AP Statistics. Guided Notes Chapter 10
10.1 Comparing Two Proportions

Is it harder to shoot free-throws with distractions? To investigate, a basketball player went to the gym and shot 20 free-throws. Ten of the free-throws were shot without any distractions and the other 10 were shot with his friends trying everything they could to distract him. The order of the 20 shots was determined at random.

Why was it important that the order of the shots was determined at random, rather than doing all of one type of shot before the other type of shot?

The player made 5/10 (50%) of his shots in the distraction-free environment and only 3/10 (30%) of his shots in the environment with distractions, for a difference of 50% – 30% = 20%. Identify two plausible explanations for why the shooter performed better in the distraction-free environment.

Design and conduct a simulation to determine if there is convincing evidence that the shooter is better in a distraction-free environment.

Note: Simulation is a good alternative when Normal condition isn't met.

Read 604–606

What is meant by "the sampling distribution of the difference between two proportions"?

What are the shape, center, and spread of the sampling distribution of $\hat{p}_1 - \hat{p}_2$? Are there any conditions that need to be met?

See box on page 606

Note that the Normal condition isn't met for the basketball experiment.

10.1 Significance Tests for a Difference in Proportions

Read 611–615

What is the pooled (combined) sample proportion? Why do we pool the sample proportions?

What is the test statistic for a two-sample z test for a difference in proportions? Is this on the formula sheet? What does the test statistic measure?

What are the conditions for conducting a two-sample z test for a difference in proportions? How are these different than the conditions for a one-sample z interval for p?

Alternate Example: *Hearing loss*
Are teenagers going deaf? In a study of 3000 randomly selected teenagers in 1988–1994, 15% showed some hearing loss. In a similar study of 1800 teenagers in 2005–2006, 19.5% showed some hearing loss. (These data are reported in *Arizona Daily Star*, August 18, 2010)

(a) Do these data give convincing evidence that the proportion of all teens with hearing loss has increased?

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(b) Between the two studies, Apple introduced the iPod. If the results of the test are statistically significant, can we blame iPods for the increased hearing loss in teenagers?

HW: page 623 (15, 17a, 19)

Confidence Intervals for the Difference of Two Proportions

Read 608–611

What is the standard error of $\hat{p}_1 - \hat{p}_2$? How is this different than the standard deviation of $\hat{p}_1 - \hat{p}_2$? Why is this different than the standard error we used for significance tests?

What is the formula for a two-sample *z* interval for $p_1 - p_2$? Is this on the formula sheet?

What are the conditions for calculating a two-sample *z* interval for $p_1 - p_2$?

Is it OK to use your calculator for the Do step? Are there any drawbacks?

Alternate Example: *Gun Control*
Have opinions changed about gun control? Gallup regularly asks random samples of U.S. adults their opinion on a variety of issues. In a poll of 1011 U.S. adults in January 2013, 38% responded that they "were dissatisfied with the nation's gun laws and policies, and want them to be stricter." In a similar poll of 1011 adults in January 2012, only 25% agreed with this statement.

(a) Explain why we should use a confidence interval to estimate the change in opinion rather than just saying that the percentage increased by 13 percentage points.

(b) Use the results of these polls to construct and interpret a 90% confidence interval for the change in the proportion of U.S. adults who would agree with the statement about gun laws.

(c) Based on the interval, is there convincing evidence that opinions about gun control have changed?

HW: page 621 (7–13 odd)

10.1/10.2 Inference for Experiments

Read 615–619

What mistake do students often make when defining parameters in experiments? How can you avoid it?

Can you use your calculator for the Do step? Are there any drawbacks?

Alternate Example: *Cash for quitters*
In an effort to reduce health care costs, General Motors sponsored a study to help employees stop smoking. In the study, half of the subjects were randomly assigned to receive up to $750 for quitting smoking for a year while the other half were simply encouraged to use traditional methods to stop smoking. None of the 878 volunteers knew that there was a financial incentive when they signed up. At the end of one year, 15% of those in the financial rewards group had quit smoking while only 5% in the traditional group had quit smoking. Do the results of this study give convincing evidence that a financial incentive helps people quit smoking? (These data are reported in *Arizona Daily Star,* February 11, 2009)

Be able to do Two explanations!

Read 627–628

Do the Polyester activity using note cards and then Fathom

HW: page 624 (23, 25, 29–32), page 657 (57)

Significance Tests for the Difference of Two Means

Read 628–631

What are the shape, center, and spread of the sampling distribution of $\bar{x}_1 - \bar{x}_2$? Are there any conditions that need to be met?

See box on page 631

Read 633–634

What is the standard error of $\bar{x}_1 - \bar{x}_2$? Is this on the formula sheet? How do you interpret this value?

What is the formula for the two-sample *t* statistic? Is this on the formula sheet? What does it measure?

What distribution does the two-sample *t* statistic have? Why do we use a *t* statistic rather than a *z* statistic? How do you calculate the degrees of freedom?

Read 638–643 *Skip stuff about confidence intervals…*

What are the conditions for conducting a two-sample *t* test for $\mu_1 - \mu_2$?

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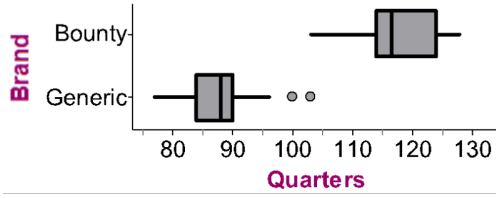
Alternate Example: *The stronger picker-upper?*
In commercials for Bounty paper towels, the manufacturer claims that they are the "quicker picker-upper." But are they also the stronger picker upper? Two AP Statistics students, Wesley and Maverick, decided to find out. They selected a random sample of 30 Bounty paper towels and a random sample of 30 generic paper towels and measured their strength when wet. To do this, they uniformly soaked each paper towel with 4 ounces of water, held two opposite edges of the paper towel, and counted how many quarters each paper towel could hold until ripping, alternating brands.

(a) The boxplots to the right display the results of their experiment. Based only on the boxplots, discuss whether or not you think the mean for Bounty is significantly higher than the mean for generic.



(b) For these data, $\bar{x}_B = 117.6$, $s_B = 6.64$, $\bar{x}_G = 88.1$, and $s_G = 6.30$. Is there convincing evidence that wet Bounty paper towels can hold more weight, on average, than wet generic paper towels?

(c) Interpret the *P*-value from (b) in the context of this question.

HW page 652 (35a, 37a, 39, 41, 53)

Confidence Intervals for the Difference of Two Means

Read 634–637

What is the formula for the two-sample t interval for $\mu_1 - \mu_2$? What are the conditions for this interval to be valid? Is this formula on the formula sheet?

Is it OK to use your calculator for the Do step? Are there any drawbacks?

Alternate Example: *Plastic grocery bags*
Do plastic bags from Target or plastic bags from Bashas hold more weight? A group of AP Statistics students decided to investigate by filling a random sample of 5 bags from each store with common grocery items until the bags ripped. Then they weighed the contents of items in each bag to determine its capacity. Here are their results, in grams:

Target:	12,572	13,999	11,215	15,447	10,896
Bashas:	9552	10,896	6983	8767	9972

(a) Construct and interpret a 99% confidence interval for the difference in mean capacity of plastic grocery bags from Target and Bashas.

(b) Does your interval provide convincing evidence that there is a difference in the mean capacity between the two stores?

HW: page 653 (43, 45, 51)