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15-112 Fall 2018 Quiz 5

Up to 30 minutes. No calculators, no notes, no books, no computers. Show your work!
Do not use dictionaries or recursion on this quiz.

1. (40 points) **Free Response:** Your task in this problem is to write a basic animation. You must follow MVC conventions in your solution. You will need to write `init(d)`, `mousePressed(e, d)`, `keyPressed(e, d)`, and `redrawAll(c, d)`; you may assume the `run()` function is already implemented. We recommend abbreviating `data` as `d`, `event` as `e`, and `canvas` as `c` (as shown above) to save time.

The animation should have the following properties:

- A 20x20 square is drawn centered in the screen. The score (which starts at 0) is drawn at the center-bottom of the screen.
- Clicking above the square moves it 50 pixels up; clicking to the right of the square moves it 50 pixels to the right.
- If the square moves partially off of the screen, one point is added to the score and the square is put back in the center of the screen
- Typing the letter 'r' puts the square back in the center of the screen and resets the score to 0.

YOU MAY CONTINUE WRITING CODE ON THIS PAGE.

2. (10 points) **Short Answer:** Write out the three elements of the MVC framework, and next to each element, write the core animation functions associated with it. Recall that the four core animation functions are `init`, `mousePressed`, `keyPressed`, and `redrawAll`.

3. (25 points) **Free Response:** Given a 2d list (grid) of 0's and 1's, write the function `findTheV(grid)` that finds a V made of 1's and returns its upper left location as a tuple of the row and col. The V is spread out over multiple cells in the grid; for example, in the following grid, the V is located at row 1 and column 0, so the function should return (1, 0).

```
[ [ 0, 0, 0, 0 ],  
  [ 1, 0, 1, 0 ],  
  [ 0, 1, 0, 0 ],  
  [ 0, 0, 0, 0 ] ]
```

A V will always be contained in a 3x2 box, and has 1's in the upper left, upper right, and lower center. It does not matter whether the other values are 0's or 1's. If there are no V's on the grid, the function should return (-1, -1). You are guaranteed there will be at most one V on the grid, and the input list will be at least size 3 by 2 and will only contain 0's and 1's. You are also guaranteed that the list will be rectangular.

4. (25 points) **Code Tracing:** Indicate what the following program prints. Place your answer (and nothing else) in the box to the right of the code.

```
import copy
def ct(a):
    b = copy.copy(a)
    c = copy.deepcopy(b)
    b[0][0] = 1
    c[1][1] = 2
    a[2] = a[0]
    c.append(4)
    b[0].append(99)
    a = a + []
    a.pop(1)
    print("a:", a)
    print("b:", b)
    print("c:", c)

z = [ [ 10, 2], [5, 8], 3 ]
ct(z)
print("z:", z)
```