

Study Questions: Single Population Statistics

GENERAL QUESTIONS

- When is a random variable a statistic?
- When is a random variable a point estimator?
- When is a random variable a test statistic?
- What is the difference between upper- and lower-case, X and x ?
- If $\text{qnorm}(x) = 0.4$ then what is x ?
- If $\text{pnorm}(x) = 0.4$ then what is x ?

CHAPTER 6. POINT ESTIMATION

- What is the difference between a point estimator and a point estimate?
- Name three unbiased estimators for $\mu = E[X]$.
- Give an unbiased estimator for $\sigma^2 = \text{Var}[X]$.
- Give an unbiased estimator for the proportion p if $X \sim \text{Binomial}(n, p)$.
- What is the formula for the sample mean?
- What is the formula for the sample variance?
- What is the standard error of the sample mean \bar{X} ?
- What is the standard error of the sample population proportion $\hat{p} = x/n$?
- What is the difference between the “sample mean” and the “population mean”?
- If $X \sim \text{Uniform}(A, B)$ is sampled n times, what can $\min(X_1, \dots, X_n)$ be used to estimate? Is it unbiased?
- What does it mean for an estimator to be “unbiased”?
- What two properties should a good estimator have?
- What is the “standard error” of a point estimator?
- How does increasing the number of samples change the standard error of \bar{X} ?

CHAPTER 7. CONFIDENCE INTERVALS

- What is a confidence interval?
- What does it mean for something to be a “95%” confidence interval?
- What is α for a 95% confidence interval?
- What is the difference between a 1-sided and 2-sided confidence interval?
- What effect does variance have on the width of confidence intervals?
- What effect does number of samples have on the width of confidence intervals?
- What effect does α have on width of the $(1 - \alpha)$ confidence interval?
- When do you use a normal distribution for confidence intervals?
- When do you use a t -distribution for confidence intervals?
- When do you use a χ^2 -distribution for confidence intervals?
- What statistic has distribution $\chi^2(n - 1)$?
- What is a prediction interval?
- What is the standard error of $(\bar{X} - X)$ used in prediction intervals?

CHAPTER 8. HYPOTHESIS TESTS

- What are the two possible results of a hypothesis test?
- In Hypothesis Testing, what probability is α giving?
- In Hypothesis Testing, what probability is β giving?
- What does the “significance level” of a hypothesis test mean?
- What does the “power” of a hypothesis test mean?
- What does “ p -value” mean?
- In Hypothesis Testing, is it better to have big or small p -values?
- In Hypothesis Testing, is it better to have big or small scores?
- Is rejecting the null hypothesis good or bad?
- In t -tests, how does degrees of freedom and standard error affect p -value?
How does number of samples affect each of these?
- What is the difference between a 1-tailed and 2-tailed hypothesis test?
- When do you use a χ^2 -test? .. a t -test? .. a z -test?
- What is a “Type I Error” in hypothesis testing?
- What is a “Type II Error” in hypothesis testing?
- List three unethical (bad) ways to try to lower p -value.
- List one ethical (good) way to try to lower p -value.
- When do you “Reject the Null Hypothesis”?