15.2.10: Chapter 11 Homework

1. What is the difference between two samples that are dependent and two samples that are independent? Give an example of two dependent samples and two independent samples.
2. What conditions are necessary in order to use the dependent samples t-test for the mean of the difference of two populations?

In Problems 3-10, classify the two given samples as independent or dependent. Explain your reasoning.

3. **Sample 1**: The SAT scores for 35 high school students who did not take an SAT preparation course; **Sample 2**: The SAT scores for 40 high school students who did take an SAT preparation course
4. **Sample 1**: The SAT scores for 44 high school students; **Sample 2**: The SAT scores for the same 44 high school students after taking an SAT preparation course
5. **Sample 1**: The weights of 51 adults; **Sample 2**: The weights of the same 51 adults after participating in a diet and exercise program for one month
6. **Sample 1**: The weights of 40 females; **Sample 2**: The weights of 40 males
7. **Sample 1**: The average speed of 23 powerboats using an old hull design; **Sample 2**: The average speed of 14 powerboats using a new hull design
8. **Sample 1**: The fuel mileage of 10 cars; **Sample 2**: The fuel mileage of the same 10 cars using a fuel additive
9. The table shows the braking distances (in feet) for each of the four different sets of tires with the car's anti-lock braking system (ABS) on and with ABS off. The tests were done on ice with cars traveling at 15 miles per hour.

Tire Set	1	2	3	4
Braking distance with ABS	42	55	43	61
Braking distance without ABS	58	67	59	75

10. The table shows the heart rates (in beats per minute) of five people before and after exercising.

Person	1	2	3	4	5
Heart Rate before Exercising	42	55	43	61	65
Heart Rate after Exercising	58	67	59	75	90

11. In a study testing the effects of an herbal supplement on blood pressure DATA in men, 11 randomly selected men were given an herbal supplement for 15 weeks. The following measurements are for each subject's diastolic blood pressure taken before and after the 15-week treatment period. At $\alpha = .10$, can you support the claim that systolic blood pressure was lowered?

(a) (DESIGN) State your Hypothesis

(b) (DESIGN) State Significance Level of the test and explain what it means,

(c) (DESIGN) Determine the statistical model (test statistic)

(d) (DESIGN) Determine decision rule (p-value method)

(e) (DATA)
Conduct the test and **circle** your decision

Before	After
123	124
109	97
112	113
102	105
98	95
114	119
119	114
112	114
110	121
117	118
130	133

Hypothesis Test: Paired Observations

0.000	hypothesized value
113.273	mean Before
113.909	mean After
-0.636	mean difference (Before - After)
5.870	std. dev.
1.770	std. error
11	n
10	df
-0.36	t
.6367	p-value (one-tailed, upper)
.3633	p-value (one-tailed, lower)
.7266	p-value (two-tailed)

Reject Ho **Fail to Reject Ho**

(f) (CONCLUSION) State your overall conclusion in language that is clear, relates to the original problem and is consistent with your decision.

12. A random sample of 25 waiting times (in minutes) before patients saw a medical professional in a hospital's minor emergency department had a standard deviation of 0.7 minute. After a new admissions procedure was implemented, a random sample of 21 waiting times had a standard deviation of 0.5 minute. At $\alpha = .10$, can you support the hospital's claim that the standard deviation of the waiting times has decreased?

(a) (DESIGN) State your Hypothesis	**(d) (DESIGN)** Determine decision rule (critical value method) **(e) (DATA)** Conduct the test and **circle** your decision
(b) (DESIGN) State Significance Level of the test and explain what it means.	Reject Ho Fail to Reject Ho **(f) (CONCLUSION)** State your overall conclusion in language that is clear, relates to the original problem and is consistent with your decision.
(c) (DESIGN) Determine the statistical model (test statistic)	

13. An engineer wants to compare the tensile strengths of steel bars that are produced using a conventional method and an experimental method. (The tensile strength of a metal is a measure of its ability to resist tearing when pulled lengthwise). To do so, the engineer randomly selects steel bars that are manufactured using each method and records the following tensile strengths (in Newtons per square millimeter). At $\alpha = .10$, can the engineer claim that the experimental method produces steel with greater mean tensile strength? Should the engineer recommend using the experimental method? First use the F test to determine whether or not to use equal variances in choosing the model.

Experimental	395	389	421	394	407	411	389	402	422	416	402	408	400	386	411	405	389
Conventional	362	352	380	382	413	384	400	378	419	379	384	388	372	383			

Hypothesis Test: Independent Groups (t-test, pooled variance)

Experimental	Conventional	
402.76	384.00	mean
11.34	17.70	std. dev.
17	14	n

29	df
18.765	difference (Experimental - Conventional)
211.416	pooled variance
14.540	pooled std. dev.
5.248	standard error of difference
0	hypothesized difference
3.58	t
.0012	p-value (two-tailed)
.0006	p-value (one-tailed, upper)
.9994	p-value (one-tailed, lower)

F-test for equality of variance

313.23	variance: Conventional
128.69	variance: Experimental
2.43	F
.0944	p-value

Hypothesis Test: Independent Groups (t-test, unequal variance)

Experimental	onventional	
402.76	384.00	mean
11.34	17.70	std. dev.
17	14	n

21	df
18.765	difference (Experimental - Conventional)
5.472	standard error of difference
0	hypothesized difference
3.43	t
.0025	p-value (two-tailed)
.0013	p-value (one-tailed, upper)
.9987	p-value (one-tailed, lower)

(a) (DESIGN) State your Hypothesis	**(d) (DESIGN)** Determine decision rule (p-value method)
(b) (DESIGN) State Significance Level of the test and explain what it means,	**(e) (DATA)** Conduct the test and **circle** your decision Reject Ho Fail to Reject Ho
(c) (DESIGN) Determine the statistical model (test statistic)	**(f) (CONCLUSION)** State your overall conclusion in language that is clear, relates to the original problem and is consistent with your decision.

14. A community college is considering using multiple measures for student placement into math courses. The existing measure is that each student takes a standardized placement exam. Based on the score, the student will be placed in one of three math courses: Elementary Level, Intermediate Level and Transfer Level. A second measure will be to use high school GPA to modify the needed placement exam score for each of the three courses.

    200 incoming students who have high school GPAs were randomly split into two groups. The first group of 100 students was given the existing placement exam only. The second group of 100 students was placed using the new second measure that utilizes both placement exams and high school GPAs.

    After three quarters, it was found that 17 of the first group completed the Transfer Level course while 31 of the second group completed the Transfer Level course. Based on this result, the researcher decided that the new multiple measures method of placing students improved the percentage of students who pass the Transfer Level math course in three quarters.

(a) (DESIGN) State your Hypothesis	**(d) (DESIGN)** Determine decision rule (any method) **(e) (DATA)** Conduct the test and **circle** your decision
(b) (DESIGN) State Significance Level of the test and explain what it means.	
(c) (DESIGN) Determine the statistical model (test statistic)	Reject Ho Fail to Reject Ho **(f) (CONCLUSION)** State your overall conclusion in language that is clear, relates to the original problem and is consistent with your decision.