AP Statistics – Chapter 13 Practice Free Response Test

1. In a study of heart surgery, one issue was the effect of drugs called beta-blockers on the pulse rate of patients during surgery. The available subjects were divided at random into two groups of 30 patients each. One group received a beta-blocker; the other group received a placebo. The pulse rate of each patient at a critical point during the operation was recorded. The treatment group had mean 65.2 and standard deviation 7.8. For the control group, the mean was 70.3 and the standard deviation was 8.3.

    Perform an appropriate significance test to see if beta-blockers reduce the pulse rate.
    a. Identify the populations and parameters of interest. Then state hypotheses.
    b. State and verify conditions for carrying out a significance test.
    c. Calculate the test statistic and the *P*-value.
    d. What conclusion would you draw?

2. A study of "adverse symptoms" in users of over-the-counter pain relief medications assigned subjects at random to one of two common pain relievers: acetaminophen and ibuprofen. In all, 650 subjects took acetaminophen, and 44 experienced some adverse symptom. Of the 347 subjects who took ibuprofen, 49 had an adverse symptom. We want to assess the evidence that the two pain relievers differ in the proportion of people who experience an adverse symptom.

    Perform an appropriate significance test to answer the question posed.
    a. Identify the populations and parameters of interest. Then state hypotheses.
    b. State and verify conditions for carrying out a significance test.
    c. Calculate the test statistic and the *P*-value.
    d. What conclusion would you draw?
    .

3. In the 2001 regular baseball season, the World Series Champion Arizona Diamondbacks played 81 games at home and 81 games away. They won 48 of their home games and 44 of the games played away. We can consider these games as samples from potentially large populations of games played at home and away.

    a. Identify the populations and parameters of interest.
    b. Construct and interpret a 90% confidence interval for the difference between the proportion of games that the Diamondbacks win at home and the proportion that they win when on the road.
    c. Most people think that it is easier to win at home than away. Use the confidence interval from part b to determine whether this is true for the Arizona Diamondbacks.

AP Statistics – Chapter 13 Practice Free Response Test - SOLUTIONS

Problem #1

1. **Step 1:** Let μ_1 = mean pulse rate of heart surgery patients who take beta blockers and μ_2 = mean pulse rate of heart surgery patients who are given a placebo. H_0: $\mu_1 = \mu_2$, or $\mu_1 - \mu_2 = 0$.
H_a: $\mu_1 < \mu_2$, or $\mu_1 - \mu_2 < 0$. **Step 2:** We need to verify conditions for using a two-sample t test: SRS— The subjects were randomly allocated to the two treatments. Normality—The large sample sizes assure us of the approximate Normality of the sampling distribution of $\bar{x}_1 - \bar{x}_2$. Independence—the 30 pulse rate readings in the two groups should be independent measurements.

Step 3: $t = \dfrac{65.2 - 70.3}{\sqrt{\dfrac{7.8^2}{30} + \dfrac{8.3^2}{30}}} = -2.45$; df $= 29$ by the rule, or df $= 57.8$ by TI calculator. The P-value =

0.0086 (by TI). (Note that if students work this by hand and use the table, they will obtain a P-value between 0.01 and 0.02 because of the discrepancy in the degrees of freedom.) **Step 4:** The result is significant at the 5% significance level because $0.0086 < 0.05$. We conclude that the mean pulse rate of heart surgery patients is lowered by beta-blockers. 2. Using df = 29, the critical value $t^* = 2.76$ and

Problem #2

Quiz 13.2A

1. The populations of interest are all people who take acetaminophen and all people who take ibuprofen. Our hypotheses are $H_0 : p_1 = p_2$ vs. $H_a : p_1 \neq p_2$, where p_1 and $p_2 =$ the proportion of

all acetaminophen and ibuprofen takers, respectively, who experience adverse symptoms. 2. SRS— The results came from a comparative randomized experiment. Independence—The population should be at least 10 times as large as the sample, so we are fairly safe in assuming that at least 6500 people take acetaminophen and at least 3470 take ibuprofen. Normality—The pooled estimate of the overall proportion of acetaminophen and ibuprofen takers who experience adverse symptoms is
$\hat{p} = (44 + 49)/(650 + 347) = 0.0933$. Since $n_1\hat{p} = 650(0.0933) = 60.6$, $n_2\hat{p} = 347(0.0933) = 32.4$,
$n_1(1 - \hat{p}) = 650(1 - 0.0933) = 589.4$, and $n_2(1 - \hat{p}) = 347(1 - 0.0933) = 314.6$, and are all ≥ 5, we are safe using the z procedures. 3. $z = (44/650 - 49/347)/\sqrt{0.0933(1 - 0.0933)(1/650 + 1/347)} = -3.801$; P-value $= 0.00014$. 4. There is strong evidence to reject H_0 and conclude that the two pain relievers differ in the proportion of people who experience an adverse reaction. 5. The correct Normality condition for the confidence interval: $n_1\hat{p}_1 = 44$, $n_1(1 - \hat{p}_1) = 606$, $n_2\hat{p}_2 = 49$, and $n_2(1 - \hat{p}_2) = 298$, which are all at least 5. The 90% CI for $p_1 - p_2$ is

Problem #3

1. Let p_1 = the proportion of all home games won by the Arizona Diamondbacks and p_2 = the proportion of away games won. The standard error for a confidence interval estimate of $p_1 - p_2$ is

$\sqrt{\dfrac{(0.593)(0.407)}{81} + \dfrac{(0.543)(0.457)}{81}} = 0.0777$. 2. We are willing to treat these samples of 81 games as independent SRSs from the respective populations of interest. The counts of successes and failures are all at least 5, so the z procedures should be fairly accurate. Our 90% CI is

$(p_1 - p_2) \pm z^* \text{SE} = (0.593 - 0.543) \pm 1.645(0.0777) = (-0.079, 0.177)$. We are 90% confident that the difference in the proportion of Diamondbacks' home and away wins is between winning 7.9% more away games and winning 17.7% more home games. 3. **Step 1:** Our hypotheses are $H_0 : p_1 = p_2$ vs.

c) Since the interval contains 0, home and away winning could likely be the same for Arizona.