

CHAPTER 23 NOTES INFERENCE ABOUT SAMPLE MEANS

We know that the sampling distribution of \bar{y} is

$$N\left(\mu, \frac{\sigma}{\sqrt{n}}\right)$$

assuming that the 4 conditions/assumptions hold.

So to use this result for inference about the population mean, μ , we need...

We now have extra variation in our standard error from the estimation of s , so the shape of the sampling distribution is no longer Normal.

William Gosset, an employee of the Guinness Brewery, figured out what the sampling distribution was, and published under the pseudonym *Student*.

CONDITIONS/ASSUMPTIONS

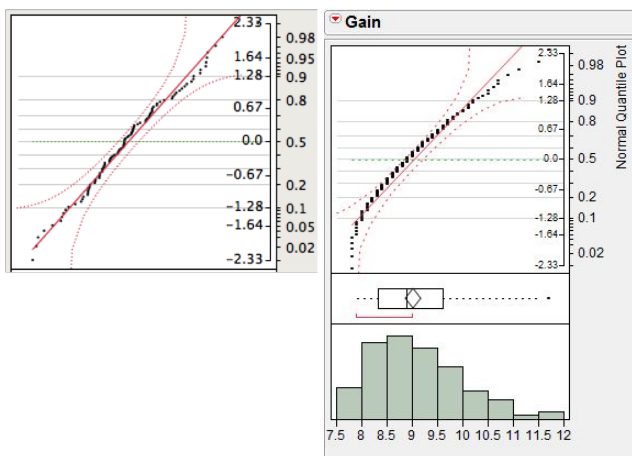
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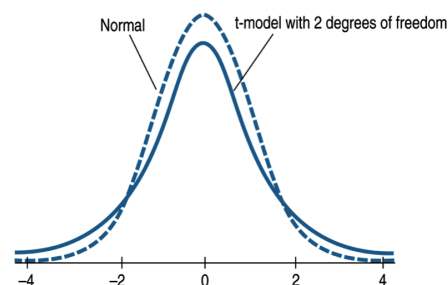
We can check the Nearly Normal Condition by:

PROPERTIES OF THE t -DISTRIBUTION

Checking for Violations of Nearly Normal Assumption



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USING THE t -TABLE

- Rows correspond to different degrees of freedom
- Confidence level found at the bottom of the column
- Critical values, t^* , are found by matching a confidence level with the degrees of freedom, (df).

A-100 Appendix E • Tables

Two tail probability One tail probability		0.20 0.10	0.10 0.05	0.05 0.025
Table T				
Values of t_α	df			
	1	3.078	6.314	12.706
	2	1.886	2.920	4.303
	3	1.638	2.353	3.182
	4	1.533	2.132	2.776
	5	1.476	2.015	2.571
	6	1.440	1.943	2.447
	7	1.415	1.895	2.365
	8	1.397	1.860	2.306
	9	1.383	1.833	2.262
	10	1.372	1.812	2.228
	11	1.363	1.796	2.201
	12	1.356	1.782	2.179
	13	1.350	1.771	2.160
	14	1.345	1.761	2.145
	15	1.341	1.753	2.131
	16	1.337	1.746	2.120
	17	1.333	1.740	2.110
	18	1.330	1.734	2.101
	19	1.328	1.729	2.093
	140	1.288	1.656	1.977
	180	1.286	1.653	1.973
	250	1.285	1.651	1.969
	400	1.284	1.649	1.966
	1000	1.282	1.646	1.962
	∞	1.282	1.645	1.960
Confidence levels		80%	90%	95%

This is just part of the t -table in your textbook.

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Recall that the general form of a confidence interval is:

$$\text{estimate} \pm ds_n \times SE$$

So, a confidence interval for μ is given by

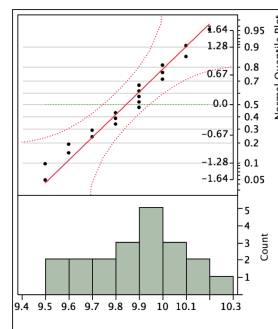
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Example

A medical study finds that in a sample of 27 members of a treatment group, the sample mean systolic blood pressure was 114.9 with a sample standard deviation of 9.3. Find a 90% CI for the population mean systolic blood pressure.

A coffee machine dispenses coffee into paper cups. You're supposed to get 10 ounces of coffee, but the amount varies slightly from cup to cup. Below are the summary statistics and plots of a random sample of 20 cups. Is there evidence that the machine is shortchanging customers?

$$\bar{y} = 9.845 \quad s = 0.199$$



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Hypothesis Tests for μ

1. Hypotheses

- Null hypothesis
- Alternative Hypothesis (Three Possibilities)

Example choosing H_o and H_A

Naysayers of “Abstinence Only” education claim that the program has not increased the average age at which a person first has sexual intercourse. If the national average is 17.1 years of age (courtesy of National Center for Family Growth), what would be appropriate Null and Alternative Hypotheses to refute this claim?

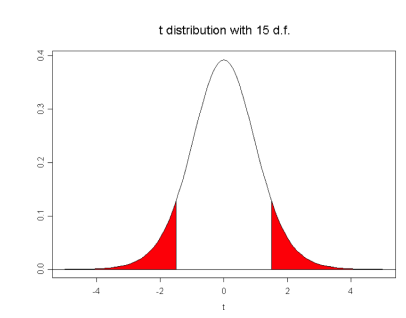
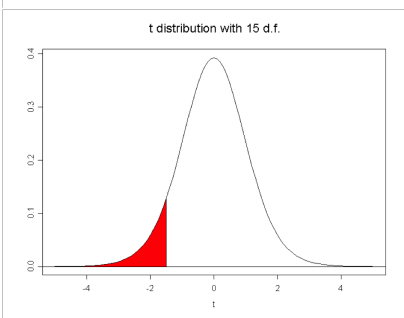
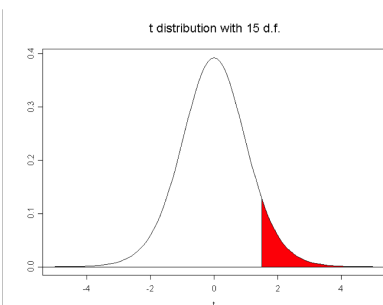
Example choosing H_o and H_A

During an angiogram, heart problems can be examined through a small tube threaded into the heart from a vein in the patients leg. It is important the tube is manufactured to have a diameter of 2.0mm. Determine appropriate Null and Alternative Hypotheses to test if there is this evidence that the diameter of the tubes is different from 2.0mm?

2. Assumptions For a Hypothesis test

3. Test Statistic

4. P-value:



5. Decision

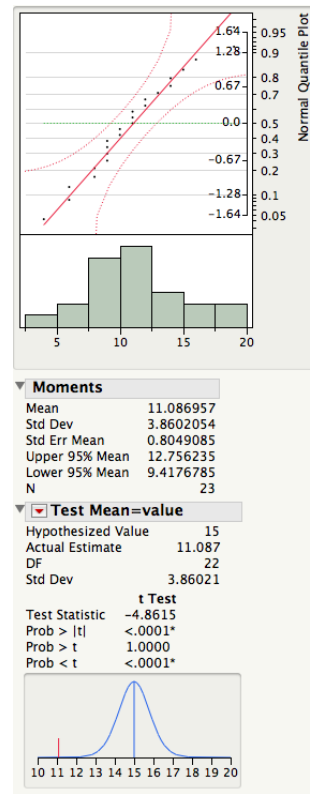
- if $p\text{-value} < \alpha$
- if $p\text{-value} \geq \alpha$

6. Conclusion stated in the context of the problem



A study was performed to see if the average number of cigarettes smoked by dutch smokers had decreased since the picture warning had been introduced. A random sample of $n = 23$ dutch smokers reported an average of $\bar{y} = 11.08$ cigarettes/day with $s = 3.86$ compared to the previous level of 15 cigarettes/day. Perform a hypothesis test to see if the introduction of the picture warnings was effective in reducing the amount smoking.

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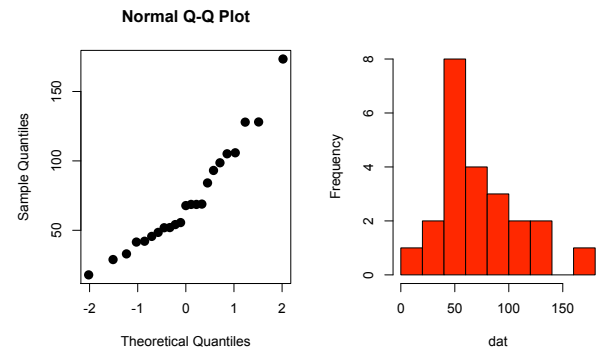


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When the Serpentine belt in your car fails, you stop. Master Pro claims their serpentine belts have an average life span of 80,000 miles. Accelerated life testing of 23 Master Pro serpentine belts resulted in a mean failure time of 72,224 miles with $s = 37,488$ miles. Is this evidence that Master Pro's claim is incorrect. use $\alpha = 0.05$.

Hypotheses:

Check Conditions:



Stem and Leaf

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0 | 8
2 | 93
4 | 22682246
6 | 8999
8 | 439
10 | 56
12 | 88
14 |
16 | 3

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