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### 15-112 Spring 2022 Quiz 7

Up to 25 minutes (up to 20 minutes for 20% proficiency bonus) . No calculators, no notes, no books, no computers. Show your work!

Do not use try/except on this quiz.

1. (3 points) **Short Answers I:** Fill in each blank with Model, View, or Controller:

- (a) The \_\_\_\_\_ draws the app using the values in the model.
- (b) The \_\_\_\_\_ contains all the data we need for the animation.
- (c) The \_\_\_\_\_ responds to keyboard, mouse, timer, and other events and updates the model.

2. (5 points) **Short Answers II:** Consider the following first lines of a program:

```
def appStarted(app):  
    app.timerDelay = 500  
    app.dots = []
```

Which of the following produce an MVC violation? Fill in each blank with **ERROR** if it is an MVC violation or **OK** if the code doesn't produce an MVC violation.

- (a) \_\_\_\_\_ Calling `len(app.dots)` inside `redrawAll`.
- (b) \_\_\_\_\_ Calling `canvas.create_rectangle` inside `mousePressed`.
- (c) \_\_\_\_\_ Calling `app.dots.append` inside `redrawAll`.
- (d) \_\_\_\_\_ Changing the value of `app.timerDelay` in a helper function called by `mousePressed`.
- (e) \_\_\_\_\_ Calling `canvas.create_rectangle` in a helper function called by `redrawAll`.

3. (12 points) **Free response: Animation** Assuming the `runApp()` function is already written for you, write `appStarted`, `keyPressed`, `mousePressed`, `redrawAll`, and `timerFired` so that when the animation is first run:

1. 10 circles are randomly positioned in the screen. Each circle with a radius of 40 pixels at a random location and random color (chosen from `['red', 'green', 'blue']`).
2. An integer number is displayed on the top-left corner that counts down in seconds starting from 20.

Game play proceeds as such:

1. Every two seconds, the colors are randomized. This means that a new random assignment of colors is done using the same three colors (red, green, blue).
2. If the user clicks inside a blue circle, the dot is removed.
3. If the user clicks outside a blue circle, the game becomes harder:
  - The radius of all circles halve (they start with 40 pixels, then 20 pixels, then 10 pixels, and finally 5 pixels).
  - A new circle appears at a random location, with a random color, and with the same radius as the other circles.
4. If the user removes all circles, then the game is over and the text "You Win!" is displayed in the center of the screen.
5. If the user makes 4 mistakes (clicks outside a blue circle) OR the countdown reaches 0, then the game is over, the screen is cleared (all dots are removed), and the text "Game over!" is displayed in the center of the screen.
6. When the game is over, nothing on the screen should change unless the game is reset using 'r'.
7. When the game is reset, the game starts again.

Make reasonable assumptions for anything not specified here. Do not hardcode values for `app.width` or `app.height`. You are only allowed to use one timer and one `timerFired` function. We recommend that, to save time writing, you abbreviate `canvas`, `event`, and `app`: use `c`, `e` and `a`, respectively.

Answer space for Question 3