

STAT 770, Spring 2017: Homework 1

- Prob. 1.5 (p. 29). Use both the score test and the exact test for testing $H_0 : \pi = 0.5$. Also report the CIs from both approaches. Use a software package (not by hand).
- Prob. 1.7abce. Obtain p-values and 95% CIs in a software package.
- Prob. 1.8. Hint: the problem is asking you to determine the sample size n needed such that a 95% CI for π (the probability of ‘*preferring the new treatment*’) has width $2(0.05) = 0.1$ when the true value is $\pi = 0.8$. Recall that the CI has width $2z_{\frac{\alpha}{2}} \sqrt{\frac{\pi(1-\pi)}{n}}$
- Prob. 1.9. Use software.
- Prob. 1.16. Hint: plot $\text{sd}(\hat{\pi})$.
- Ph.D. students only. Prob. 1.10. Hint: this is the setup in the notes with $y_1 = 0$, $t_1 = 109$, $y_2 = 65$, $t_2 = 65$, $y_3 = 44$, $t_3 = 22$, etc. You need to estimate the rate ‘deaths per corps years’ $\hat{\mu}$. Once you have this, you can carry out Pearson’s test. There are five categories: 0, 1, 2, 3, and 4 deaths in a year. Define the five probabilities

$$\begin{aligned}p_1 &= e^{-\hat{\mu}} \\p_2 &= e^{-\hat{\mu}} \hat{\mu} \\p_3 &= e^{-\hat{\mu}} \hat{\mu}^2 / 2 \\p_4 &= e^{-\hat{\mu}} \hat{\mu}^3 / 6 \\p_5 &= e^{-\hat{\mu}} \hat{\mu}^4 / 24\end{aligned}$$

and let $p_+ = \sum_{i=1}^5 p_i$. Then the expected number (under the truncated Poisson distribution) for category i is $200p_i/p_+$.

- Ph.D. students only. Prob. 1.17ab. Hint: find the formula for the variance of the sum of random variables (it involves the covariance of pairs).
- Ph.D. students only. Prob. 1.29. This is like the calf pneumonia problem in the notes. Note that part c is just ‘explain.’