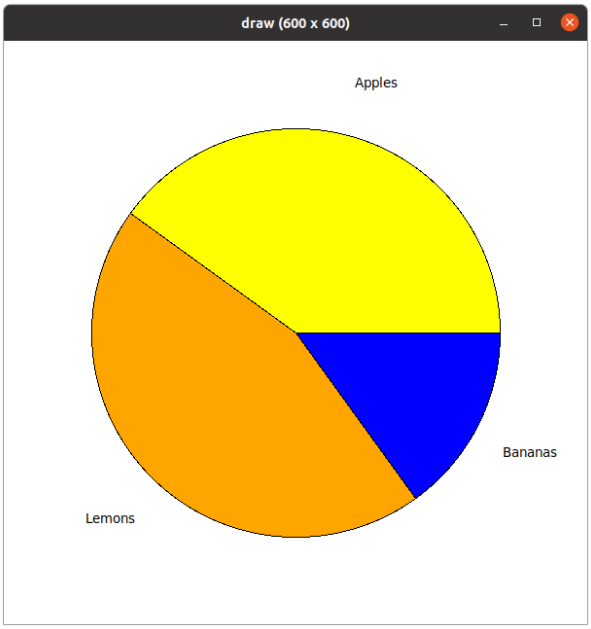
Name: _____ Andrew Id: _____

15-112 Spring 2021 Quiz 09

25 minutes.

This entire quiz is a multi-part free response question where you will write code to produce a pie-chart. You will need to read carefully to make sure you understand the problem. (Reading and understanding the problem is part of the quiz.) **Read through the entire quiz before writing anything, otherwise you might waste time.**

By the end of the quiz, given a list `L = [("Apples",80),("Lemons",90),("Bananas",30)]`, your code should draw the following chart:



In this pie chart, apples comprise 40% of the chart, lemons 45%, and bananas 15%. The percentage of apples, for example, is calculated by dividing the quantity of apples in the list by the total quantity of all items in the list (80 / 200 = 40%).

You will solve this problem in three parts. Before that, however, we need to discuss a tkinter function you might not be familiar with.

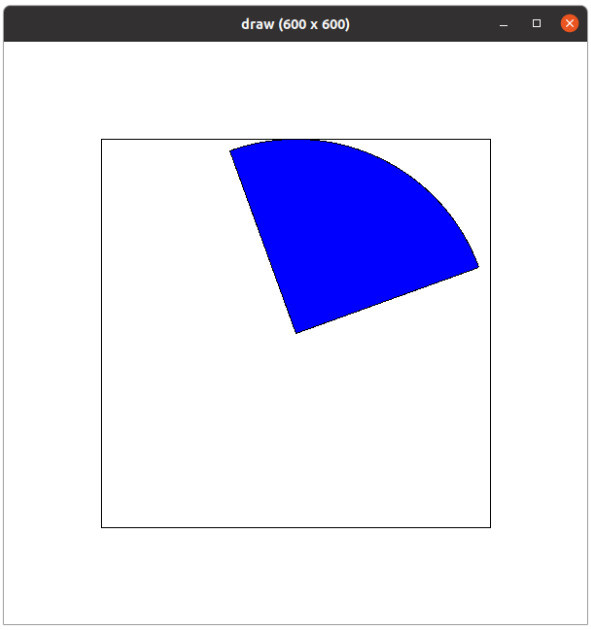
Preliminary: Drawing an Arc tkinter has a function called `draw_arc`. It can be used to draw partial circles/ovals. To use it, you specify the (x,y) coordinates that are the same as with `draw_oval`, but you can also specify a starting angle and extent of how much circle to draw.

The starting angle is measured starting at the furthest right point on the circle and goes counter-clockwise. The extent specifies how many degrees of circle to draw. Both numbers are in degrees, not radians.

Example 1

```
canvas.create_rectangle(100,100,500,500)
canvas.create_arc(100,100,500,500,start=20,extent=90,fill="blue")
```

produces:

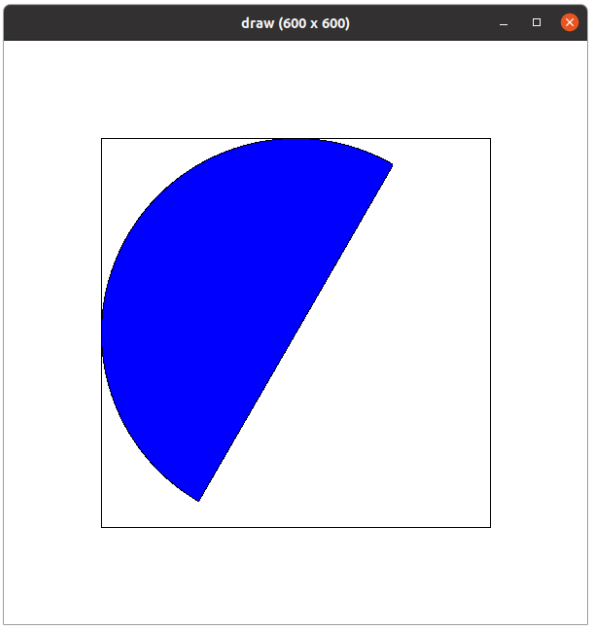


Note that the arc starts 20 degrees counter-clockwise from the furthest right point, and 90 degrees of circle are drawn.

Example 2

```
canvas.create_rectangle(100,100,500,500)
canvas.create_arc(100,100,500,500,start=60,extent=180,fill="blue")
```

produces:



Note that the arc starts 60 degrees counter-clockwise from the furthest right point, and 180 degrees of circle are drawn.

Part A: Calculating the Ratios [5 pts] Write the function `calcRatios(L)` which, given a list of tuples `L`, mapping names to quantities, returns a new list of tuples mapping names to ratios.

The input argument, `L`, contains tuples of `("Item Name", How Many)`. For example, `L = [("Apples",80),("Lemons",90),("Bananas",30)]` means "80 Apples, 90 Lemons, and 30 Bananas".

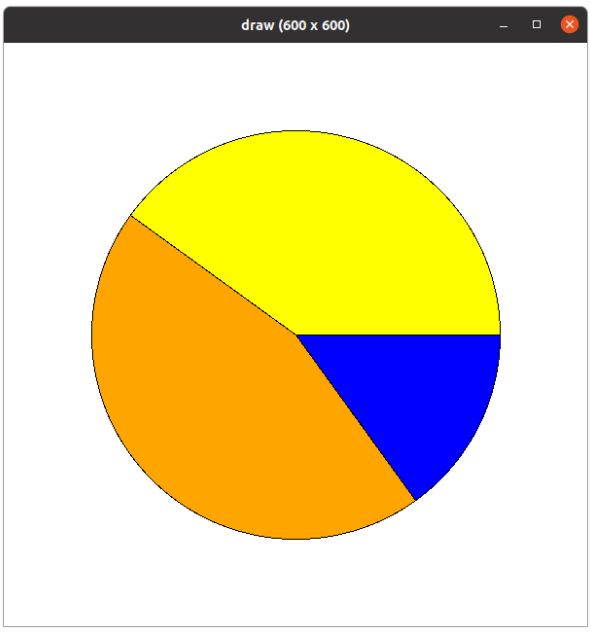
Calling `calcRatios([("Apples",80),("Lemons",90),("Bananas",30)])` returns `[('Apples', 0.4), ('Lemons', 0.45), ('Bananas', 0.15)]`, because Apples are 40% of the total number of items, Lemons 45%, and Bananas 15%.

Part B: Drawing the Pie Chart [15 pts] Write the non-destructive function `drawPieChart(canvas, width, height, L)` which is given a canvas, canvas width, canvas height, and a list of tuples `L`, mapping names to quantities. It should then draw a pie chart (without labels) of the data.

For example, calling:

```
L = [("Apples",80),("Lemons",90),("Bananas",30)]
drawPieChart(canvas, 600, 600, L)
```

Will produce the following image:



In this pie chart, the yellow corresponds to apples (40% of the chart), orange is lemons (45% of the chart), and blue is for bananas (15% of the chart).

Notes:

- The exact size of the circle is not specified. Just choose something reasonable that you calculate based on the arguments `width` and `height`.
- Your pie chart should always be a circle that fits in the window, even if `width != height`.
- Each slice of the pie should be a different color. You can assume that there will be, at most, five different items in `L`. (So you only need to handle up to five colors.)
- You may assume you have the function `calcRatios`, even if yours is not functional.

Write your answer on the next page.

Answer space for Part B.

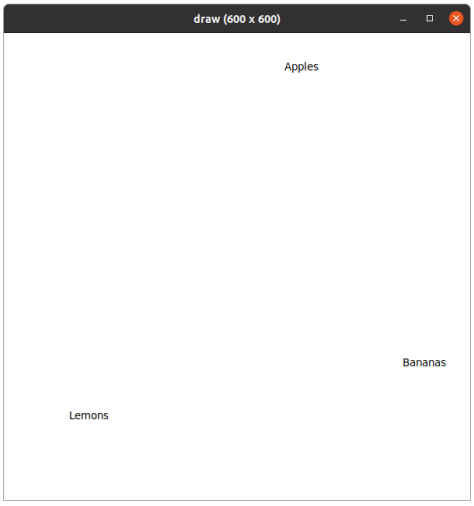
(Extra Credit) Part C: Adding Labels [3 pts] Note: Extra credit problems are graded more strictly than normal problems, meaning there is less opportunity for partial credit. Only attempt this problem if you have finished the prior two.

Write the function `drawLabels(canvas, width, height, L)` which is given a canvas, canvas width, canvas height, and a list of tuples `L`, mapping names to quantities. It should then add labels to the appropriate location on the canvas that would look good on the final pie chart.

For example, calling:

```
L = [("Apples",80),("Lemons",90),("Bananas",30)]
drawLabels(canvas, 600, 600, L)
```

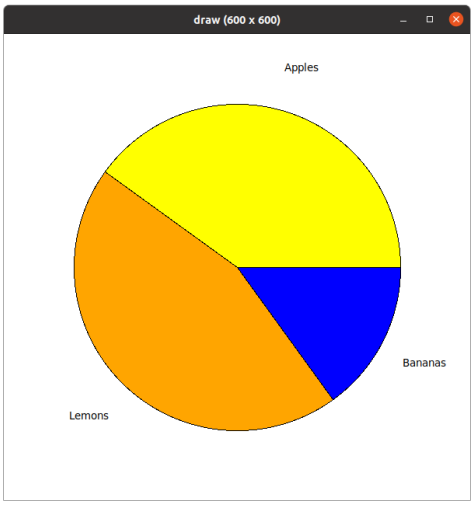
Will produce the following image:



Calling both draw functions:

```
L = [("Apples",80),("Lemons",90),("Bananas",30)]
drawPieChart(canvas, 600, 600, L)
drawLabels(canvas, 600, 600, L)
```

Will produce the following image:



Note: You may assume you have the function `calcRatios`, even if yours is not functional.

Write your answer on the next page.

Answer space for Extra Credit Part C.