



# Chapter 8

Lecture 3  
Sections: 8.4 – 8.5



## Testing Claims About a Population Mean when $\sigma$ is Known

### Assumptions

1. The sample is a simple random sample.
2. The value of the population standard deviation  $\sigma$  *is known*.
3. Either or both of these conditions is satisfied: The population is normally distributed or  $n > 30$ .

### Test Statistic for Testing a Claim About a Mean when $\sigma$ is known:

$$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} = \frac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}}$$

## Testing Claims About a Population Mean when $\sigma$ is unknown

### Assumptions

1. The sample is a simple random sample.
2. The value of the population standard deviation  $\sigma$  is not known.
3. Either or both of these conditions is satisfied: The population is normally distributed or  $n > 30$ .

### Test Statistic for Testing a Claim About a Mean when $\sigma$ is unknown:

$$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \frac{\bar{x} - \mu_{\bar{x}}}{s_{\bar{x}}}$$

1. In order to test  $H_0: \mu = 100$  versus  $H_1: \mu \neq 100$ , a simple random sample of size  $n = 40$  is obtained.
  - a. Does the population need to be normally distributed in order to test this hypothesis by using the methods presented in this section?
  - b. If the sample mean is 98 and  $s = 5.1$ , compute the test statistic.

2. In 1990, the mean pH level of the rain in Los Angeles was 5.03. A chemist claims that the acidity of rain has increased. "This means that the pH level of the rain has decreased". In 2005, 20 rain dates were randomly selected and it was found that the average pH level was 4.77. Assume that the population is normal and the population standard deviation is 0.2. At a 0.01 level of significance, test the claim.

3. With the recent rise in gas prices, the news claims that the average gas price in Los Angeles County is \$3.30 for 91 octane. In a simple random sample of 120 gas stations in the county, it was found that the average price is \$3.25 with a standard deviation of \$0.05. Test the claim that the average gas price in Los Angeles County is greater than the news reported average.

4. A random sample of 100 healthy new born babies is obtained and the average weight is 6.87lbs. Assuming that  $\sigma = 1.5$ lbs, use a 0.03 significance level to test a [www.wiki.answers.com](http://www.wiki.answers.com) claim that the mean average weight of all healthy new born babies is equal to 7.10lbs.

**Minitab Output:**

Test of mu = 7.1 vs not = 7.1

The assumed standard deviation = 1.5

N	Mean	SE Mean	97% CI	Z	P
100	6.87000	0.15000	(6.54449, 7.19551)	-1.53	0.125

5. The Carolina Tobacco Company advertised that its best selling nonfiltered cigarettes contain at most 40mg of nicotine, but Consumer Advocate Magazine ran a test of 10 randomly selected cigarettes and found the amounts shown below in mg. It's a serious matter to charge that the company advertising is wrong, so the magazine editor chooses a significance level of 0.02 in testing the belief that the mean nicotine content is greater than 40mg. Assume the data comes from a normally distributed population and test the magazine's claim.

47.3 39.3 40.3 38.3 46.3 43.3 42.3 49.3 40.3 46.3

**Minitab Output:**

**One-Sample T: Nicotine in mg**

Test of  $\mu = 40$  vs  $> 40$

Variable	N	Mean	StDev	SE Mean	Bound	T	P
Nicotine in mg	10	43.3000	3.8006	1.2019	39.9091	2.75	0.011

6. A former student who has earned a BA in economics randomly selected 36 new text books in the college book store. He found that they had prices with a mean of \$70.41 and a standard deviation of \$19.70. Is there sufficient evidence to warrant rejection of a claim in the college catalog that the mean price of a textbook is less than \$75?

7. Claim: The mean IQ scores of PhD professors is greater than 124. Assume that the population is normally distributed and a random sample of 24 professors showed that their average IQ score was 128 with a standard deviation of 8. Test the claim at a 0.025 significance level.