

Math 3215: Homework 6

Will Perkins

Not to turn in

1 Regression

Recall our linear regression model:

$$y_i = \alpha + \beta(x_i - \bar{x}) + \epsilon_i$$

where $\epsilon_i \sim N(0, \sigma^2)$.

1. Find the MLE for α (with proof)
2. Find the MLE for β (with proof)
3. Find the MLE for σ^2 (with proof)
4. Describe the step by step procedure for reporting a linear regression model from a sample with confidence intervals. Start with explaining what you would report.

2 Statistics

1. You work at the headquarters of a cellphone manufacturing company. Your company runs two different factories. You get a sample of 200 phones from each factory and will see how many don't work due to manufacturing errors. Your bosses ask 'Is one of the factories doing better than the other?' Describe how you would set up the following experiment and calculate p -values. Be specific about which probability distribution you will use for your model.
2. A software company claims their dictation software makes 2 errors per 100 words on average. You want to test their claim. You speak 500 words and the software only makes 1 error. What can you say qualitatively and quantitatively about the software?
3. Give a well-argued rough estimate of the number of samples you'd need to take to be 99% confident about the average height of a Georgia Tech student to within the nearest half inch.

3 Probability

1. Prove that $\frac{\chi_n^2 - n}{\sqrt{2n}} \Rightarrow N(0, 1)$. (χ_n^2 is a Chi-Squared distribution with n degrees of freedom).
2. Find the probability that the minimum of n independent $Pois(1)$ random variables is ≤ 2 .