ECE 341 - Homework #14

Chi-Squared Tests. Due Thursday, June 11th

Fair Die

The following Matlab code generates a random number from 1..6 (6-sided die).

```
RESULT = zeros(1,6);

for n=1:120
    d6 = ceil( 6*rand );
    RESULT(d6) = RESULT(d6) + 1;
end

RESULT
```

1) Use a chi-squared test to determine if it is a fair die (all numbers equal probability) with 120 rolls.

2) Use a chi-squared test to determine if it is a fair die (all numbers equal probability) with 120,000 rolls.

Loaded Die

The following Matlab code generates a random number from 1..6 (6-sided die).

```
RESULT = zeros(1,6);

for n=1:120
    if(rand < 0.1)
        d6 = 6;
    else
        d6 = ceil( 6*rand );
    end

    RESULT(d6) = RESULT(d6) + 1;
end

RESULT
```

3) Use a chi-squared test to determine if it is a fair die (all numbers equal probability) with 120 rolls.

4) Use a chi-squared test to determine if it is a fair die (all numbers equal probability) with 120,000 rolls.

Am I psychic?

5) Take a deck of playing cards. Predict the suit of the top card then reveal it. If correct, place it in one pile. If incorrect, place it in another pile.

5a) How many times were you correct? Incorrect?

5b) From your results, determine the odds that you are guessing (25% chance of being correct) using a chi-squared test.

Poisson approximation for a binomial distribution.

5) Let X be the number of 1's and 2's you get when you roll 60 dice. The Poisson approximation for the pdf is

$$\lambda = np = 20$$

$$\binom{60}{x} \left(\frac{2}{6}\right)^x \left(\frac{4}{6}\right)^{60-x} \approx \left(\frac{1}{x!}\right) 20^x \, e^{-20}$$

- Use Matlab to count the number of 1's and 2's you get when you roll 60 dice
- Repeat 100 times
- Check whether the result is consistent with a Poisson distribution with $\lambda = np = 20$ using a Chi-squred test