ECE 322
Assignment 2

Arun Woosaree

XXXXXXX

October 27, 2019

1

To test the individual states, we are concerned with the stationary probabilies. The following linear system of equations is derived from the graph: (Note: there was a typo addressed by the professor. The transition from C to B has a weight of 1. In general, the sum of probabilities of edges leaving any node is equal to 1.)

$$p_A = 0.5p_E$$

$$p_B = p_A + p_C$$

$$p_C = 0.5p_E + 0.6B$$

$$p_D = 0.4p_B$$

$$p_E = p_D$$

The last equation is dropped, because otherwise the system would be linearly dependent. p_D is determined from the following relationship:

$$p_A + p_B + p_C + p_D + p_E = 1$$

The system of equations is solved using the following code:

```python
import numpy as np
import string

a = np.array(
    [
        # a    b    c    d    e
        [-1,   0,   0,   0,   0.5],
        [1,   -1,   1,   0,   0],
        [0,   0.6,  -1,   0,   0.5],
        [0,   0.4,   0,  -1,   0],
        #[0,   0,   0,   1,  -1],
        [1,   1,   1,   1,   1],
    ]
)

#b = np.array([0, 0, 0, 0, 0, 1])
b = np.array([0, 0, 0, 0, 1])

x = np.linalg.solve(a, b)

alphabet = string.ascii_uppercase

d = dict()
for i in range(len(x)):
    d[alphabet[i]] = x[i]

for k,v in sorted(d.items(), key=lambda x: x[1], reverse=True):
        print(f"{k}: {v}")
```

which results in:

p_B: 0.3571428571428571
p_C: 0.28571428571428564
p_E: 0.1428571428571429
p_D: 0.14285714285714288
p_A: 0.07142857142857145

Thus, the order in which to test the individual states is: B, C, E, D, A.

As for testing the transitions, we look at the probabilities of the transitions, and pick the highest ones first. Therefore, the transitions I would test first are:

$A \rightarrow B$

$D \rightarrow E$

$C \rightarrow B$

, since they all have the highest probability of 1