ECE 341 - Test #3

Markov Chains and Data Analysis. Summer 2021

Open-Book, Open Notes. Calculators, Matlab, Tarot cards, Internet allowed. Just not other people.

1) Markov Chains:

Two people, A and B, are playing a game.

- A has a 20% chance of winning   A gains +1 point on a win
- There is a 70% chance of a tie   Neither A nor B score a point
- A has a 10% chance of losing   A loses 2 points

If A reaches +2 points, A wins the match (win by 2)

If A reaces -2 points, B wins the match

1a) What is the state transition matrix (going from k games to k+1 games)

1b) What is the probability that the match will end after 10 games (either A or B wins after 10 games)

1c) What is the probability that A will eventually win the match?

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2) t-Test: One data set.

a) Generate 10 random numbers in Matlab

```
X = zeros(10,1);
for i=1:10
   X(i) = 100*sum(  rand(4,1) .^ 0.4 );
   end
```

b) Use a t-test to determine the 90% confidence interval for X

t-score	90% confidence interval for x

c) Use a t-test to determine the probability that $X > 350$

t-score	p(X > 350)

3) t-Test (Two data sets):

3a) Generate two sets of random numbersfor X and Y in Matlab (10 trials each)

```
X = zeros(10,1);
for i=1:10
   X(i) = 100*sum(  rand(4,1) .^ 0.4 );
   end

Y = zeros(10,1);
for i=1:10
   Y(i) = 90*sum(  rand(6,1) .^ 0.7 );
   end
```

3b) If you generate an 11th value for X and Y, what is the probability that Y > X?

t-score	p(y(11) > x(11))

3c) Based up 10 data points, what is the probability that the mean of Y is larger than the mean of X?

t-score	p(mean(Y) > mean(X))

4) Chi-Squared Test:

The following Matlab code generated 100 random values for X:

```
RESULT = zeros(1,5);

for i=1:100
    d5 = ceil( 5*(rand ^ 0.9) );
    RESULT(d5) = RESULT(d5) + 1;
    end

RESULT
```

It is conjectured that X has a uniform distribution over the range of (0, 5)

4a) Generate 100 values for X and give the result (give the number of times you rolled each number)

1	2	3	4	5	6

4b) Determine if X does or does not have a uniform distribution (i.e. is a fair die) using a Chi-squared test.

chi-squared critical value	p(d5 is not a uniform distribution)

5) F-Test (Three data sets):

The reaction time of three people are measured:

Person	A	B	C
Reaction Times	0.2253	0.1924	0.2419
	0.1923	0.1893	0.1976
	0.1854	0.2018	0.3063

5a) What is the probability that the variance of A is different than the variance of B? (F-test)

F-score	p(var(A) != var(B))

5b) What is the probability that all three people have the same average reaction time using an ANOVA test?

MSSb	MSSw	F-score	p(means are different)