

# S:9.2-Various Hypothesis Tests

Objective: Given a word problem, you will be able to choose an appropriate hypothesis test and interpret the results.

## Review

1. Identify null hypothesis, alternate hypothesis and preset level of significance. ( $H_0$ ,  $H_1$ , and  $\alpha$ )
2. Test statistic - z, t,  $\hat{p}$
3. P-value - probability
4. Test-conclusion - compare to p-value (less then-reject)
5. Interpretation of test results - explain in words

## Testing $\mu$ when $\sigma$ is known: z-test

-Must be a normal distribution or  $n \geq 30$ .

## Example 1: Use graphing calculator to conduct a z test

Let  $x$  be a random variable representing the average number of sunspots observed in a four-week period. It is assumed that  $\mu = 41$ . A random sample of 40 such periods gave the following data:

12.5	14.1	37.6	48.3	67.3	70.0	43.8	56.5	59.7	24.0
12.0	27.4	53.5	73.9	104.0	54.6	4.4	177.3	70.1	54.0
28.0	13.0	6.5	134.7	114.0	72.7	81.2	24.1	20.4	13.3
9.4	25.7	47.8	50.0	45.3	61.0	39.0	12.0	7.2	11.3

Previous studies of sunspot activity during this period indicate  $\sigma = 35$ . Do the data indicate that the mean sunspot activity during the Spanish colonial period was higher than 41? Use  $\alpha = 0.05$ .

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1. Check Requirements
  2. Identify  $H_0$ ,  $H_1$ , and  $\alpha$
  3. Enter data in List 1
  4. STAT > TESTS> Z-test...follow prompts
  5. Conclude test (compare p-value to  $\alpha$ )
  6. Interpret

### **Testing $\mu$ when $\sigma$ is not known: t-test**

-Must be a normal distribution. (small samples)

### **Example 2: Use graphing calculator to conduct a t test**

The drug 6-mP is used to treat leukemia. The following data represent the remission times (in weeks) for a random sample of 21 patients using 6-mP:

10	7	32	23	22	6	16	34	32	25	11
20	19	6	17	35	6	13	9	6	10	

Let  $x$  be a random variable representing the remission time (in weeks) for all patients using 6-mP. Assume the  $x$  distribution is mound-shaped and symmetrical. A previously used drug treatment had a mean remission time of  $\mu = 12.5$  weeks. Do the data indicate that the mean remission time of 6-mP is different? Use  $\alpha = 0.01$ .

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1. Check Requirements
2. Identify  $H_0$ ,  $H_1$ , and  $\alpha$
3. Enter data in List 1
4. STAT > TESTS> t-test...follow prompts
5. Conclude test (compare p-value to  $\alpha$ )
6. Interpret

### **Testing a proportion: 1-PropZTest**

-Must have  $np \geq 5$  and  $nq \geq 5$  or be normal

### **Example 3: Use graphing calculator to conduct a proportion z test**

A research center claims that 50% of U.S. adults have accessed the Internet over a wireless network with a laptop computer. In a random sample of 100 adults, 39 say they have accessed the Internet over a wireless network with a laptop computer, which is less than 50%. At  $\alpha = 0.01$ , is there enough evidence to support the researcher's claim?

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1. Check Requirements
2. Identify  $H_0$ ,  $H_1$ , and  $\alpha$
3. STAT > TESTS> 1-PropZTest...follow prompts
4. Conclude test (compare p-value to  $\alpha$ )
5. Interpret

# Pepsi vs. Coca-Cola

Name\_\_\_\_\_

In the 1970s and 1980s, Pepsi began airing television commercials in which it claimed more cola drinkers preferred Pepsi over Coca-Cola in a blind taste test. The Coca-Cola company was the market leader in soda sales. After the television ads began airing, Pepsi sales increased and began rivaling Coca-Cola sales. Assume the claim that more than 50% of cola drinkers prefer Pepsi over Coca-Cola. You work for an independent market research firm and are asked to test this claim.

1. How would you do it?

a) When Pepsi performed this challenge they went to shopping malls to obtain their sample. Do you think this type of sampling is representative of the population? Explain.

b) What sampling technique would you use to select the sample for your study?

c) Identify at least two possible flaws or biases in your study.

2. In your study, 280 out of 560 cola drinkers prefer Pepsi over Coca-Cola. Using these results, test the claim that more than 50% of cola drinkers prefer Pepsi over Coca-Cola. Use  $\alpha = 0.05$ . Interpret your decision in the context of the original claim. Does the decision support Pepsi's claim of more than 50% liking Pepsi over Coca-cola?

3. Keeping the same null hypothesis from problem 1, we are going to do a statistical test based on this class and which is preferred more: Pepsi or Coca-cola.

a) Class Results (before)

b) Class Results (after)

c) Based on our class results, would we reject or accept the null hypothesis?

4. Your conclusions:

a) Why do you think that Pepsi used a blind test?

b) Do you think that brand image or taste has more influence on consumer preferences for cola?

c) What other factors may influence consumer preferences besides taste and branding?