Confidence Intervals and Hypothesis Tests: Two Samples

9.8 Confidence Interval, Two Population Means: Matched-Pair Experiments

1. A group of 11 overweight or obese men were placed on the Alternative-Day Fasting diet (ADF diet) for 8 weeks. The diet involves consuming only 25% of your normal calorie intake every other day. During the remaining days of the week, you are instructed to eat normally. The before-after results are included below:

Subject	1	2	3	4	5	6	7	8	9	10	11
Weight Before	260	285	305	315	290	300	302	269	278	321	247
Weight After	238	269	285	295	281	287	290	265	270	307	245

Form a 99% confidence interval for the average difference between before and after weight when using the ADF diet for 8 weeks. What conclusions can be drawn from the interval? $\left(\bar{x} = 12.73, s = 6.57\right)$

2. A Statistics professor at FIU has created a review technique for applied courses which involves focusing on streamlining the solving process for a set of problems. To determine if this review method significantly shortens the length of time to complete problems on the exam, he timed 10 students while they completed two different (but similar) five question quizzes. One quiz was given before the students learned the review technique, and another was given after the students learned and had the chance to practice the review technique. The results are given below. Create a 95% Confidence interval for the difference between the time to take the quiz before and after learning the review technique. What can be concluded from the interval? $\left(\bar{x} = 1.44, s = 1.09\right)$

Subject	1	2	3	4	5	6	7	8	9	10
Time Before (min)	20.3	15.8	25.6	18.9	17.1	22.3	24.7	19.8	19.9	21.6
Time After	17.9	16.2	23.2	16.9	16.9	21.9	22.1	17.4	18.4	20.7

3. The Statistics professor had it pointed out to him that reviewing normally before taking the second quiz could have produced the same average difference in completion time on the quiz. To determine if this was indeed the case, again the professor timed ten students while they completed two different (but similar) five question quizzes. One quiz was given before the students had a chance to review, and another was given after the students reviewed using their own method. The results are given below. Use a 95% confidence level to compare the before and after times. Is a significant difference in the time to complete the two quizzes? $\left(\bar{x}=0.75, s=1.03\right)$

Subject	1	2	3	4	5	6	7	8	9	10
Time Before (min)	21.2	14.8	24.9	19.1	25.1	20.4	17.3	23.5	20.2	21.0
Time After	19.1	14.6	22.6	18.9	24.8	20.0	15.9	22.1	21.3	20.7

Answers:

1. Based on the sample data, it seems the ADF diet causes a significant amount of weight loss because the interval limits for μ_d are positive which means that the before –after subtraction yielded a positive average difference (i.e. – it shows that the before weight was higher than the after weight). Specifically, we are 99% confident that the ADF diet will produce an average weight loss of somewhere between 6.45 pounds and 19.01 pounds.

$\bar{x}=12.73, s=6.57$

$d.f.=10$

$t_{\alpha/2}=t_{.005,10}=3.169$

$E=3.169*\frac{6.57}{\sqrt{11}}\approx 6.278$

$\left(6.45,19.01\right)$

$6.45<\mu_d<19.01$

2. Based on the sample data, it seems that the time to complete the second quiz is between 0.66 minutes and 2.22 minutes shorter on average (because the subtraction was done before – after and the interval is entirely positive).

$\bar{x}=1.44, s=1.09$

$d.f.=9$

$t_{\alpha/2}=t_{.025,9}=2.262$

$E=2.262*\frac{1.09}{\sqrt{10}}\approx 0.77968$

$\left(0.66,2.22\right)$

$0.66<\mu_d<2.22$

3. Based on the sample data, it seems that the time to complete the second quiz is quiz is between 0.13 minutes and 1.49 minutes shorter on average (because the subtraction was done before – after and the interval is entirely positive). This indicates that perhaps just reviewing and retaking improves scores significantly. However, the lower interval limit is very close to zero, so this might indicate that there is barely a significant improvement without the professor's method.

$\bar{x} = 0.75, s = 1.03$

$d.f. = 9$

$t_{\alpha/2} = t_{.025,9} = 2.262$

$E = 2.262 * \frac{1.03}{\sqrt{10}} \approx 0.73677$

$(0.013, 1.49)$

$0.13 < \mu_d < 1.49$