1) Define a \( F \) distribution. What does the distribution look like?

2) What are we estimating when we use a \( F \) distribution?

3) What are we assuming about \( \sigma_1 \) and \( \sigma_2 \) when using the two sample \( t \)-test statistic?

4) What is the reason for using a plus four estimate? What is the plus four estimate?

5) What is the standard error for a plus four estimate? What is the standard error for \( \hat{p} = \frac{X}{n} \), where \( X \) is binomially distributed with parameters \( n \) and \( p \)?

6) In the following, should you use a \(+4\) method, large sample confidence interval, or neither for 95% confidence?
   a) \( n = 20, \ X = 15 \)
   b) \( n = 100, \ X = 15 \)
   c) \( n = 8, \ X = 4 \)

7) Evaluate the following where \( \Gamma \) is the gamma function
   a) \( \Gamma (1) \)
   b) \( \Gamma (5) \)

8) Define a \( t \)-distribution. In your definition how many degrees of freedom are there?

9) Draw a \( t \)-distribution next to a normal distribution and point out the differences. What happens as \( n \to \infty \)?

10) Suppose \( \bar{x}_1 \sim N (\mu_1, \frac{\sigma_1^2}{n}) \) and \( \bar{x}_2 \sim N (\mu_2, \frac{\sigma_2^2}{n}) \). What is the mean, standard deviation, and distribution of \( \bar{x}_1 - \bar{x}_2 \) (Show every step for the mean and standard deviation and assume \( x_i \)'s are independent)?

11) Define the two-sample \( t \)-statistic. Does it have a \( t \)-distribution? How many degrees of freedom does it have?

12) Define a symmetric random walk. After 4 flips of a coin, draw two possible sample paths.

13) What is the simple linear regression model? What are the parameters?

14) Assume that \( u_{b_1} = \beta_1 \). If \( b_0 = \hat{y} - b_1 \bar{x} \), show that

\[ \mu_{b_0} = \beta_0. \]

Hint: Use \#13

Remark: This shows that \( b_0 \) is an unbiased estimator of \( \beta_0 \).

15) If

\[ \hat{y} = b_0 + b_1 x \]

define least squares regression line then,
\[ b_0 = \]
and
\[ b_1 = \]
where \( b_0 \) and \( b_1 \) estimate \( \beta_0 \) and \( \beta_1 \) in the least squares regression model.
16) How do we estimate \( \sigma \) in the least squares regression model? What is \( \sigma \)?

17) Define the chi square statistic. What does the distribution look like? How is it used?

18) What is the standard error of the sample mean?

19) Assume that \( \hat{p}_1 = \frac{X_1}{n_1} \) and \( \hat{p}_2 = \frac{X_2}{n_2} \), where \( X_1 \sim B(n_1, p_1) \) and \( X_2 \sim B(n_2, p_2) \). What is the mean and standard deviation of \( D = \hat{p}_1 - \hat{p}_2 \)?

20) T or F?
   \( t \) procedures are not robust against outliers.

21) Given that \( P[T \geq 3.707] = 0.05 \) with \( df = 6 \), find \( P[T \leq -3.707] \) with \( df = 6 \) where \( T \) has a \( t \)-distribution.

22) If \( df = 6 \) in a \( t \)-distribution, then \( n = \)