Assignment #5

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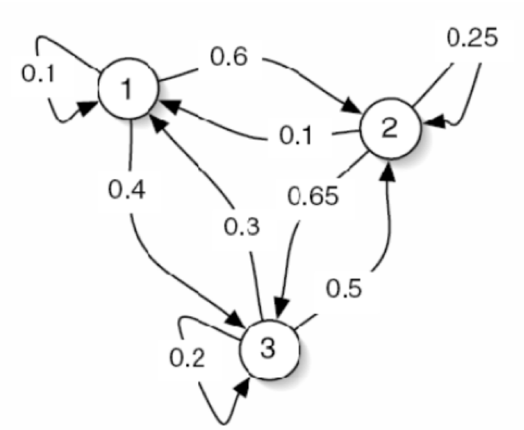
Consider the following finite Markov chain, where arcs are labeled by transition probabilities. Is it ergodic (i.e., aperiodic and irreducible)? What is the steady-state distribution? Show your calculation or program.



To test if it is ergodic, we need to know whether $(1-d)E/n + dA^T$ is a stochastic matrix, a kind of transpose matrix for Markov Model. We can finally get that it is ergodic.

```
ones = np.identity(3)
prob = np.array([[0.1, 0.6, 0.3],
                 [0.1, 0.25, 0.65],
                 [0.3, 0.5, 0.2]])

test = 0.15 * np.ones([3, 3]) / 3 + 0.85 * np.transpose(prob)
test = np.sum(test, axis = 0)
print test
```

And to find the steady state, we need to find π which $\pi = A^T * \pi$. In other words, we need to solve the linear equations below:

$$\begin{cases} 0.9x - 0.1y - 0.3z = 0 \\ -0.6x + 0.75y - 0.5z = 0 \\ -0.3x - 0.65y + 0.8z = 0 \\ x + y + z = 1 \end{cases} \tag{1}$$

It is possible to compute by hand; however, it is more convenient to do this by implementing the code. Eventually, we can know that there is no root that can satisfy four equations simultaneously, which means there is no steady state.