

ECE 341 - Test #3

Markov Chains and Data Analysis

Open-Book, Open Notes. Calculators, Matlab, Tarot cards, StatTrek allowed.

Giving or receiving help from others or from Chegg **not** allowed

1) Markov Chains: Four people are playing ball. Each second, a person either passes the ball or keeps it with probability p as shown below.

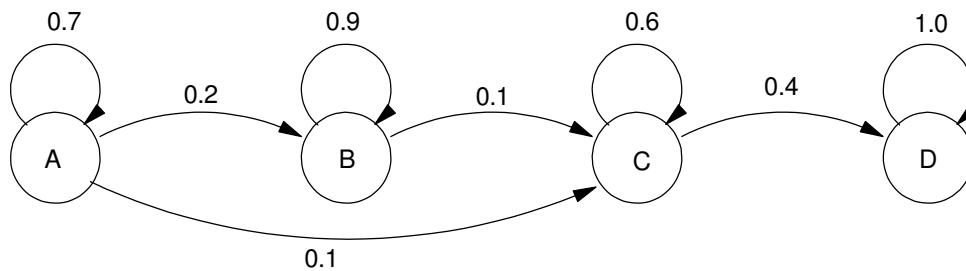
a) Express the probability that each person has the ball at time $k+1$ as:

$$X(k+1) = AX(k)$$

b) Assume the z-transform for person D having the ball is

$$Y(z) = \left(\frac{0.04z(z-0.7)}{(z-1)(z-0.9)(z-0.7)(z-0.6)} \right)$$

Find $y(k)$ using z-Transforms



2) t-Test (One data set). A Monte-Carlo simulation was run for 8-card poker. Each simulation deals 100,000 hands of 8-cards. The number of times a hand contains 2-pair is recorded:

hands = { 37625 37802 37611 37431 }

- a) Determine the mean and standard deviation for this data
- b) (individual) If I run this experiment one more time, what number will I get with a confidence level of 90%? (5% tails)
- c) (population) From this data, what is the 90% confidence interval for the actual probability of getting 2-pair when dealt 8 cards?

3) t-Test (Two data sets): The global average temperature over two decades are as follows (source: NOAA):

Time-Span	mean (milli-degrees F)	standard deviation (milli-degrees F)	# years
A: 1880 - 1889	-176.58	80.98	10
B: 1890 - 1899	-243.58	92.92	10

- a) (Individual) What is the probability that any given year in A is warmer than any given year in B?
- b) (population) What is the probability that the temperature is rising? (mean of B is more than the mean of A)?

4) Chi-Squared Test: The following Matlab code generated 100 random values for a 7 sided die.

```
Result = zeros(7,1);  
for i=1:100  
    die = ceil( 7*(rand ^ 0.8));  
    Result(die) = Result(die) + 1;  
end  
Result
```

- a) Generate the frequency of rolling each number 1..7 with 100 rolls of the die
- b) Determine if X has a uniform distribution (fair die) using a Chi-squared test.

5) ANOVA (Three data sets): The global average temperature over three decades are presented below. Determine the probability that the data sets have a different mean (temperatures are changing) using an F-test.

Time-Span	mean (milli-degrees F)	standard deviation (milli-degrees F)	# years
A: 1880 - 1889	-176.58	80.98	10
B: 1890 - 1899	-243.58	92.92	10
C: 1900 - 1910	-305.83	131.23	10