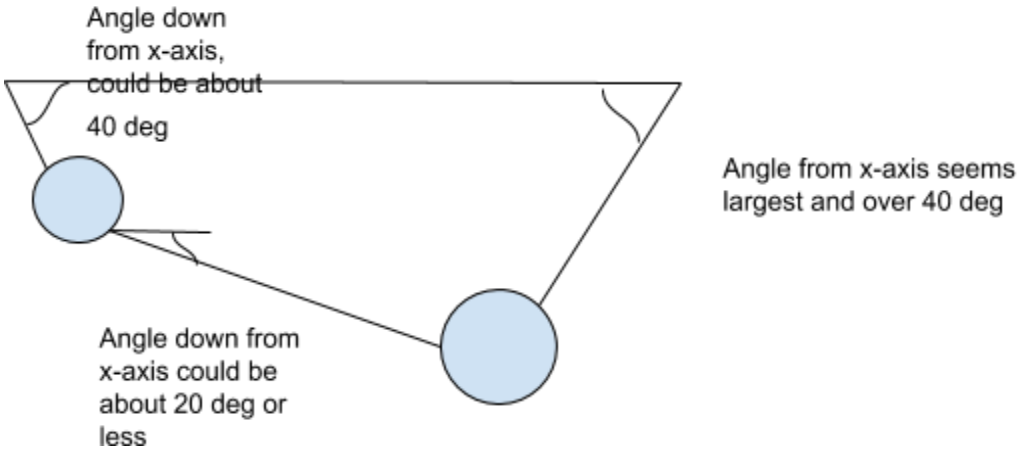
Jessica Hamilton
COmputational
Lab 04
Masses on a string

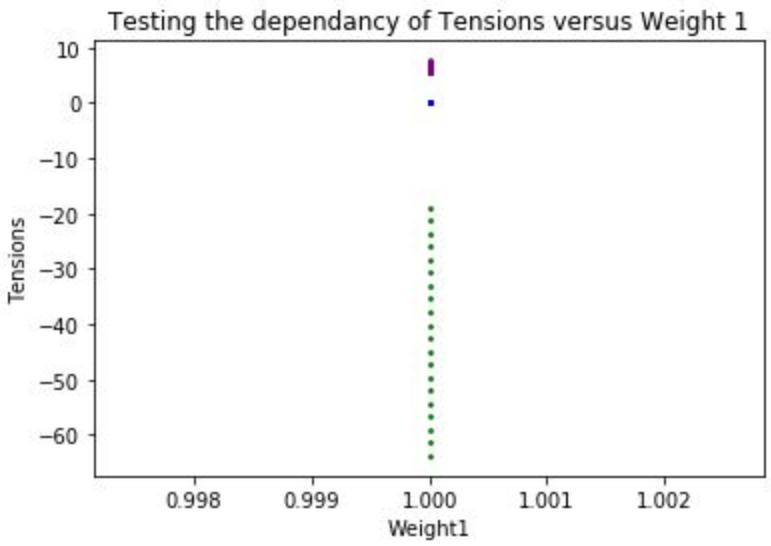
To begin the problem of determining the unknown variables, tensions and angles, and the problem using linear algebra, you must initially guess what the values may be. For my initial guesses for the tensions are: tension 1= 2, tension 2=5, tension 3 = 7. My though process for this is that it seems the setup would require the greatest tension for tension 3 and the least tension for tension 1 where tension 2 was somewhere in the middle. For the angles, it took looking at the diagram and determining the rough angles from experience and also taking into account the angle with respect to the theta=0 axis. Then i computed the actual cos and sin values for the respective angles since in the coding to determine the Jacobian, it is easiest to combine the sin of the theta or the cos of theta and determine the actual angle after the approximate values are found. In doing this I determined sin(theta1) = 0.500, sin(theta2) = 0.2588, sin(theta3) = 0.707, cos(theta1)=0.8660, cos(theta2)=0.9659, and cos(theta3)= 0.7971.

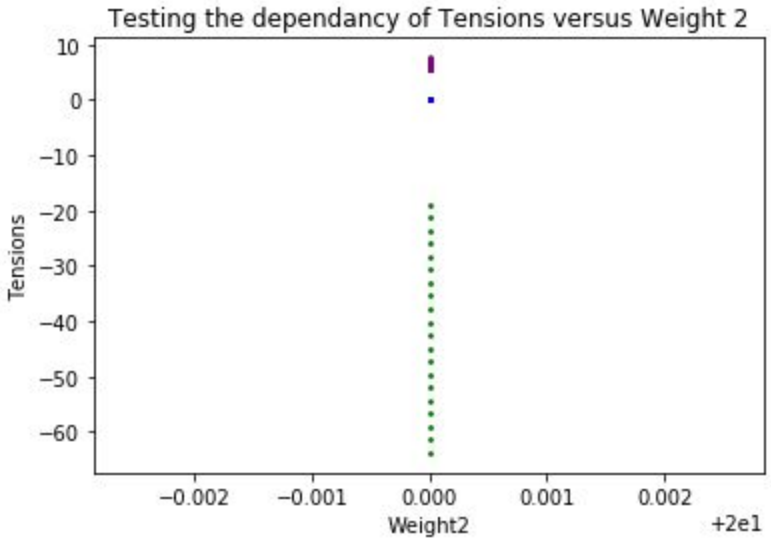
After running the code looking at the values for the tensions and the angles, they do seems reasonable with the given initial guesses. The tensions are positive, the angles with respect to the x-axis seem reasonable.
These are the respective angles: [-39.49430284] [-21.2414172] [46.10703641]
These are the tension values: [1.00077422] [6.06102207] [12.68435998]



When using values that are either a 1 or a 0 for the tensions or angles will break things and/or make unrealistic values. But the values that are around what I initially guess from looking at the given example and actually computing values of reasonable angles, it seems to stay reasonable. Extreme values do not to well. Larger tension values tend to predict tension values that are negative.

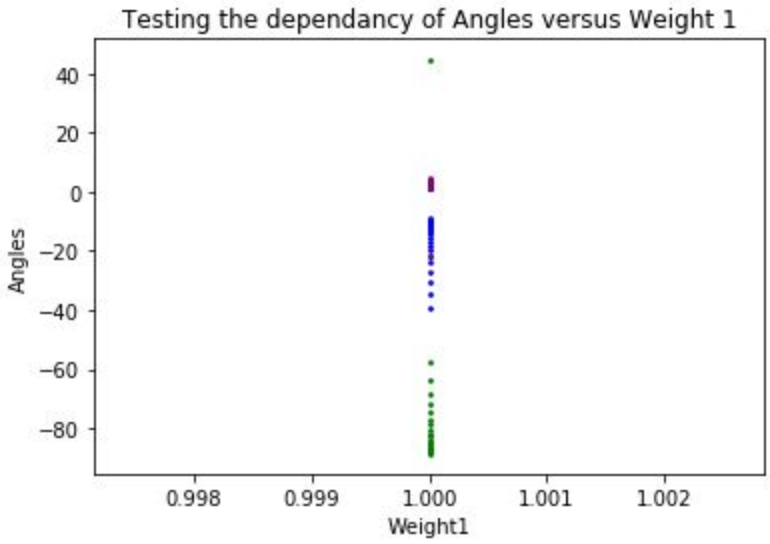
Looking for the dependence in the different variables, the graphs produced for varying the tensions shows a dependance on the second tension and slightly the first tension. Their values do not vary much. The third tension varies uniformly.

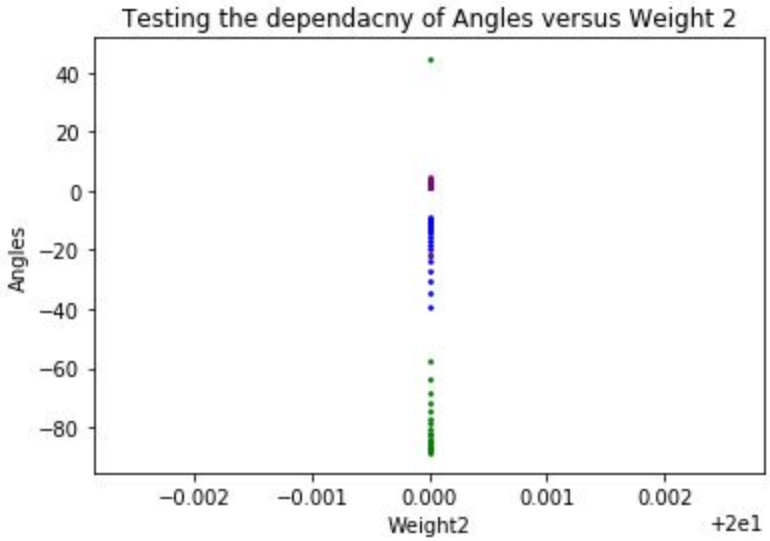




Both comparisons to weight one and weight two shows no spread in tension two, little spread in tension one, and uniform spread in tension3.

In looking at the graphs produced for the varying angles, seems to affect the overall values more. The first angle seems to cluster within a certain range, but as it reaches over -20, then it spread if larger and the values are not as reasonable. The same argument is made for the third angle, but the opposite direction. As the values decrease in negativity, they seem to reach a point where the variation is greater and the values are not as reasonable. There is not as much flexibility in the second angle, which makes sense due to it being determined really by the other angles. The range is smaller and once of that range, the values go straight to unreasonable.


Testing the dependancy of Angles versus Weight 1
Angles
40
20
0
−20
−40
−60
−80
0.998
0.999
1.000
1.001
1.002
Weight1


Testing the dependacny of Angles versus Weight 2
Angles
40
20
0
−20
−40
−60
−80
−0.002
−0.001
0.000
0.001
0.002
+2e1
Weight2