

# ECE 341 - Test #3: Name \_\_\_\_\_

## Markov Chains and Data Analysis

**1) Markov Chains:** Two players are playing a match. To win the match, a player has to win three games in a row. Assume for each game

- A has a 50% chance of winning
- B has a 40% chance of winning, and
- There is a 10% chance of a tie (breaking all winning streaks)

a) Express the probability that player A or B has an n-game winning streak as:

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

where  $X(k)$  is defined as the probability after game  $k$  that

$$X(k) = \begin{bmatrix} \text{A has a 3-game winning streak (A wins)} \\ \text{A has a 2-game winning streak} \\ \text{A has a 1-game winning streak} \\ \text{Zero-game winning streak} \\ \text{B has a 1-game winning streak} \\ \text{B has a 2-game winning streak} \\ \text{B has a 3-game winning streak (B wins)} \end{bmatrix}$$

b) Explain how you would determine the odds of A winning the match (A is first to get a 3-game winning streak).

- Or find the odds if you have access to Matlab

**2) t-Test (One data set).** The gain of nine 6144 NPN transistors were recorded:

- Gain = {374, 370, 359, 370, 351, 357, 352, 364, 372}
- mean = 363.2222
- standard deviation = 8.7860

a) (individual) If I measure a tenth 6144 NPN transistor, what is the 90% confidence interval for the gain of this transistor?

b) (population) What is the 90% confidence interval for the average gain of a 6144 NPN transistor?

**3) t-Test (Two data sets):** The points scored by the Vikings and Packers in 2022 are as follows:

Team	Average points	standard deviation points	games
Vikings	24.9444	8.3135	17
Packers	21.7647	9.2096	17

a) (Individual) Determine using a Student t-Test the probability that the Vikings will outscore the Packers next time they play.

b) (population) Determine using a Student t-Test the probability that the Vikings have the better offense overall.

4) Chi-Squared Test: The points scored by the Minnesota Vikings in 2022 were:

Point Range	0-9	10-19	20-29	30-39	40-49	Total Games
Frequency	3	2	12	4	0	21

Use a chi-squared test to determine the chance that the Vikings score has a uniform distribution (equal likelihood over the range of (0,49) points).

5) ANOVA (Three data sets): The points scored in 2022 by the Vikings, Packers, and Bears are as follows. Use an Analysis of Variance test to determine the probability that the means are different.

Team	mean (points per game)	standard deviation (points per game)	# games
Vikings	24.9444	8.3135	17
Packers	21.7647	9.2096	17
Bears	19.1765	8.4575	17