Review of Part V

Math 2200
Models

• Independent Bernoulli trials
• Geometric: Number of trials needed for a success
• Binomial: Number of successes in a fixed number of trials
  – Normal approximation (np>10, nq>10)
  – Poisson approximation (np<5)
• Normal (approximately): sample proportion
  – Based on the CLT
  – Several conditions to check
• Normal (approximately): difference of two sample proportions
  – Based on the CLT
  – Several conditions to check
Confidence interval

- Confidence level: 90%, 95%, 99%
- Critical value: $Z^*$
- Standard error
  - An estimate of standard deviation
- Margin of error $= Z \times S.E.$
- C.I. $= \text{Estimate} \pm \text{M.E.}$
- Higher confidence $\rightarrow$ larger critical value
  $\rightarrow$ larger margin of error $\rightarrow$ wider C.I.
Confidence Interval

To find the confidence interval on TI-83/TI84, use STAT > TESTS > 1-PropZInt, and enter
x: number of success
n: number of Bernoulli trials
C-Level: confidence level
Hypothesis testing

- **Null hypothesis**
  - It gives a known model for the data

- **Alternative hypothesis**
  - One-sided or two-sided

- **Significance level**
  - Controls the probability of Type I error
  - Probability of wrongly rejecting the true null hypothesis

- **Power**
  - $1 -$ probability of Type II error
  - Probability of correctly rejecting the false null hypothesis
Hypothesis testing

• P-value
  – Reject $H_0$ if p-value < significance level
    • Equivalent to $z$-score > critical value
    • The critical value vs. the significance level
  – The probability that the null model could produce data as rare as the data observed in the sample or the experiment, merely as a consequence of sampling error
    – It is NOT the probability the null hypothesis is true

• Can NOT say “accept the null hypothesis”
  – Say “fail to reject”
Hypothesis testing

- Tradeoff between $\alpha$ and $\beta$
- To reduce both, increase the sample size

To compute the p-value on TI-83/TI-84, use STAT > TESTS > 2-PropZTest, and enter the appropriate information.
Sample size?

• Based on margin of error
  – For a conservative result, use $p=q=0.5$

• Based on a desired power
  – Depends on the value of the parameter under the alternative hypothesis
    • Choose an effect size
    • Focus on the values you feel more likely
Relationship between C.I. and tests

• If the value under $H_0$ is covered by the C.I., we do not reject $H_0$
  – How do you relate the level of confidence for the C.I. with the significance level of the test?
  – In this course, the C.I. matches a test with a two-sided alternative hypothesis
  – Difference in the calculation
    • C.I.: the parameter is unknown
      – Use standard error
    • Test: the parameter is given by $H_0$
      – Use standard deviation
Two Proportions

Two proportions: $\hat{p}_1$ and $\hat{p}_2$

Confidence interval for $\hat{p}_1 - \hat{p}_2$

- To compute by hand, find the estimate, the standard error and $Z^*$.
- On TI-83, use STAT > TESTS > 2-propZInt

$H_0: \hat{p}_1 = \hat{p}_2$

- On TI-83, use STAT > TESTS > 2-PropZTest