Lab 4 and 5

Github Clone Details:

```
$ git clone https://github.com/ninja11/Robotics.git
$ cd Lab/lab4
$ autograder.py
```

Lab 5 Video

Location: https://youtu.be/dc4IWqZ1NYs

Object: Avocado being used as a ball (due to ball unavailability). However, Cozmo still identifies it as a ball as seen below😊

We can see in the video that Cozmo looks around for the ball first. When the ball is detected, it starts moving towards the ball with a speed inversely proportional to the radius of the ball he sees. Thus as he gets closer to the ball, he goes slower. Once he reaches very close to the ball, he stops, moves his lift up and down, calls out “Found the ball!” and then changes colors on his backpack.

Algo description: find_ball

```
For each image:
        Apply cv2.GaussianBlur(opencv_image, (7, 7), 0)
        Obtain all detected circles using cv2.HoughCircles

        If detected circles = None, ball = None
        Else
        For each circle in detected circles:
                Create mask of original image height and width
                Draw the circle on the mask
                Copy that image using that mask
                Apply thresholds and find contours
                Get cropped image using crop mask data
                Identify average image color of the cropped image
```

```
        From the above selected_circle = circle with the darkest image color since the
assumption of          environment is black ball in a light colored room
        If the circle with darkest image color has average color > 50 (means not close
to black) ball = None
Else ball = selected_circle
```

Algo description: goto_ball

```
While true:

       Scour the surroundings by turning each time by 5 degrees to identify the ball
       using find_ball

       While ball is not None:
              Set motor speed inversely proportional to the radius of the ball observed
              as:
              motor_right = 200*(1/new_radius)
              motor_left = 200*(1/new_radius)

              robot.drive_wheels(motor_right, motor_left)

              ball = get new image of the ball (the radius will now increase as Cozmo
              has now gone closer to the ball)

              if ball is not None:
                  new_radius = ball[2] //update radius
              else: // when Cozmo is extremely close to the ball, he just sees a black
              screen (ball = None)
                  break;

         stop all motors
         move lift up
         move lift down
         say "Found ball"
         turn backback light red
         turn backback light green
         turn backback light blue
         turn backback light white
```