

# Stat 104 – Lecture 26

## Another Example

- What is the mean heart rate for all young adults?
- Could the population mean heart rate for young adults be 70 beats per minute or is it something higher?

1

---

---

---

---

---

---

---

---

## Sample Data

- Random sample of  $n = 25$  young adults.
- Heart rate – beats per minute  
70, 74, 75, 78, 74, 64, 70, 78, 81, 73  
82, 75, 71, 79, 73, 79, 85, 79, 71, 65  
70, 69, 76, 77, 66

2

---

---

---

---

---

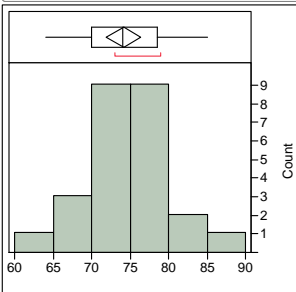
---

---

---

### Distributions

#### Heart Rate



#### Moments

Mean	74.16
Std Dev	5.3749419
Std Err Mean	1.0749884
Upper 95% Mean	76.378667
Lower 95% Mean	71.941333
N	25

3

---

---

---

---

---

---

---

---

# Stat 104 – Lecture 26

## Summary of Data

- $n = 25$
- $\bar{y} = 74.16$  beats
- $s = 5.375$  beats

4

---

---

---

---

---

---

---

---

## Step 1 – Assumptions

- Quantitative variable – heart rate.
- Randomization – random sample of 25 young adults.
- Distribution of heart rate is approximately normal.

5

---

---

---

---

---

---

---

---

## Step 2 – Hypotheses

- $\mu$  is the population mean heart rate of young adults.

$$H_0 : \mu = 70$$

$$H_A : \mu > 70$$

6

---

---

---

---

---

---

---

---

# Stat 104 – Lecture 26

## Step 3 – Sample Evidence

$$t = \frac{\bar{y} - \mu_0}{\left(\frac{s}{\sqrt{n}}\right)} = \frac{74.16 - 70}{\left(\frac{5.375}{\sqrt{25}}\right)} = \frac{4.16}{1.075}$$

$$t = 3.87$$

Use Table T to find the P-value.

7

---

---

---

---

---

---

---

---

## Table T

df	Right-tail probability						P-value
	0.100	0.050	0.025	0.010	0.005	0.001	
2							
3							
4							
⋮							
24			2.064	2.492	2.797	3.467	3.87

The P-value is less than 0.001.

8

---

---

---

---

---

---

---

---

## Step 4 – Probability Value

- Alternative hypothesis  
–  $H_A: \mu > 70$
- P-value is the one tail probability,  $df = 24$ .
- Table T: P-value is less than 0.001.

9

---

---

---

---

---

---

---

---

# Stat 104 – Lecture 26

## Step 5 - Results

- Reject the null hypothesis because the P-value is less than the significance level,  $\alpha$ .
- The mean heart rate for the population of young adults is more than 70 beats per minute.

10

---

---

---

---

---

---

---

---

## Alternatives

$$H_0 : \mu = \mu_0$$

$$H_A : \mu < \mu_0, \text{ One tail prob (Pr} < t)$$

$$H_A : \mu > \mu_0, \text{ One tail prob (Pr} > t)$$

$$H_A : \mu \neq \mu_0, \text{ Two tail prob (Pr} > |t|)$$

11

---

---

---

---

---

---

---

---

Distributions			
Heart Rate			
Moments		Test Mean=value	
Mean	74.16	Hypothesized Value	70
Std Dev	5.3749419	Actual Estimate	74.16
Std Err Mean	1.0749884	DF	24
Upper 95% Mean	76.378667	Std Dev	5.37494
Lower 95% Mean	71.941333		
N	25	<b>t Test</b>	
		Test Statistic	3.8698
		Prob >  t	0.0007 *
		Prob > t	0.0004 *
		Prob < t	0.9996

12

---

---

---

---

---

---

---

---