

## AP Statistics - Chapter 7 Extra Practice

An SRS of 100 postal employees found that the average amount of time these employees had worked for the U.S. Postal Service was  $J = 7$  years with standard deviation  $s = 2$  years. Assume the distribution of the time the population has worked for the Postal Service is approximately normal with mean  $\mu$ . Are these data evidence that  $\mu$  has changed from the value of 7.5 years of 20 years ago? To determine this we test the hypotheses  $H_0: \mu = 7.5, H_a: \mu \neq 7.5$  using the one-sample  $t$  test.

5. The appropriate degrees of freedom for this test are  
A) 9            B) 10            C) 99            D) 100
6. The  $P$ -value for the one-sample  $t$  test is  
A) larger than 0.10            B) between 0.10 and 0.05            C) between 0.05 and 0.01            D) below 0.01
7. A 95% confidence interval for the mean amount of time  $\mu$  the population of Postal Service employees has spent with the postal service is  
A)  $7 \pm 2$             B)  $7 \pm 1.984$             C)  $7 \pm 0.4$             D)  $7 \pm 0.2$
- 

8. Suppose the mean and standard deviation obtained were based on a sample of 25 postal workers rather than 100. The  $P$ -value would be  
A) larger            B) smaller  
C) unchanged, since the difference between  $J$  and the hypothesized value  $\mu = 7.5$  is unchanged  
D) unchanged, since the variability measured by the standard deviation stays the same
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9. We wish to see if the dial indicating the oven temperature for a certain model oven is properly calibrated. Four ovens of this model are selected at random. The dial on each is set to  $300^\circ$  F; after one hour, the actual temperature of each is measured. The temperatures measured are  $305^\circ, 310^\circ, 300^\circ,$  and  $305^\circ$ . Assuming that the actual temperatures for this model when the dial is set to  $300^\circ$  are normally distributed with mean  $\mu$ , we test whether the dial is properly calibrated by testing the hypotheses  $H_0: \mu = 300, H_a: \mu \neq 300$   
Based on the data, the value of the one-sample  $t$  statistic is  
A) 5            B) 4.90            C) 2.45            D) 1.23
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15. To estimate  $\mu$ , the mean salary of full professors at American colleges and universities, you obtain the salaries of a random sample of 400 full professors. The sample mean is  $J = \$73220$  and the sample standard deviation is  $s = \$4400$ . A 99% confidence interval for  $\mu$  is  
A)  $73,220 \pm 11,440$   
B)  $73,220 \pm 572$   
C)  $73220 \pm 431$   
D)  $73220 \pm 28.6$
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12. The water diet requires the dieter to drink two cups of water every half hour from when he gets up until he goes to bed, but otherwise allows him to eat whatever he likes. Four adult volunteers agree to test the diet. They are weighed prior to beginning the diet and after six weeks on the diet. The weights (in pounds) are

Person	1	2	3	4
Weight before the diet	180	125	240	150
Weight after six weeks	170	130	215	152

For the population of all adults, assume that the weight loss after six weeks on the diet (weight before beginning the diet – weight after six weeks on the diet) is normally distributed with mean  $\mu$ . To determine if the diet leads to weight loss, we test the hypotheses  $H_0: \mu = 0, H_a: \mu > 0$ . Based on these data we conclude that

- A) we would not reject  $H_0$  at significance level 0.10  
 B) we would reject  $H_0$  at significance level 0.10 but not at 0.05  
 C) we would reject  $H_0$  at significance level 0.05 but not at 0.01  
 D) we would reject  $H_0$  at significance level 0.01

19. A medical researcher wishes to investigate the effectiveness of exercise versus diet in losing weight. Two groups of 25 overweight adults subjects are used, with a subject in each group matched to a similar subject in the other group on the basis of a number of physiological variables. One of the groups is placed on a regular program of vigorous exercise, but with no restriction on diet, and the other group is placed on a strict diet, but with no requirement to exercise. The weight losses after 20 weeks are determined for each subject and the difference between matched pairs of subjects (weight loss of subject in exercise group – weight loss of matched subject in diet group) is computed. The mean of these differences in weight loss is found to be –2 pounds with standard deviation  $s = 6$  pounds. Is this evidence of a difference in mean weight loss for the two methods? To test this, consider the population of differences (weight loss overweight adult would experience after 20 weeks on the exercise program) – (weight loss the same adult would experience after 20 weeks on the strict diet). Let  $\mu$  be the mean of this population of differences and assume their distribution is approximately normal. We test the hypotheses  $H_0: \mu = 0, H_a: \mu \neq 0$  using the matched-pairs  $t$  test. The  $P$ -value for this test is

- A) larger than 0.10      B) between 0.10 and 0.05      C) between 0.05 and 0.01      D) below 0.01

26. Researchers compared two groups of competitive rowers: a group of skilled rowers and a group of novices. The researchers measured the angular velocity of each subject's right knee, which describes the rate at which the knee joint opens as the legs push the body back on the sliding seat. The sample size  $n$ , the sample means, and the sample standard deviations for the two groups are given below.

Group	$n$	Mean	Standard Deviation
Skilled	16	4.2	0.6
Novice	16	3.2	0.8

The researchers wished to test the hypotheses

$H_0$ : the mean knee velocities for skilled and novice rowers are the same

$H_a$ : the mean knee velocity for skilled rowers is larger than for novice rowers

The data showed no strong outliers or strong skewness, so the researchers decided to use the two-sample  $t$  test. The value of the  $t$  test statistic is

- A) 1.0      B) 1.25      C) 2.0      D) 4.0

A researcher wished to test the effect of the addition of extra calcium to yogurt on the “tastiness” of yogurt. A collection of 200 adult volunteers was randomly divided into two groups of 100 subjects each. Group 1 tasted yogurt containing the extra calcium. Group 2 tasted yogurt from the same batch as group 1 but without the added calcium. Both groups rated the flavor on a scale of 1 to 10, 1 being “very unpleasant” and 10 being “very pleasant.” The mean rating for group 1 was  $J_1 = 6.5$  with a standard deviation  $s_1 = 1.5$ . The mean rating for group 2 was  $J_2 = 7.0$  with a standard deviation  $s_2 = 2.0$ . Assume the two groups are independent. Let  $\mu_1$  and  $\mu_2$  represent the mean ratings we would observe for the entire population represented by the volunteers if all members of this population tasted, respectively, the yogurt with and without the added calcium.

27. Referring to the information above, assuming two sample  $t$  procedures are safe to use, a 90% confidence interval for  $\mu_1 - \mu_2$  is (use the conservative value for the degrees of freedom)
- A)  $-0.5 \pm 0.25$       B)  $-0.5 \pm 0.32$       C)  $-0.5 \pm 0.42$       D)  $-0.5 \pm 0.5$
28. Referring to the information above, suppose the researcher had wished to test the hypotheses  $H_0: \mu_1 = \mu_2, H_a: \mu_1 < \mu_2$ . The  $P$ -value for the test is (use the conservative value for the degrees of freedom)
- A) larger than 0.10      B) between 0.10 and 0.05      C) between 0.05 and 0.01      D) below 0.01
29. Referring to the information above, which of the following would lead us to believe that the  $t$  procedures were not safe to use here?
- A) The sample medians and means for the two groups were slightly different  
 B) The distributions of the data were moderately skewed  
 C) The data are integers between 1 and 10 and so cannot be normal  
 D) Only the most severe departures from normality would lead us to believe the  $t$  procedures were not safe to use
30. Referring to the information above, if we had used the more accurate software approximation to the degrees of freedom, we would have used which of the following for the number of degrees of freedom for the  $t$  procedures?
- A) 199      B) 198      C) 184      D) 99

A researcher wished to compare the average amount of time spent in extracurricular activities by high school students in a suburban school district with that in a school district of a large city. The researcher obtained an SRS of 60 high school students in a large suburban school district and found the mean time spent in extracurricular activities per week to be  $J_1 = 6$  hours with a standard deviation  $s_1 = 3$  hours. The researcher also obtained an independent SRS of 40 high school students in a large city school district and found the mean time spent in extracurricular activities per week to be  $J_2 = 4$  hours with a standard deviation  $s_2 = 2$  hours. Let  $\mu_1$  and  $\mu_2$  represent the mean amount of time spent in extracurricular activities per week by the populations of all high school students in the suburban and city school districts, respectively.

35. Referring to the information above, assuming two sample  $t$  procedures are safe to use, a 95% confidence interval for  $\mu_1 - \mu_2$  is (use the conservative value for the degrees of freedom)
- A)  $2 \pm 0.5$  hours      B)  $2 \pm 0.84$  hours      C)  $2 \pm 1.01$  hours      D)  $2 \pm 1.34$  hours
36. Referring to the information above, suppose the researcher had wished to test the hypotheses  $H_0: \mu_1 = \mu_2, H_a: \mu_1 \neq \mu_2$ . The  $P$ -value for the test is (use the conservative value for the degrees of freedom)
- A) larger than 0.10      B) between 0.10 and 0.05      C) between 0.05 and 0.01      D) below 0.01
37. Referring to the information above, if we had used the more accurate software approximation to the degrees of freedom, we would have used which of the following for the number of degrees of freedom for the  $t$  procedures?
- A) 99      B) 98      C) 60      D) 50

**Answer Key**

- 5. C
- 6. C
- 7. C
- 8. A
- 9. C
- 12. A
- 15. B
- 17. B
- 19. A
- 26. D
- 27. C
- 28. C
- 29. D
- 30. C
- 35. C
- 36. D
- 37. B