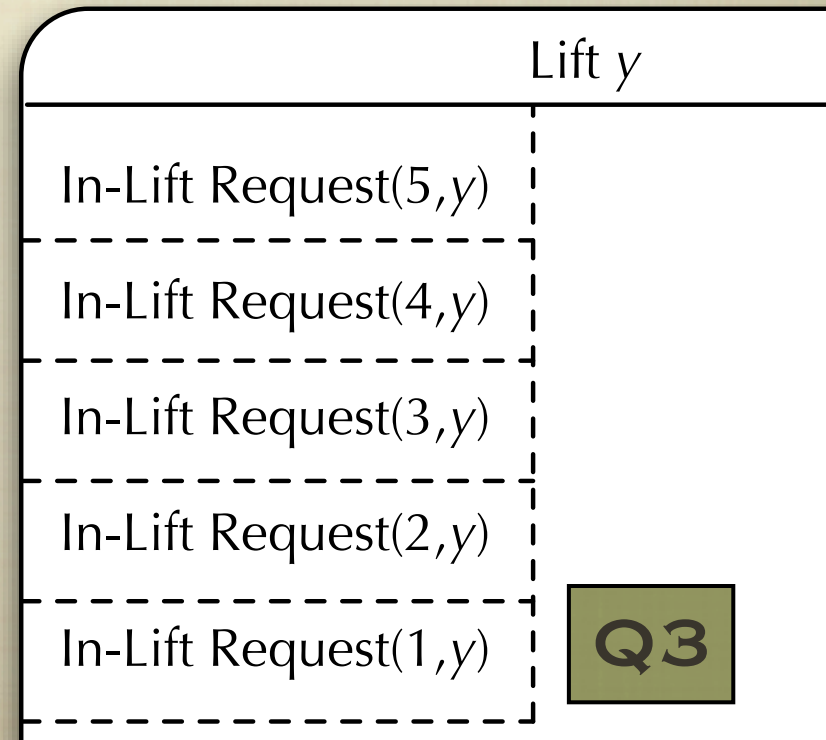
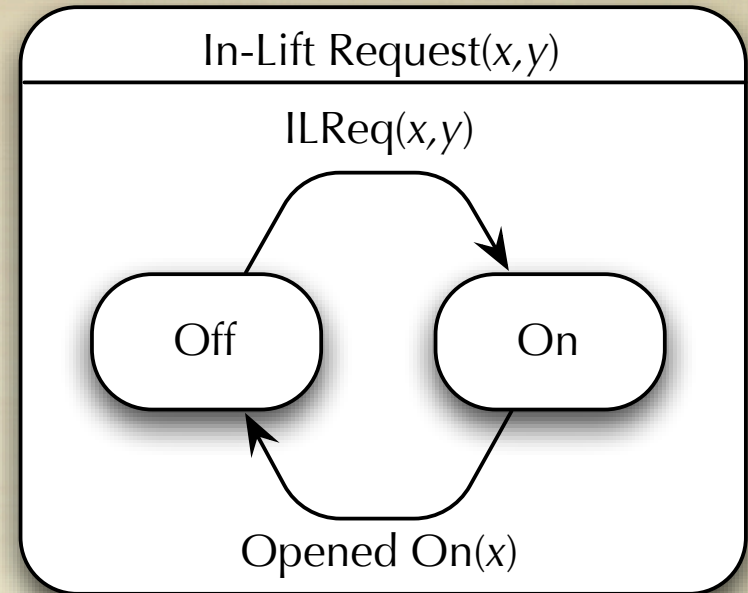
- exit/closeDoors

DO ACTION WHEN STATE IS EXITED VIA ANY TRANSITION



# ABSTRACTION

- SOMETIMES WE NEED MULTIPLE NEARLY IDENTICAL SUBSTATES
- CONSIDER:  
IN-LIFT FLOOR REQUESTS

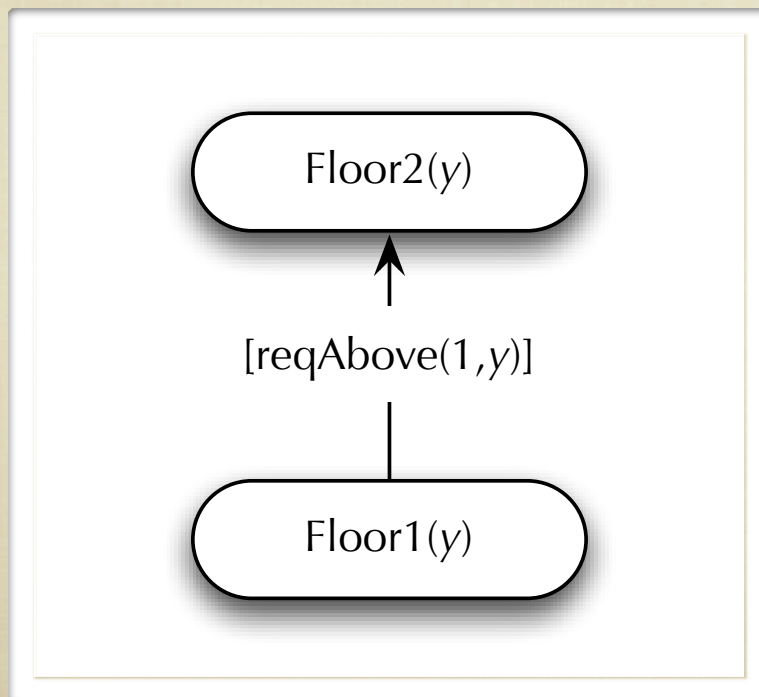


# ABSTRACT GUARDS

- CAN DEFINE PREDICATES TO USE IN GUARDS

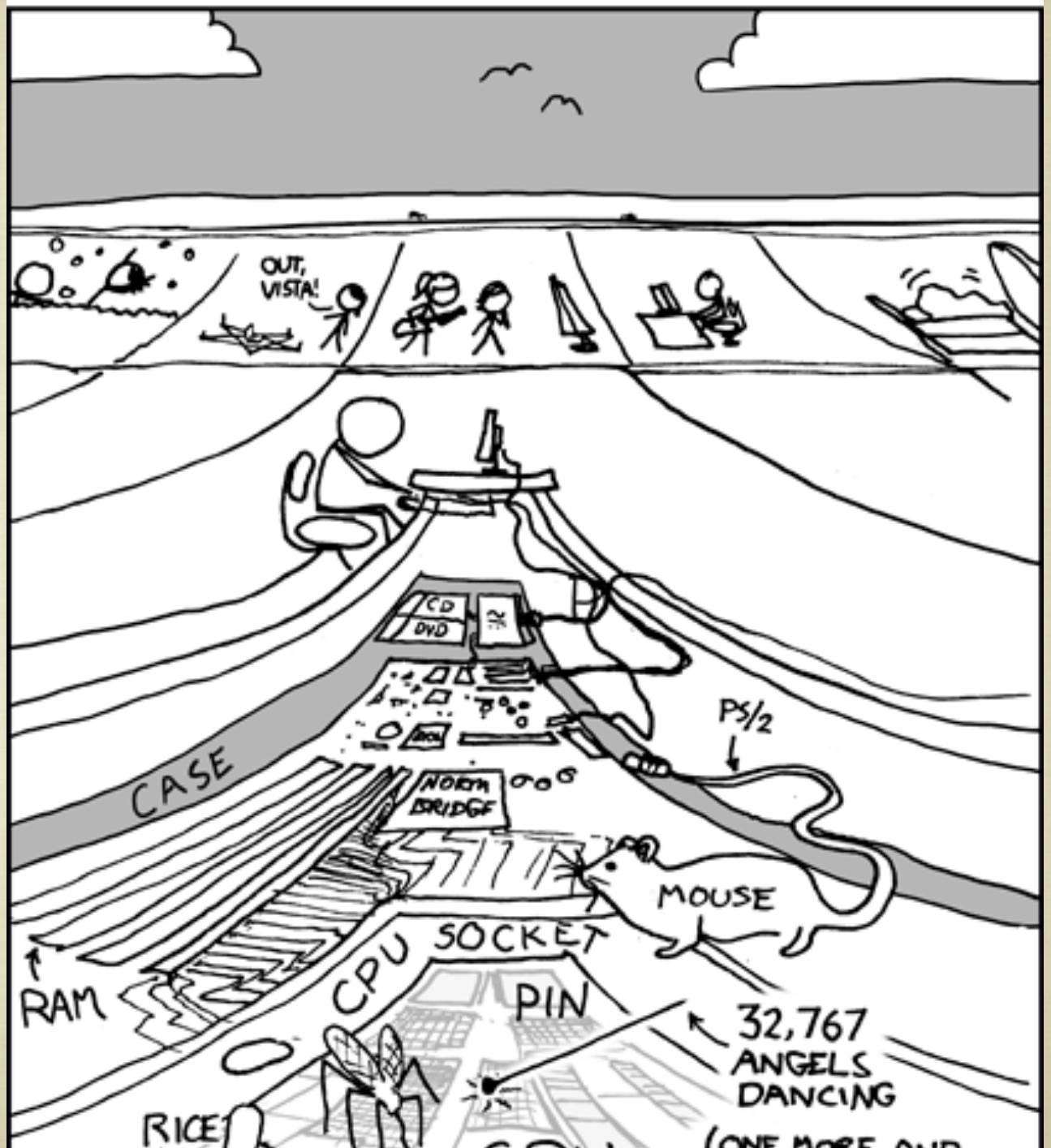
- E.G., USING ALLOY NOTATION:

- $\text{reqAbove}(f,l) = (\text{some } f' > f \mid \text{in InLiftRequest}(f',l).\text{On})$



NOT SUFFICIENT  
FOR P4!

SIZES ACCURATE ON A VERTICAL LOG SCALE



# DEPTH

[HTTP://XKCD.COM/485/](http://xkcd.com/485/)

# SOME DESIGN GUIDELINES

**REFER TO THESE  
WHEN COMPLETING P4!**

<http://www.agilemodeling.com/style/stateChartDiagram.htm>

# STATES

- **IDENTIFY THE STATES FIRST**
- **KEEP NAMES SHORT BUT DESCRIPTIVE**
- **BEWARE OF:**
  - **BLACK HOLES – NO ARROWS OUT**
  - **MIRACLES – NO ARROWS IN**

# LAYOUT

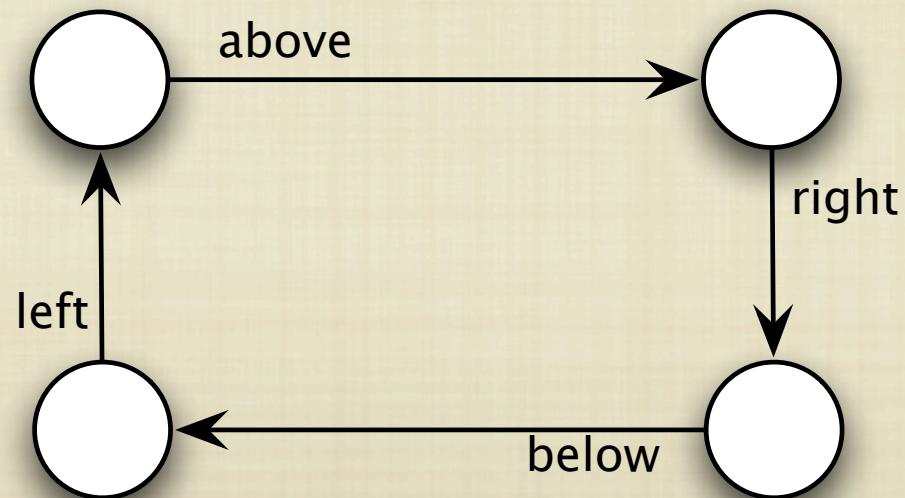
- FAVOR PUTTING INITIAL STATE IN TOP-LEFT CORNER

# SUBSTATES

- **USE NESTED SUB-STATES FOR COMMON TRANSITIONS**
- **FROM MANY STATES TO ONE STATE, OR**
- **FROM ONE STATE TO MANY**
- **USE ORTHOGONAL MACHINES FOR “PIECES” THAT RUN IN PARALLEL**

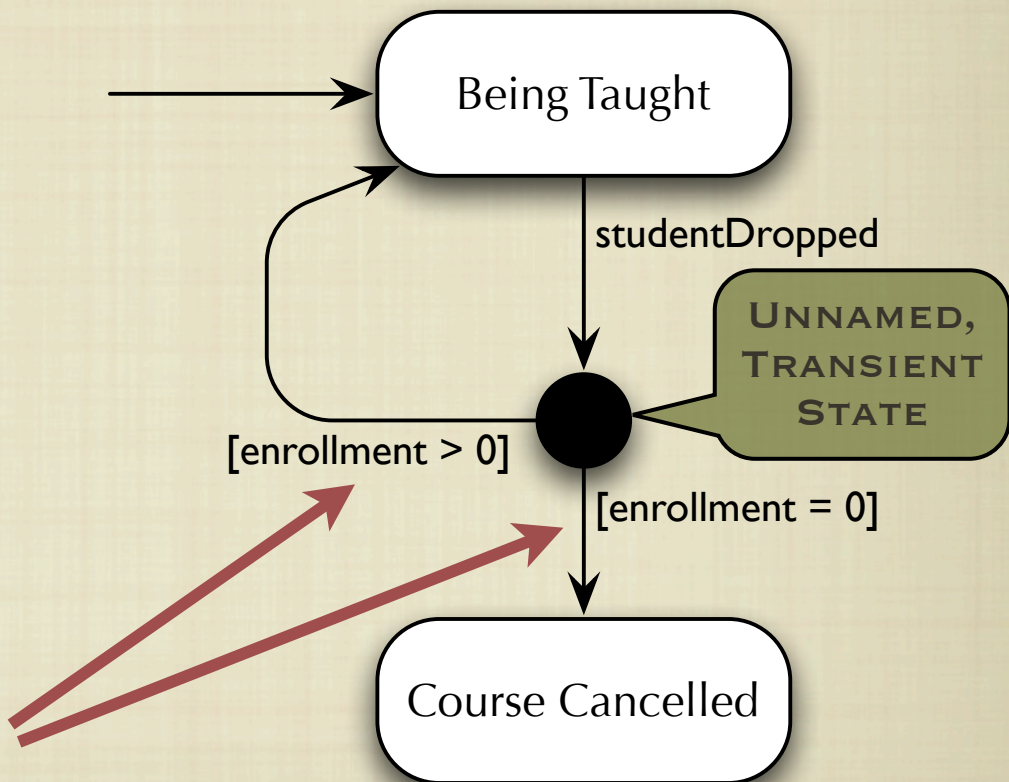
# TRANSITIONS/ACTIONS

- NAME TRANSITION EVENTS IN PAST TENSE
- PUT TRANSITION LABELS NEAR SOURCE STATE
- SUGGESTED LABEL LOCATIONS:



# GUARDS

- TO AVOID ACCIDENTAL NON-DETERMINISM, GUARD CONDITIONS SHOULD BE DISJOINT
- $[x > 0]$  AND  $[x \leq 0]$ , INSTEAD OF
- $[x \geq 0]$  AND  $[x \leq 0]$
- CAN USE GUARDS WITHOUT EVENTS TO INDICATE “TRANSITION IMMEDIATELY WHEN TRUE”



# ITERATE!

- ADD BASIC FUNCTIONALITY FIRST
  - JUST MOVEMENT OF LIFTS BETWEEN FLOORS
- ITERATIVELY ADD FEATURES
  - IN-LIFT REQUESTS
  - DOORS
  - ARROWS ...

# TOOLS

EXPERIMENT WITH TOOLS EARLY!  
MAKE SURE YOU CAN DRAW  
SUBSTATES AND EXPORT TO PDF.

- **HW11: SCANS OF NEAT, HAND-DRAWN SKETCHES ARE OK**
- **P4: MUST USE A SOFTWARE TOOL FOR DRAWING**
  - **VISIO – GOOGLE FOR STATECHART STENCILS**
  - **OMNIGRAFFLE – ON LAB MACS**
  - **OTHERS?**
  - **AVOID MS PAINT**  
(UNLESS YOU ALREADY HATE LIFE)