AP Statistics Chapter 9 Practice FR Test: Testing a Claim

Show all work for the following on the answer sheet. Answer completely and clearly.

1. A certain intelligence test is designed to have a population of scores following a normal distribution with a mean score of 100. Below are scores on this intelligence test from 6 randomly selected undergraduate students from Thorndike University.

110	118	110	122	110	150

   a) Do these scores suggest that, on average, the population of undergraduates at Thorndike University have higher than average intelligence scores? Carry out an appropriate test at the 5% level to help answer this question.

   b) What would constitute a Type I error for this test?

2. A drug manufacturer claims that 9 out of 10 doctors (90%) recommend aspirin for their patients with headaches. To test this claim, a random sample of 100 doctors is obtained. Of these 100 doctors, 82 indicate that they recommend aspirin.

   a) Do these results support the claim of the drug manufacturer? Support your conclusion with a test of significance. Use $\alpha = .01$.

   b) What would constitute a Type II error for this test?

3. Is a person's pulse rate higher when they are standing than when that person is sitting? To answer this question, a group of 14 students measured each other's pulse rate in both positions. The data collected are given in the table below. Consider this to be a random sample taken from a population in which the difference between these two pulse rate measurements is normal.

Member	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pulse Rate Sitting	62	74	82	88	68	66	72	84	72	82	80	72	64	62
Pulse Rate Standing	68	78	80	92	64	76	72	91	82	76	92	74	60	58
Difference	6	4	-2	4	-4	10	0	7	10	-6	12	2	-4	-4

   a) Carry out an appropriate test to answer the students' question. Use $\alpha = .05$.

   b) Explain why the design of this experiment is better than having two separate treatment groups with one group of students measured while sitting and the other group measured while standing.

AP Statistics Chapter 9 Practice FR Test: SOLUTIONS

1. a) **One-Sample *T* Test**

Hypotheses	Test Statistic and P-value
μ = intelligence score of Thorndike U. students H_0: $\mu = 100$ H_a: $\mu > 100$	$\bar{x} = 120$, $s = 15.543$ $t = \dfrac{120 - 100}{15.543 / \sqrt{6}} = 3.152$, P = .013
Conditions SRS: random sample stated Normal: stated as normal Independent: $10n = 60$. The population of students should easily be more than 60	Decision and Conclusion • Reject the null at the 5% level • The undergrad students at Thorndike Univ. appear to be of higher intelligence than the average person, as judged by this test.

b) A Type I error would be concluding that Thorndike U. students have higher intelligence test scores when in fact they do not.

2. a) **One-Proportion *Z* Test**

Hypotheses	Test Statistic and P-value
p = proportion of doctors who recommend aspirin for their patients with headaches H_0: p = 0.9 H_a: p < 0.9	$\hat{p} = \dfrac{82}{100} = 0.82$, $n = 100$ $z = \dfrac{0.82 - 0.9}{\sqrt{\dfrac{(0.9)(0.1)}{100}}} = -2.667$, P = .004
Conditions SRS: random sample stated Normal: $100(.9) = 90 \geq 10$, $100(.1) = 10 \geq 10$ Independent: $10n = 1000$. The population of doctors should easily be more than 100	Decision and Conclusion • Reject the null at the 1% level • The drug manufacturer claim that 90% of doctors recommend aspirin as a treatment for headaches does not appear to be true.

b) A Type II error would be concluding that 90% of doctors do recommend aspirin for headaches when in fact less than 90% of doctors recommend aspirin for headaches.

3. a) **Paired Differences *T* Test**

Hypotheses	Test Statistic and P-value
μ = mean difference between sitting and standing pulse rates (diff = standing − sitting) H_0: $\mu = 0$ H_a: $\mu > 0$	$\bar{x} = 2.5$, $s = 5.984$ $t = \dfrac{2.5 - 0}{5.984 / \sqrt{14}} = 1.563$, P = .071
Conditions SRS: random sample stated Normal: stated as normal Independent: $10n = 140$. The population of students should easily be more than 140	Decision and Conclusion • Fail to reject the null at the 5% level • The pulse rate measurements on these students do not provide significant evidence that standing pulse rate is higher than the sitting pulse rate.

b) A matched-pairs design like this allows for direct comparison of the treatments on each subject. This eliminates lurking variables that exist due to differences between people.