

ECE 341 - Homework #14

Chi-Squared Tests. Due Thursday, June 11th

Please make the subject "ECE 341 HW#13" if submitting homework electronically to Jacob_Glower@yahoo.com (or on blackboard)

Refrigerator Door:

1) The time that a refrigerator door is held open is recorded over a 2-day period. It is conjectured that this is an exponential distribution. Use a chi-squared test to determine whether this is or isn't.

day 1:

5.126, 5.720, 3.112, 12.250, 3.811, 32.847, 4.269, 5.085, 3.521, 3.552,
3.950, 8.417, 5.051, 5.868, 3.353, 3.959, 3.086, 50.000, 5.863, 3.531,
4.271, 6.421

day 2:

11.673, 2.425, 20.651, 4.796, 3.967, 2.836, 165.279, 1.156, 6.025, 5.884,
78.509, 56.183, 4.987, 5.047, 5.139, 28.309, 3.200, 2.620, 41.602, 7.147,
10.963, 6.559, 13.491, 18.940, 4.327, 6.277, 9.794, 7.398, 5.823, 7.126

Am I psychic?

Person A rolled a 6-sided die 100 times and predicted the result before each roll. What is the probability that person A is psychic? (i.e. reject the null hypothesis that guessing was random)

Prediction (in order)

2 6 1 6 1 6 2 2 5 2 2 5 2 5 6 4 3 4 6 5 1 1 5 2 5 5 1 6 1 5 5 3 3 1 4 1 6 3 1
3 3 1 4 3 4 4 1 1 5 3 5 3 3 4 2 3 3 1 4 1 1 1 6 4 6 5 1 1 6 5 4 3 6 1 4 5 3 5
4 4 6 4 4 4 4 2 4 1 5 4 3 4 1 4 3 4 1 6 2 5

Die Roll (in order)

2 4 6 2 3 2 4 5 5 1 4 1 2 6 4 4 4 2 5 2 4 3 6 6 4 4 4 2 5 1 4 4 6 2 1 4 2 1 1
6 6 2 4 6 1 3 6 6 3 3 4 6 2 5 5 3 4 2 4 1 5 1 4 5 3 6 1 6 5 6 2 6 2 3 6 5 4 1
5 5 1 4 3 3 4 4 3 6 2 2 4 4 4 6 2 4 4 5 4 2

- 2) Is this a fair die? (use a Chi-squared to test the null hypothesis: all numbers have a 1/6 chance of coming up)
- 3) Is the prediction random? (each number has equal probability). Check with a Chi-squared test.
- 4) Is the person psychic? (does the predicted number match the actual die roll more than it should?). Check with a Chi-squared test.

Poisson approximation for a binomial distribution.

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

$$\binom{60}{x} \left(\frac{1}{6}\right)^x \left(\frac{5}{6}\right)^{60-x} \approx \left(\frac{1}{x!}\right) 10^x e^{-10}$$

- Use Matlab to count the number of 1's you get when you roll 60 dice
- Repeat 100 times
- Check whether the result is consistent with a Poisson distribution with $\lambda = Np = 10$ using a Chi-squared test