AP Stats
Chap 20-21
Practice Test Name ______________________________ Pd ________

SECTION I

Number of Questions — 15
Percent of Total Grade — 50

Directions: Solve each of the following problems, using the available space (or extra paper) for scratchwork. Decide which is the best of the choices given and place that letter on the ScanTron sheet. No credit will be given for anything written on these pages for this part of the test. Do not spend too much time on any one problem.

Write the null and alternative hypotheses you would use to test the following situation.

1. A new manager, hired at a large warehouse, was told to reduce the 26% employee sick leave. The manager introduced a new incentive program for employees with perfect attendance. The manager decides to test the new program to see if it's better. What are the null and alternative hypotheses?
   A. H_0: $p > 0.26$
   H_A: $p < 0.26$
   B. H_0: $p = 0.26$
   H_A: $p < 0.26$
   C. H_0: $p < 0.26$
   H_A: $p = 0.26$
   D. H_0: $p = 0.26$
   H_A: $p > 0.26$
   E. H_0: $p = 0.26$
   H_A: $p \neq 0.26$

2. The U.S. Department of Labor and Statistics released the current unemployment rate of 5.3% for the month in the U.S. and claims the unemployment has not changed in the last two months. However, the states statistics reveal that there is a change in the U.S. unemployment rate. What are the null and alternative hypotheses?
   A. H_0: $p = 0.053$
   H_A: $p \neq 0.053$
   B. H_0: $p = 0.053$
   H_A: $p > 0.053$
   C. H_0: $p < 0.053$
   H_A: $p = 0.053$
   D. H_0: $p > 0.053$
   H_A: $p < 0.053$
   E. H_0: $p \neq 0.053$
   H_A: $p = 0.053$

Provide an appropriate response.

3. An entomologist writes an article in a scientific journal which claims that fewer than 12% of male fireflies are unable to produce light due to a genetic mutation. Identify the Type I error in this context.
   A. The error of failing to reject the claim that the true proportion is at least 12% when it is actually less than 12%.
   B. The error of failing to accept the claim that the true proportion is at least 12% when it is actually less than 12%.
   C. The error of accepting the claim that the true proportion is at least 12% when it really is at least 12%.
   D. The error of rejecting the claim that the true proportion is at least 12% when it really is at least 12%.
   E. The error of rejecting the claim that the true proportion is less than 12% when it really is less than 12%.

4. A survey investigates whether the proportion of 8% for employees who commute by car to work is higher than it was five years ago. Identify the Type II error in this context.
   A. The survey concludes that commuting by car is on the rise, but in fact there is no change in commuting.
   B. The product of the survey's sample size and sample proportion was less than 10.
   C. The survey concludes that commuting by car is on the rise since the commuting can only increase.
   D. The survey states there in no change in commuting, but in fact commuting by car is increasing.
   E. The survey sampled only a dozen employee commuters.

5. Suppose that a manufacturer is testing one of its machines to make sure that the machine is producing more than 97% good parts (H_0: $p = 0.97$ and H_A: $p > 0.97$). The test results in a P–value of 0.122. Unknown to the manufacturer, the machine is actually producing 99% good parts. What probably happens as a result of the testing?
   A. They correctly fail to reject H_0.
   B. They correctly reject H_0.
   C. They fail to reject H_0, making a Type I error.
   D. They fail to reject H_0, making a Type II error.
   E. They reject H_0, making a Type I error.

6. Not wanting to risk poor sales for a new soda flavor, a company decides to run one more taste test on potential customers, this time requiring a higher approval rating than they had for earlier tests. This higher standard of proof will increase
   I. the risk of Type I error
   II.the risk of Type II error
   III. power
   A. II only
   B. I and III
   C. I and II
   D. I only
   E. III only

7. We are about to test a hypothesis using data from a well-designed study. Which is true?
   I. A small P-value would be strong evidence against the null hypothesis.
   II. We can set a higher standard of proof by choosing $\alpha = 10\%$ instead of 5%.
   III. If we reduce the alpha level, we reduce the power of the test.
   A. None
   B. I and III only
   C. II only
   D. I only
   E. III only

8. To plan the course offerings for the next year a university department dean needs to estimate what impact the "No Child Left Behind" legislation might have on the teacher credentialing program. Historically, 40% of this university's pre-service teachers have qualified for paid internship positions each year. The Dean of Education looks at a random sample of internship applications to see what proportion indicate the applicant has achieved the content-mastery that is required for the internship. Based on these data he creates a 90% confidence interval of (33%, 41%). Could this confidence interval be used to test the hypothesis H_0: $p = 0.40$ versus H_A: $p < 0.40$ at the $\alpha = 0.05$ level of significance?
   A. Yes, since 40% is in the confidence interval he fails to reject the null hypothesis, concluding that there is not strong enough evidence of any change in the percent of qualified applicants.
   B. Yes, since 40% is in the confidence interval he accepts the null hypothesis, concluding that the percentage of applicants qualified for paid internship positions will stay the same.
   C. No, because the dean only reviewed a sample of the applicants instead of all of them.
   D. No, because he should have used a 95% confidence interval.
   E. Yes, since 40% is not the center of the confidence interval he rejects the null hypothesis, concluding that the percentage of qualified applicants will decrease.

Decide whether or not the conditions and assumptions for inference with the two-proportion z-test are satisfied. Explain your answer.

9. A researcher wishes to determine whether the proportion of American women who smoke differs from the proportion of American men who smoke. He wants to test the hypothesis H_0: $p_1 = p_2$ where p_1 represents the proportion of American women who smoke and p_2 represents the proportion of American men who smoke. He randomly selects 100 married couples. Among the 100 women in the sample are 21 smokers. Among the 100 men are 29 smokers. Are the assumptions for a two-sample z-test for two population proportions met? If not, which assumption is violated and why?
   A. The assumptions and conditions necessary for inference are not satisfied. The samples were not randomly selected
   B. The assumptions and conditions necessary for inference are not satisfied. Since married couples were surveyed, the two samples are not independent.
   C. The assumptions and conditions necessary for inference are satisfied.
   D. The assumptions and conditions necessary for inference are not satisfied. The 10% Condition for each sample is not satisfied.
   E. The assumptions and conditions necessary for inference are not satisfied. The number of successes among the sample of men is not more than 10.

Construct the indicated confidence interval for the difference in proportions. Assume that the samples are independent and that they have been randomly selected.

10. A survey of randomly chosen adults found that 36 of the 63 women and 42 of the 73 men follow regular exercise programs. Construct a 95% confidence interval for the difference in the proportions of women and men who have regular exercise programs.
    A. (–0.171, 0.163)
    B. (0.405, 0.738)
    C. (0.373, 0.770)
    D. (–0.202, 0.770)
    E. (–0.202, 0.738)

11. In a random sample of 500 people aged 20–24, 22% were smokers. In a random sample of 450 people aged 25–29, 14% were smokers. Construct a 95% confidence interval for the difference in smoking rates for the two groups.
    A. (0.025, 0.135)
    B. (0.035, 0.125)
    C. (0.032, 0.128)
    D. (0.048, 0.112)
    E. (0.032, 0.112)

Interpret the given confidence interval.

12. A study was conducted to determine if patients recovering from knee surgery should receive physical therapy two or three times per week. Suppose p_3 represents the proportion of patients who showed improvement after one month of therapy three times a week and p_2 represents the proportion of patients who showed improvement after one month of therapy twice a week. A 95% confidence interval for $p_3 - p_2$ is (0.18, 0.31). Give an interpretation of this confidence interval.
    A. We are 95% confident, based on the data, that patients who receive therapy three times per week show between 18% and 31% more improvement after one month than patients who receive therapy twice a week.
    B. We know that 95% of all knee–surgery patients will show between 18% and 31% more improvement with therapy three times per week instead of twice a week.
    C. We are 95% confident, based on the data, that the proportion of patients who show improvement with therapy three times per week is between 18% and 31% lower than the proportion who show improvement with therapy twice a week.
    D. We are 95% confident, based on the data, that the proportion of patients who show improvement with therapy three times per week is between 18% and 31% higher than the proportion who show improvement with therapy twice a week.
    E. We know that 95% of all knee–surgery patients will show between 18% and 31% more improvement with therapy twice a week instead of three times per week.

A two-sample z-test for two population proportions is to be performed using the P-value approach. The null hypothesis is $H_0: p_1 - p_2 = 0$ and the alternative is $H_a: p_1 - p_2 \neq 0$. Use the given sample data to find the P-value for the hypothesis test. Give an interpretation of the p-value.

13. $n_1 = 200$ $n_2 = 100$
$x_1 = 11$ $x_2 = 8$

A. P-value = 0.0201; If there is no difference in the proportions, there is about a 2.01% chance of seeing the observed difference or larger by natural sampling variation.
B. P-value = 0.1011; There is about a 10.11% chance that the two proportions are equal.
C. P-value = 0.402; If there is no difference in the proportions, there is about a 40.2% chance of seeing the observed difference or larger by natural sampling variation.
D. P-value = 0.402; If there is a difference in the proportions, there is a 40.2% chance of seeing the observed difference by natural sampling variation.
E. P-value = 0.0201; There is about a 2.01% chance that the two proportions are equal

14. The center in the city provided a weight loss for 152 out of 200 participants. The center in the suburb provided a weight loss for 109 out of 140 participants.

A. P-value = 0.6899; There is about a 68.99% chance that the two proportions are equal.
B. P-value = 0.6899; If there is no difference in the proportions, there is about a 68.99% chance of seeing the observed difference or larger by natural sampling variation.
C. P-value = 0.6554; If there is no difference in the proportions, there is about a 65.54% chance of seeing the observed difference or larger by natural sampling variation.
D. P-value = 0.3446; There is about a 34.46% chance that the two proportions are equal.
E. P-value = 0.3446; If there is no difference in the proportions, there is about a 34.46% chance of seeing the observed difference or larger by natural sampling variation.

Use a two proportion z-test to perform the required hypothesis test. State the conclusion.

15. Use the given sample data to test the claim that $p_1 > p_2$. Use a significance level of 0.05.

Sample 1	Sample 2
$n_1 = 85$	$n_2 = 90$
$x_1 = 38$	$x_2 = 23$

A. $H_0: p_1 - p_2 = 0$ $H_A: p_1 - p_2 > 0$
Test statistic: z = 2.66
P-value = 0.00394
Reject the null hypothesis. There is sufficient evidence to support the claim that $p_1 > p_2$.

B. $H_0: p_1 - p_2 = 0$ $H_A: p_1 - p_2 \neq 0$
Test statistic: z = 2.66
P-value = 0.00788
Reject the null hypothesis. There is sufficient evidence to support the claim that $p_1 \neq p_2$.

C. $H_0: p_1 - p_2 = 0$ $H_A: p_1 - p_2 > 0$
Test statistic: z = 2.66
P-value = 0.00788
Reject the null hypothesis. There is sufficient evidence to support the claim that $p_1 > p_2$.

D. $H_0: p_1 - p_2 = 0$ $H_A: p_1 - p_2 < 0$
Test statistic: z = 2.66
P-value = 0.99606
Fail to reject the null hypothesis. There is not sufficient evidence to support the claim that $p_1 < p_2$.

E. $H_0: p_1 - p_2 = 0$ $H_A: p_1 - p_2 > 0$
Test statistic: z = 2.66
P-value = 0.99606
Fail to reject the null hypothesis. There is not sufficient evidence to support the claim that $p_1 > p_2$.