Math 10 - Homework Chapter 10 Answers

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.

Independent samples are from two distinct and unrelated populations. Example: 30 patients are given an experimental drug and 30 other patients are given a placebo.
Dependent samples are two measurements of a sample from a single population. Example: 30 students are given an assessment test. After a specialized study course, the same students take another assessment test and the scores are compared.

2. What conditions are necessary in order to use the dependent samples t-test for the mean of the difference of two populations?

The data need to matched by a common characteristic.

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

   Independent – Two distinct populations

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

   Dependent – One population, two measurements

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

   Dependent – One population, two measurements

6. Sample 1: The weights of 40 females
   Sample 2: The weights of 40 males

   Unclear, but probably Independent – Two distinct populations

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

   Independent – Two distinct populations

8. Sample 1: The fuel mileage of 10 cars
   Sample 2: The fuel mileage of the same 10 cars using a fuel additive

   Dependent – One population, two measurements

9. The table shows the braking distances (in feet) for each of 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**

Dependent – One population, two measurements

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

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

Dependent – One population, two measurements

For the following questions, State Ho and Ha **and** choose the correct model from this list:

a) One population, Z test for mean
b) One population, t test for mean
c) One population, Z test of proportion
d) One population, Chi-square test of variance
e) Z-test: comparing two independent population means
f) t-test: independent samples, two population pooled variance.
g) t-test: independent samples, two population unequal variance.
h) t-test: dependent sampling, matched pairs

11. You want to support the claim that male bass singers are taller than male tenor singers. 20 singers of each type will be sampled. Assume that population variances are not equal for these two groups.

$Ho: \mu_1 \leq \mu_2 \quad Ha: \mu_1 > \mu_2$ **Model: g**

12. You want to reject the claim that no more than 10% of students will suffer financial hardship if tuition increased. 400 students will be sampled.

$Ho: p \leq .10 \quad Ha: p > .10$ **Model: c**

13. An investor wants to reject the claim that the standard deviation for mutual fund portfolios is no more than 10. A total of 31 mutual fund portfolios will be sampled.

$Ho: \sigma \leq 10 \quad Ha: \sigma > 10$ **Model: d**

14. A study claims people now spend, on average, more time on the Internet than they do watching television. 200 people will be asked how much time they spent on the TV and on the Internet. You want to support this claim.

$Ho: \mu_d \leq 0 \quad Ha: \mu_d > 0$

d = time on internet - time on TV **Model: h**

15. Is there a difference in quality between vegetables bought at farmers markets and vegetables bought at a high end grocer? Test this claim by sampling random vegetables from 20 farmers markets and 20 high end grocers. Assume that population variances are equal for these two groups.

$Ho: \mu_1 = \mu_2 \quad Ha: \mu_1 \neq \mu_2$ **Model: f**

16. A study claims the average age for a community college student is over 27. You want to support this claim and sample 20 students.

$Ho: \mu \leq 27 \quad Ha: \mu > 27$ **Model: b**

17. A community college district compared the number of hours students worked at an outside job at its two colleges. Design and run a test to determine if there is a significant difference in hours worked by students at the 2 colleges. Use a 1% level of significance for this test. Assume population variances are equal.

(a) (DESIGN) State your Hypothesis

$Ho: \mu_1 = \mu_2 \quad Ha: \mu_1 \neq \mu_2$

(b) (DESIGN) State Significance Level of the test and explain Type I error.

$\alpha = .01$**, the maximum probability of Type I error: we would incorrectly claim that there is a difference in mean hours worked by students at the two colleges.**

(c) (DESIGN) Determine the statistical model (test statistic) Explain your reasoning.

Model: Pooled variance t-test. This model is appropriate because there is independent sampling and we are assuming population variance are equal

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

Reject Ho if p-value < alpha.

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

	College A	College B
sample mean	25.57	13.86
sample std dev	11.90	11.19
sample size	14	14

Reported p-values	two tail	lower tail	upper tail
pooled variance t-test	0.012	0.006	0.994
unequal variance t-test	0.013	0.007	0.993
matched pairs t-test	0.000	0.001	0.999

Correct p-value **0.012**

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.

There is insufficient evidence to conclude that there is a difference in mean hours worked by students at the two colleges.

18. Does the home team have an advantage in NBA basketball games? In a study of 75 games, the visiting team points were compared to the home team points. Design and conduct a hypothesis test with a significance level of 5%

(a) (DESIGN) State your Hypothesis

$Ho: \mu_d \geq 0 \quad Ha: \mu_d < 0$

d= visitor score-home score

(b) (DESIGN) State Significance Level of the test and explain Type I error.

$\alpha = .05$ **, the maximum probability of Type I error: we would incorrectly claim that home team scores more points on average than the visiting team.**

(c) (DESIGN) Determine the statistical model (test statistic) Explain your reasoning.

Model: Matched Paired t-test. This model is appropriate because there is dependent sampling.

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

Reject Ho if p-value < alpha.

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

	Visiting	Home
sample mean	95.47	101.31
sample std dev	12.91	12.72
sample size	75	75

Reported p-values	**two tail**	**lower tail**	**upper tail**
F-test for variances	0.899		
pooled variance t-test	0.006	0.003	0.997
unequal variance t-test	0.006	0.003	0.997
matched pairs t-test	0.000	0.000	1.000

Correct p-value **0.000**

Reject Ho

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

Home teams have an advantage - they do score more points on average than visiting teams.

19. Do directed reading activities in the classroom help elementary school students improve aspects of their reading ability? A treatment class of 21 third-grade students participated in these activities for eight weeks, and a control class of 23 third-graders followed the same curriculum without the activities. After the eight-week period, students in both classes took a Degree of Reading Power (DRP) test which measures the aspects of reading ability that the treatment is designed to improve. At the 5% level of significance, can you conclude that directed reading activities improved DRP scores?

(a) (DESIGN) State your Hypothesis

$Ho: \mu_1 \le \mu_2 \quad Ha: \mu_1 > \mu_2$

(b) (DESIGN) State Significance Level of the test and explain Type I error.

$\alpha = .05$ **, the maximum probability of Type I error: we would incorrectly claim that directed reading activities improved DRP scores.**

(c) (DESIGN) Determine the statistical model (test statistic) Explain your reasoning.

Model: Unequal variance t-test. This model is appropriate because there is independent sampling and there is a significant difference between the population variances (F-test pvalue=0.049)

(d) (DESIGN) Determine decision rule (pvalue method)

Reject Ho if p-value < alpha.

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

	Treatment	Control
sample mean	51.48	41.52
sample std dev	11.01	17.15
sample size	21.00	23.00

Reported p-values	**two tail**	**lower tail**	**upper tail**
F-test for variances	0.049		
pooled variance t-test	0.029	0.985	0.015
unequal variance t-test	0.034	0.983	0.017
matched pairs t-test	n/a	n/a	n/a

Correct p-value **0.017**

Reject Ho

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

Directed reading activities in the classroom improved DRP scores, helping elementary school students improve aspects of their reading ability.