

ECE 341 - Homework #14

Chi-Squared Tests

Loaded Dice

- 1) The following Matlab code generates 90 random numbers from 1..6 (sixty 6-sided dice)

```
RESULT = zeros(1,6);  
for i=1:90  
    d6 = ceil(rand*6);  
    RESULT(d6) = RESULT(d6) + 1;  
end
```

Use a chi-squared test to determine if this is a fair die.

- 2) The following Matlab code generates 90 random die rolls with 15% loading (15% of the time you roll a 6)

```
RESULT = zeros(1,6);  
for i=1:90  
    if(rand < 0.15) d6 = 6;  
    else d6 = ceil(rand*6);  
    end  
    RESULT(d6) = RESULT(d6) + 1;  
end
```

Use a chi-squared test to determine if this is a fair die.

Mendel's Experiment

- 3) Mendel showed that there are dominant and recessive genes. When two hybrid plants are crossed (Gg x Gg), 75% of the offspring should display the dominant trait (GG or Gg) while 25% show the recessive trait (gg). Repeat this experiment in Matlab.

Suppose you flip a coin which has a 75% chance of success ($p = 0.75$). What is the probability of getting *exactly* 3 heads in 4 tosses?

note: This is a binomial distribution.

- 4) Suppose you run this experiment n times. Each experiment of four tosses, you get *exactly* 3 heads and 1 tails.

Use a chi-squared test to determine how large n has to be until you can be 99% certain the experiment is rigged.

Am I psychic?

- 5) Shuffle a deck of 52 playing cards. Without looking at the top card, predict the suit (clubs, diamonds, hearts, and spades). Repeat for all 52 cards, keeping track of how many you got right and how many you got wrong.

- From the results, use a chi-squared test to determine if you are just guessing (25% chance of getting the suit correct.)