

Stat 104 – Lecture 25

t Distribution

Confidence Level

80%	90%	95%	98%	99%	99.8%
df					
9		2.262			

1

95% Confidence Interval

- $\bar{y} = 4.762$
- $n = 10, df = (10 - 1) = 9$
- $s = 0.314$
- $t^* = 2.262$

2

Calculation

$$\bar{y} - t^* \left(\frac{s}{\sqrt{n}} \right) \text{ to } \bar{y} + t^* \left(\frac{s}{\sqrt{n}} \right)$$
$$4.762 - 2.262 \left(\frac{0.314}{\sqrt{10}} \right) \text{ to } 4.762 + 2.262 \left(\frac{0.314}{\sqrt{10}} \right)$$
$$4.762 - 0.225 \text{ to } 4.762 + 0.225$$
$$4.537 \text{ to } 4.987$$

3

Stat 104 – Lecture 25

Interpretation

- We are 95% confident that the population mean alcohol content of beer is between 4.537% and 4.987%.

4

Interpretation

- The population mean alcohol content of beer could be any value between 4.537% and 4.987%.
- If we repeat the procedure that produces a confidence interval, 95% of intervals produced will capture the population mean.

5

Testing Hypotheses

- Use sample data, in the form of a sample statistic, to support or refute hypotheses.
- How likely is it to get the sample data if a hypothesis is true?

6

Stat 104 – Lecture 25

Testing – Step by Step

- Step 1 – Assumptions
- Step 2 – Hypothesis
- Step 3 – Test Statistic
- Step 4 – P-value
- Step 5 – Results

7

Step 1 – Assumptions

- Quantitative variable – alcohol content
- Randomization – random sample of 10 beers
- Distribution of alcohol content is approximately normal.

8

Step 2 – Hypotheses

- μ is the population mean alcohol content of beer.
- Null hypothesis
 - $H_0: \mu = 5$
- Alternative hypothesis
 - $H_A: \mu < 5$

9

Stat 104 – Lecture 25

Step 3 – Sample Evidence

- Sample mean,
– $\bar{y} = 4.762$
- Sample standard deviation,
– $s = 0.314$

10

Step 3 – Sample Evidence

- Test statistic,

$$t = \frac{\bar{y} - \mu_0}{\left(\frac{s}{\sqrt{n}}\right)} = \frac{4.762 - 5}{\left(\frac{0.314}{\sqrt{10}}\right)} = \frac{-0.238}{0.0993} = -2.397$$

- Even though t is negative look up the positive value.

11

Table T

df	Right-Tail Probability				
	0.100	0.050	0.025	P-value	0.010
1					
2					
3					
⋮					
9					

→
2.262
2.397
2.821

The P-value is between 0.01 and 0.025

12

Stat 104 – Lecture 25

Step 4 – Probability Value

- Alternative hypothesis
– $H_A: \mu < 5$
- P-value is the right tail probability, $df = 9$.
- Table T: P-value is between 0.01 and 0.025.

13

Step 5 - Results

- Reject the null hypothesis because the P-value is small, less than 0.05
- The population mean alcohol content of beer is less than 5%.

14

Confidence Interval

- Results of the test agree with the confidence interval.
- We are 95% confident that the population mean alcohol content of beer is between 4.537% and 4.987%.

15
