Worksheet 10

1. **(Ratio Test)** Let $X_1, \ldots, X_n \overset{iid}{\sim} Exp(\lambda)$. What is the test statistic Λ for the corresponding likelihood ratio test for the null hypothesis $H_0 : \lambda = 1$.

2. **(Ratio Test)** Let $X_1, \ldots, X_n \overset{iid}{\sim} Poisson(\lambda)$. What is the test statistic Λ for the corresponding likelihood ratio test for the null hypothesis $H_0 : \lambda = 1$.

3. **(Ratio Test)** Let $X_1, \ldots, X_n \overset{iid}{\sim} Bernoulli(p)$. What is the test statistic Λ for the corresponding likelihood ratio test for the null hypothesis $H_0 : p = 0.2$.

4. **(Ratio Test)** Let $X \sim Bin(n, p_1)$ and $Y \sim Bin(n, p_2)$ be independent random variables, assuming that n is a known quantity. We want to test the hypothesis that $H_0 : p_1 = p_2$. What are the corresponding Θ and Θ_0 in our updated formulation of hypothesis testing?[1] If we use a Likelihood Ratio Test for this hypothesis, how many degrees of freedom should Λ have?

[1] We will derive the actual test itself in a more general form next class.

5. **(Ratio Test)** Recall that we used the one-sample ANOVA test with the null-hypothesis that the means of K samples are all the same. Write down and describe the values of Θ and Θ_0 that correspond to this test. If we use a Likelihood Ratio Test for this hypothesis, how many degrees of freedom should Λ have?

6. **(MLE Practice)** Let $X_1, \ldots, X_n \overset{iid}{\sim} Uniform(0, a)$. Find the MLE estimator for a. Note: You cannot do this using the derivative. Just think about it!