

4/10 Chapter 9-4 Inference from Matched pairs

CI( $\mu$ )      CI( $\mu_1 - \mu_2$ )

HT( $\mu$ )      HT( $\mu_1 - \mu_2$ )

CI( $p$ )      CI( $p_1 - p_2$ )

HT( $p$ )      HT( $p_1 - p_2$ )

CI( $\sigma$ )      CI( $\sigma_1 - \sigma_2$ )

A is good

Is B better than A?

Matched mean 2 experimental units  
or 2 observations are paired (connected)

TWINS separated at birth

genetic

environment if they different

Experimental Unit

Exper Unit	Treatment A	Treatment B	Different $D = A - B$
1	$A_1$	$B_1$	$A_1 - B_1 = d_1$
2	$A_2$	$B_2$	$A_2 - B_2 = d_2$
3	$A_3$	$B_3$	$A_3 - B_3 = d_3$
4	$A_4$	$B_4$	$A_4 - B_4 = d_4$
5	$A_5$	$B_5$	$A_5 - B_5 = d_5$
6	$A_6$	$B_6$	$A_6 - B_6 = d_6$

kid	wt
$K_1$	40
$K_2$	38
$K_3$	43
$K_4$	49

2 at random to get cereal A  
 The other two get cereal B

Gain in muscle mass

$K_3 \& K_4$  get A  $\rightarrow$  get 10 lbs  
 $K_1 \& K_2$  get B  $\rightarrow$  get 8 lbs.

$$CI(\mu_A - \mu_B) = CI(\mu_D)$$

$$CI(\mu_1 - \mu_2)$$

$$CI(\mu) = \bar{x} \pm t_{\alpha/2} \left( \frac{s}{\sqrt{n}} \right)$$

$$CI(\mu_D) = \bar{d} \pm t_{\alpha/2} \left( \frac{s_d}{\sqrt{n}} \right)$$

Testing Fire Retardants



20 min

Quiz 14(2)

Patient	Vitamin treatment		$d(N-S)$
	1 = natural	2 = Synthetic	
1	8	6	2
2	6	5	1
3	6	5	1
4	9	6	3
5	7	8	-1
6	8	5	3
mean	7.3	5.8	$\bar{d} = 1.5$
SD	1.21	1.17	$S_d = 1.57$

$n=6$

error rate of 0.05 for the test

route	Time for lane		diff
	Regular	carpool	
1	50.3	46.6	3.7
2	28.2	28.2	0
3	19.9	18.5	1.4
4	24.7	16.3	8.4
5	60.1	55.7	4.4
6	58.2	57.3	0.9
$\bar{x} =$	40.23	37.07	$\bar{d} = 3.13$
$s =$	17.99	18.44	$s_d = 3.08$
$n = 6$	6	6	6
			d.f. = 5

(R-C)

$$\mu_c \leq \mu_R - 5$$

Practice

Mean for regular is more than 10 minutes more than carpool avg

$$\mu_c + 10 < \mu_R$$

$$\mu_R > \mu_c + 10$$

$$\mu_R - \mu_c > 10$$

$$5 \leq \mu_R - \mu_c$$

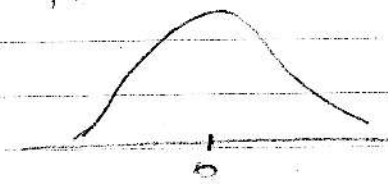
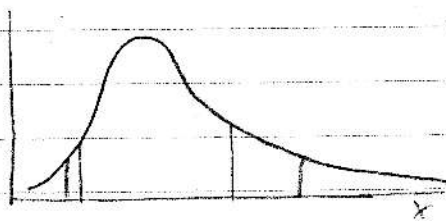
$$H_0: (\mu_R - \mu_c) \geq 5 \quad \text{or} \quad \mu_d \geq 5$$

$$H_1: (\mu_R - \mu_c) < 5 \quad \mu_d < 5$$

$\alpha = 0.05$  Left tail

approximately normal

p. 406



$$d, f = 5 \quad t_{\frac{\alpha}{2}} = 2.571$$

$$95\% \text{ CI } (\mu_d) = \bar{d} \pm t_{\frac{\alpha}{2}} \left( \frac{S_d}{\sqrt{n}} \right)$$

$$95\% \text{ CI } (\mu_d) = 1.5 \pm 2.571 \left( \frac{1.52}{\sqrt{6}} \right) = 1.5 \pm 1.595$$

$$[-0.095 < \mu_d < 3.095]$$

$$\mu_d = \mu_N - \mu_S$$

Is it reasonable to claim that

$$\mu_N = 10 \text{ and } \mu_S = 12$$

$$(\mu_N - \mu_S) = 10 - 12 = (-2)$$

(No) Because it is not in range

Look for match pairs in problems

$$\mu_1 - \mu_2 = \mu_d$$

1 = Hot

2 = Cold than  $\rightarrow \mu_H - \mu_C$

Quiz ~ 14 (1)

Do carpool lanes save time? Use the results of the experiment below to test the claim that using the carpool lane causes the average commute time to be at least 5 min less per trip. For the experiment 6 randomly selected routes were selected. For each route, the time required was test using the regular lanes and using the carpool lane. The data are given below. Use a type I

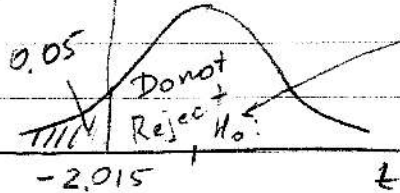
sample H

$$\frac{\bar{x} - \mu}{s/\sqrt{n}}$$

$$\frac{\bar{d} - \mu_d}{s_d/\sqrt{n}} = \frac{3.13 - 5}{3.08/\sqrt{6}} = \frac{-1.87}{1.257} =$$

Reject  $H_0$ :

$$= -1.488$$



Conclusion : Do not Reject  $H_0$ :

EXCEL paired 2.xls

◇ - □

range in different lower