

## Chapter 11: Inferences on Two Samples

### Section 11.5: Putting it together: Which method do I use?

GOAL: Help determine which method to use when reading word problems.

To determine which kind of statistical inference you need to do, be on the look-out for specific phrasing:

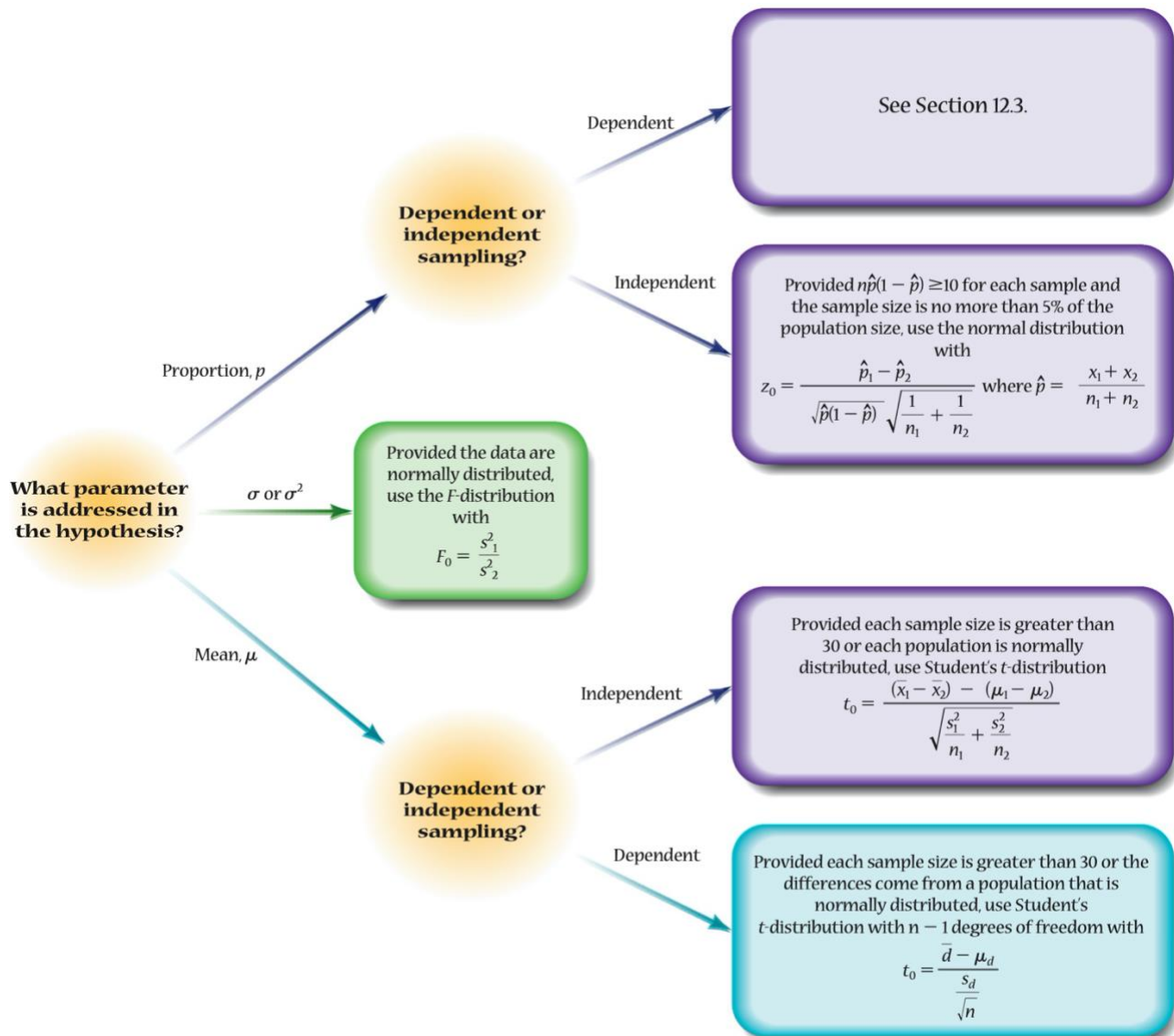
Two types of inference:

#### 1. Confidence Intervals (CI):

- “find the CL% **confidence interval** for (parameter)”
- “**estimate** the value of (fill-in parameter)... with a confidence level of...”

#### 2. Hypothesis tests (HT):

- “**test the claim** about (fill-in parameter)...”
- “do we think the (parameter) **has gotten smaller/has changed/has gotten bigger?**”
- “determine if a **majority** of .... believe ....” This is specific to proportions.
- Is the phrasing of the problem making a **claim**?



**Important Note on Notation:** I use  $z^*$  or  $t^*$  to denote the test statistics for proportions and means, respectively.

## Practice Problems

Instructions: For each of the following problems:

- (i) state the parameter;
- (ii) determine the type of inference (CI or HT);
  - if CI, state the point estimate
  - if HT, state both hypotheses
- (iii) which calculator functions do you need to use?
- (iv) Use your calculator to answer the problem; either state the conclusion of a hypothesis test or give the confidence interval (no work necessary)

**PROBLEM 1:** It is a commonly held belief that Crossovers are safer than small cars. If a Crossover and small car are in a collision, does the Crossover sustain less damage (as suggested by the cost of repair)? Consumer Reports crashed Crossovers into small cars, with the Crossover moving 15 miles per hour and the front of the Crossover crashing into the rear of the small car. The data is normally distributed. Below are the repair costs:

Crossover into Car	Small Car Damage	Crossover Damage	
Lexus RX-350 into Honda Insight	1274	1721	
Nissan Pathfinder into Hyundai Elantra	2327	1434	
Toyota RAV4 into Kia Forte	3223	850	
Jeep Cherokee into Kia Niro Hybrid	2058	2329	
Ford Explorer into Toyota Camry	3095	1415	
Honda CR-V into Ford Focus	3386	1470	
Chevrolet Equinox into Nissan Sentra	4560	2884	

Do the sample data suggest that Crossovers are safer? Use the level of significance  $\alpha = 0.01$ . Use PVM.

**Answer:**

- (i) Two Dependent Means. Matched-Pairs. Difference of Average cost of repair of each group.
- (ii) Hypothesis Test. Right-Tailed Test.
- (iii) TTest
- (iv) For full solutions see Example 2, Section 11.2

**PROBLEM 2:** The Gallup Organization wanted to investigate the time that American men and women spend hanging out with their friends. A random sample of 700 men surveyed spent a mean time of 10 hrs per week with their friends with a standard deviation of 1.9 hours. On the other hand, 740 women surveyed spent a mean time of 7.5 hours with a standard deviation of 1.6 hours. Construct a 95% confidence interval estimate for the difference between the corresponding population means.

**Answer:**

- (i) Two Independent Means. Difference of time spent hanging out with friends from each group.
- (ii) Confidence Interval.
- (iii) 2SampTInt
- (iv) For full solutions see Example 3, Section 11.3

**PROBLEM 3:** An insurance company is concerned that men are more likely to speed than women. In a sample of 500 randomly selected women, 27 have been ticketed for speeding in the last year. In a sample of 250 randomly selected men, 26 have been ticketed for speeding in the last year. Use a 0.05 significance level to test the insurance company's claim that the percentage of women ticketed for speeding is less than the percentage of men. Use the P-Value Method.

**Answer:**

- (i) Two Independent Proportions. Proportion of group that got speeding tickets.
- (ii) Hypothesis Test. Left-Tailed Test.
- (iii) 2PropZTest
- (iv) For full solutions see Example 2, Section 11.1

**PROBLEM 4:** A study was conducted to test the effectiveness of a sweetener called xylitol in preventing ear infections in preschool children. In a randomized experiment, 159 preschool children took five daily doses of xylitol, and 46 of these children got an ear infection during the three months of the study. Meanwhile, 165 children took five daily doses of placebo syrup, and 68 of these children got an ear infection during the study. Construct a 90% confidence interval for the difference in the proportion of children that got ear infections for the control group and the xylitol group.

**Answer:**

- (i) Two Independent Proportions. Proportion of group who got ear infections.
- (ii) Confidence interval for Difference of proportions.
- (iii) 2PropZInt
- (iv) For full solutions see Example 4, Section 11.1

**PROBLEM 5:** A professor at a large community college wanted to determine whether there is a difference in the means of final exam scores between students who were allowed to text in class and those who weren't. She believed that the mean of the final exam scores for the texting class would be lower than that of the non-texting class but her students didn't think so. Were the students correct? The professor randomly selected 30 final exam scores from each group, and they are listed below.

67.6	41.2	85.3	55.9	82.4	91.2	73.5	94.1	64.7	64.7
70.6	38.2	61.8	88.2	70.6	58.8	91.2	73.5	82.4	35.5
94.1	88.2	64.7	55.9	88.2	97.1	85.3	61.8	79.4	79.4

Texting class

77.9	95.3	81.2	74.1	98.8	88.2	85.9	92.9	87.1	88.2
69.4	57.6	69.4	67.1	97.6	85.9	88.2	91.8	78.8	71.8
98.8	61.2	92.9	90.6	97.6	100	95.3	83.5	92.9	89.4

Non-texting class

**Answer:**

- (i) Two Independent Means. Difference of Average final exam scores from each group.
- (ii) Hypothesis Test. Left-Tailed Test.
- (iii) 2SampTTest
- (iv) For full solutions see Example 2, Section 11.3

**PROBLEM 6:** In clinical trials of the anti-inflammatory drug Inflaminex, adult and adolescent allergy patients were randomly divided into two groups. Some patients received 500mcg of Inflaminex, while some patients received a placebo. Of the 2103 patients who received Inflaminex, 520 reported bloody noses as a side effect. Of the 1671 patients who received the placebo, 368 reported bloody noses as a side effect. Is there significant evidence to conclude that the proportion of Inflaminex users who experienced bloody noses as a side effect is greater than the proportion of the placebo group at the  $\alpha = 0.01$  level of significance? Use the Critical Value Method.

**Answer:**

- (i) Two Independent Proportions. Proportion of group who got bloody noses.
- (ii) Hypothesis Test. Right-Tailed Test.
- (iii) 2PropZTest
- (iv) For full solutions see Example 3, Section 11.1

**PROBLEM 7:** A company claims that its 12-week special exercise program significantly reduces weight. A random sample of eight persons was selected, and the following table gives the weights (in lbs) of those eight persons before and after the program.

		Weight (in pounds)							
Before		180	195	177	221	208	199	148	230
After		185	187	171	214	208	194	150	227

Construct a 90% confidence interval for the mean before-after differences.

**Answer:**

- (i) Two Dependent Means. Matched-Pairs. Difference of Average weight loss of each group.
- (ii) Confidence Interval.
- (iii) TInterval
- (iv) For full solutions see Example 3, Section 11.2

**PROBLEM 8:** A study of zinc-deficient mothers was conducted to determine whether zinc supplements during pregnancy results in babies with increased weights at birth. 294 expectant mothers were given a zinc supplement, and the mean birth weight was 3214 grams with a standard deviation of 669 g. There were 286 expectant mothers who were given a placebo, and the mean weight was 3088 g with a standard deviation of 728 grams. Using a 0.01 significance level, is there sufficient evidence to support the claim that a zinc supplement does result in increased birth weights?

**Answer:**

- (i) Two Independent Means. Difference of Average weight of babies from each group.
- (ii) Hypothesis Test. Right-Tailed Test.
- (iii) 2SampTTest
- (iv) For full solutions see Example 1, Section 11.3