# 02-725 HW5

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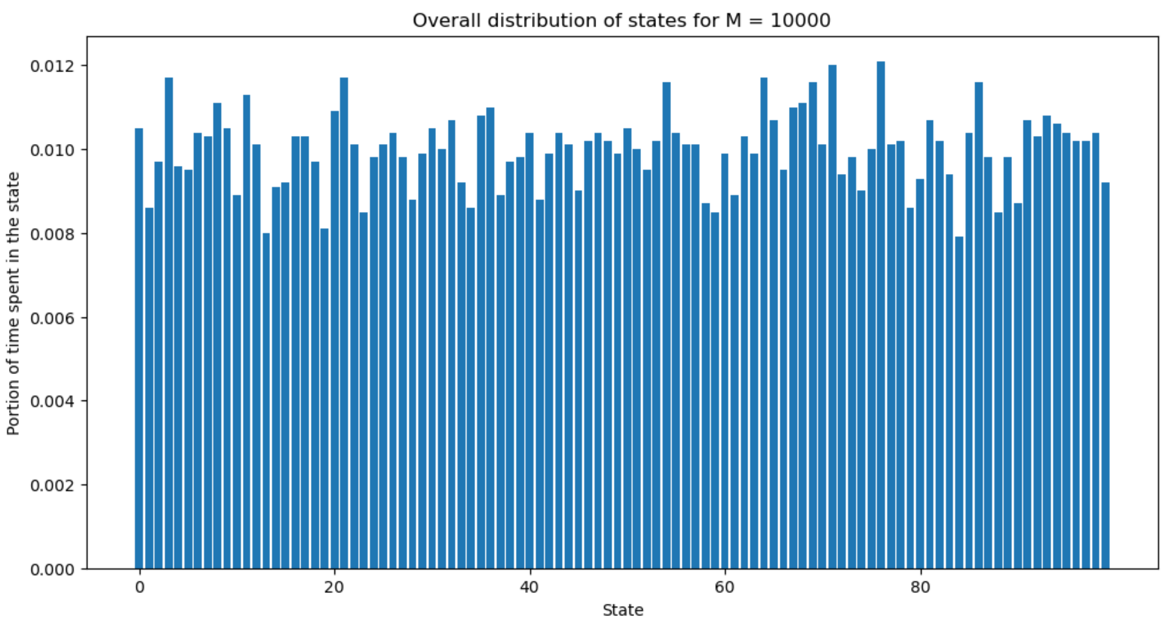
### 1 MARKOV CHAIN

1.1 Since the transition probability matrix is symmetric, the equilibrium distribution should be uniform.

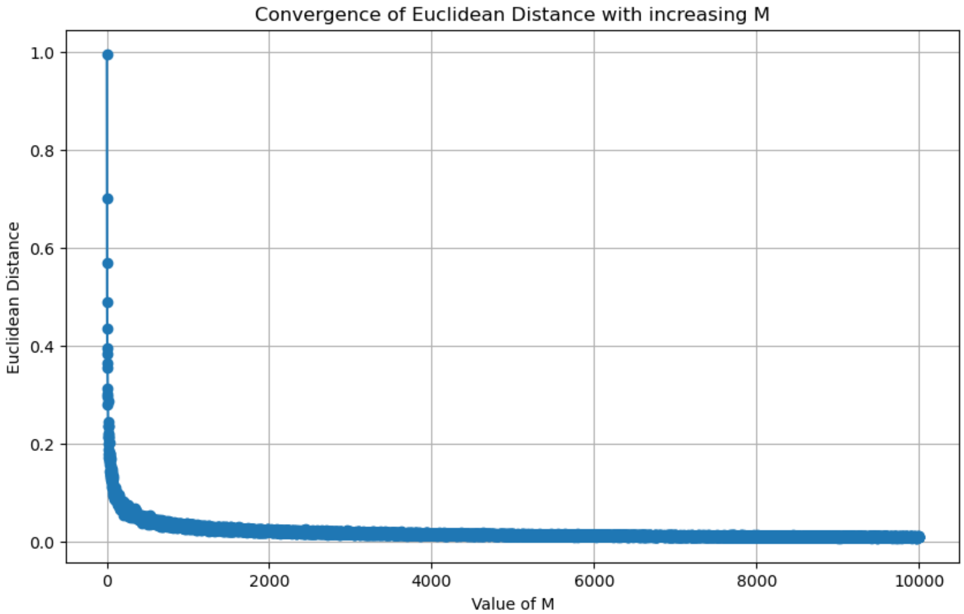
1.2 Refer to code. The eigenvector represents a uniform distribution where every value is very close to 0.01.

1.3 Refer to code.

1.4 Below is the overall portion of time the Markov chain spends in each of the 100 states for M = 10,000:




The plot above shows that the portion of time spent in each state is very close to 0.01 as well. Below is the plot that shows the euclidean distances between expected equilibrium distribution and observed equilibrium distribution as a function of increasing value of M. The plot below shows that the euclidean distance between the expected equilibrium distribution and observed equilibrium distribution becomes 0 around M = 1800.



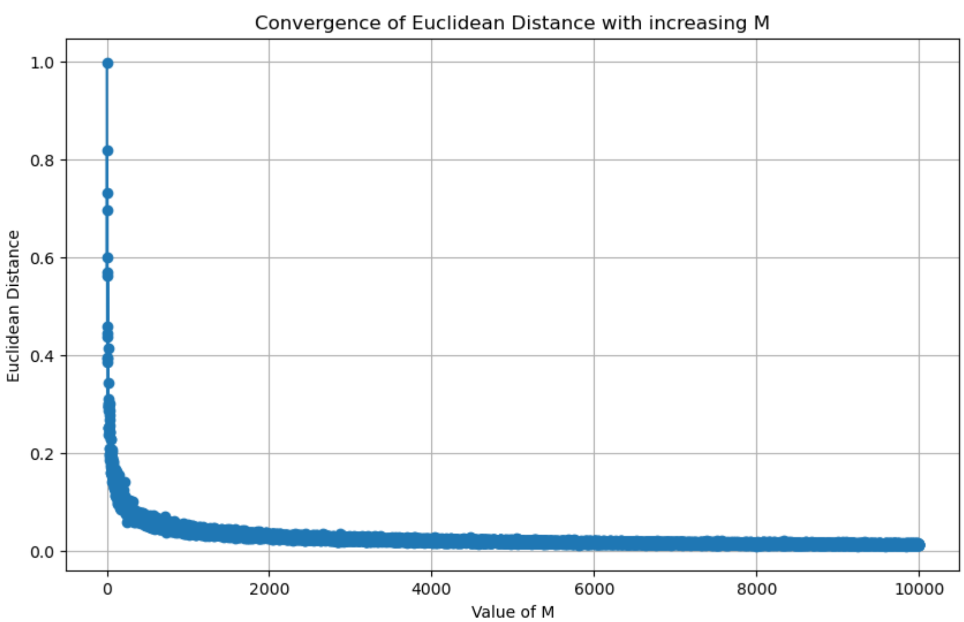

## 2 MCMC

2.1 Refer to code.

2.2 Refer to code.

2.3 Refer to code. The euclidean distance between the first eigenvector and the desired equilibrium is $0.0511$

2.4 The euclidean distance between approximate equilibrium distribution after M=10,000 and the desired equilibrium distribution is $0.01258$.




The plot above shows the change in the euclidean distance between the observed distribution and the desired equilibrium distribution as a function of increasing value of M. As the plot shows, the euclidean distance becomes close to $0$ slightly around M = $3000$ and therefore in this case, it takes a larger value of M for the euclidean distance to converge as compared to part 1.