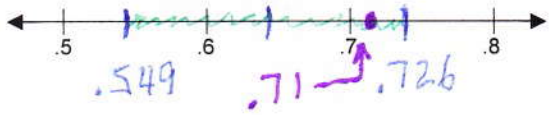
7.2 – Estimating a Population Proportion (Part 2)

Concept	Details	Examples
Round-off rule for confidence intervals	Round the confidence interval limits for p to three significant digits.	Which of these confidence intervals follow this rule? • (.023, .054) No, only 2 • (.00652, .00795) Yes, have 3 • (.01082, .03431) No, have 4
Requirements for estimating a population proportion **(BTDT)** (Sec. 7.2, part 1)	To estimate a population proportion, p, these requirements must be met: 1. A simple random sample is taken. 2. There are at least 5 successes and at least 5 failures. 3. The conditions for the binomial distribution are satisfied.	
Procedure for constructing a confidence interval for p, the population proportion	1. Verify that the three requirements above for estimating a population proportion are satisfied. 2. Continue in one of these two ways: • By hand **(BTDT)** (Sec. 7.2, part 1): a. Find the critical value $z_{\alpha/2}$ that corresponds to the desired confidence level (see the table of critical values on the last handout). b. Calculate $\hat{p}$ ($= x/n$) and $\hat{q}$ ($= 1 - \hat{p}$). c. Determine n (the number of trials). d. Calculate the margin of error E using the formula $E = z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}}$ e. Using the values you calculated for $\hat{p}$ and E, express the confidence interval in one of these three ways: ➢ $\hat{p} - E < p < \hat{p} + E$ ➢ $\hat{p} \pm E$ ➢ $(\hat{p} - E, \hat{p} + E)$ • Use your calculator. Decide what these are: • x (number of successes) • n (total number of trials) • the desired confidence level. See the separate calculator sheet to see how to use your calculator's `1PropZInt` function to find a confidence interval estimate for the population proportion, p. Note that when we use our calculators we do **not** need to use that table to find the appropriate value of $z_{\alpha/2}$ (Yay!!). However, we sometimes do need that table (see next page).	A random sample of 80 SRJC students found 51 were taking more than 8 units. Find the 95% confidence interval estimate of the population proportion p. (For this example: $x = 51$ $n = 80$ Confidence level = 95% To calculate E by hand, we'd use $\hat{p} = 51/80 = .6375$ $\hat{q} = 1 - .6375 = .3625$ $z_{\alpha/2} = 1.96$ $n = 80$ to get $E = 0.105$) (.532, .743) **or** $.532 < p < .743$ **or** $.638 \pm .105$ For the previous example, would a 90% confidence interval be wider or narrower than the 95% confidence interval? Narrower (See Part A, #12-14 on Assignment 17 supplemental sheet.) Use your calculator to find the 90% confidence interval estimate of the population proportion p for the previous example. (For this example: $x = 51$ $n = 80$ Confidence level = 90%) (.549, .726) ***It is narrower*** Draw this 90% confidence interval on a number line. Show the endpoints and where $\hat{p}$ should be. $\hat{p} = .638$  Later, a complete study of all SRJC students found the true population proportion of students taking more than 8 units was .71. Do the above results for a 90% confidence interval support this finding? Yes Why or why not? Because .71 is in the interval (.549, .726)

(continued)

7.2 – Estimating a Population Proportion (Part 2) (continued)

Concept	Details	Examples
Sample size for estimating a population proportion, p	We can start out (as we did in that previous example) with data from a certain sample size to determine the margin of error (we started out with a sample size of 80 and a 95% confidence level to get a margin of error of 0.105). It is also possible to start out with a margin of error that we want, and use that to determine the sample size required to get that margin of error. You can take the above formula for E and solve it for n. Use one of these formulas to get the sample size n needed to estimate the population proportion p to within a certain margin of error E: When an estimate $\hat{p}$ **is** known: (Formula 7-2, page 348) $n = \frac{[z_{\alpha/2}]^2 \hat{p}\hat{q}}{E^2}$ When an estimate $\hat{p}$ **is not** known: (Formula 7-3, page 348) $n = \frac{[z_{\alpha/2}]^2 .25}{E^2}$ where: • $z_{\alpha/2}$ is the critical z score based on the desired confidence level (see the table of critical values on page 343 and on the last handout) • $\hat{p}$ is a sample proportion • $\hat{q}$ is $1 - \hat{p}$ • E is the desired margin of error. Because our calculators don't have a built-in function to calculate sample size, we **will** need to use that table to find the appropriate value of $z_{\alpha/2}$.	Consider our survey of how many SRJC students are taking more than eight units. We want a margin of error of .073 with a 95% confidence level. (a) Recall that in our earlier example, a sample size of **80** (with a 95% confidence level) resulted in a margin of error of **0.105**. If we still want a 95% confidence level, but with the smaller margin of error of **0.073**, will the sample size have to be more or less than 80? More (b) To find a sample size for this example, what value should we use for $z_{\alpha/2}$? 1.96 (c) Find the sample size we need to get a margin of error of .073 if $\hat{p}$ is unknown. $n = \frac{(1.96)^2 (.25)}{(.073)^2} \approx 180.22$ → 181 round up (d) Later a sample is taken and for this sample $\hat{p} = .64$. Find the sample size we need to get a margin of error of .073 if $\hat{p}$ is estimated to be 64%. $n = \frac{(1.96)^2 (.64)(.36)}{(.073)^2} = 166.09$ → 167 (e) To understand why we use .25 when $\hat{p}$ and $\hat{q}$ are unknown, watch Glenn use his calculator to calculate $\hat{p} \cdot \hat{q}$ for lots of values. Because we want to be sure sample size n is large enough, we would want to choose the $\hat{p}$ and $\hat{q}$ values that give us the largest $\hat{p} \cdot \hat{q}$ value; this would result in giving us the largest n.
Round-off rule for determining sample size	To make sure the sample size is at least as large as it should be, if the computed sample size is not a whole number, **round it up** to the next higher whole number.	
Better-performing confidence intervals	Be advised that there are other formulas to manually find confidence intervals that give better results (see page 350). Would you want to use the formula on page 350? No	
Assignment #18	The Supplemental Sheet for Assignment #18 has been **canceled**.	