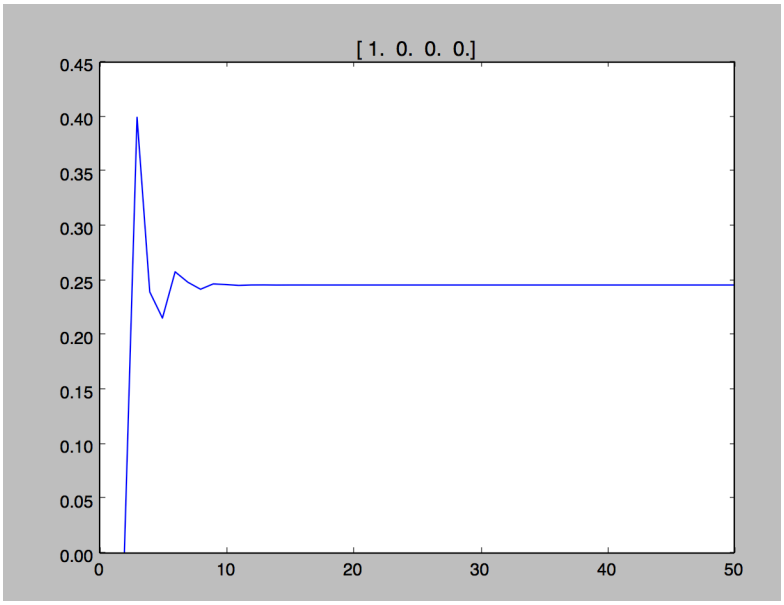
2.) See images below
steady state convergences
0.34653363 0.05940606 0.29702879 0.29703152
0.34653359 0.059406 0.29703031 0.2970301
[0.13793078 0.24630491 0.29556666 0.32019766]

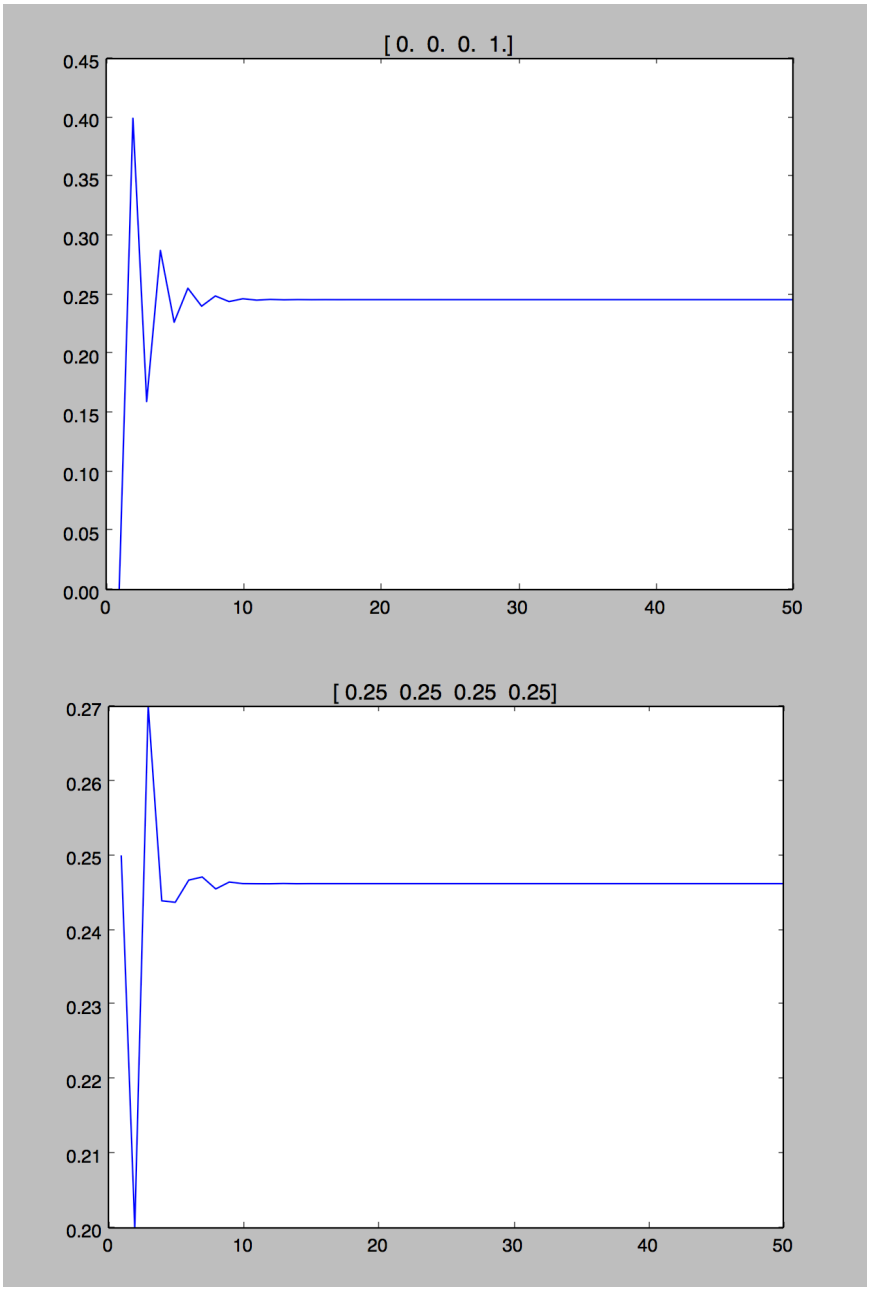
Were they the same vector? If they were different, why?
These two do not lead to a different steady state vector. The reason is because the steady state vector is the same for both initial vectors. Although one vector may take longer to converge to a steady state, they will both eventually converge.

4.)

What were the frequencies of time steps 20, 50,100,1000,10000
[0.34999999999999998, 0.0, 0.34999999999999998, 0.29999999999999999]
[0.34000000000000002, 0.0, 0.34000000000000002, 0.32000000000000001]
[0.33000000000000002, 0.0, 0.34000000000000002, 0.33000000000000002]
[0.33300000000000002, 0.0, 0.33400000000000002, 0.33300000000000002]
[0.33329999999999999, 0.0, 0.33339999999999997, 0.33329999999999999]

How does this relate too number two's answers?
These results make sense with the results from question two. Since state two had such a low probability, it was very unlikely we would land
in that state.




[0. 0. 0. 1.]
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0
10
20
30
40
50
[0.25 0.25 0.25 0.25]
0.27
0.26
0.25
0.24
0.23
0.22
0.21
0.20
0
10
20
30
40
50