AP Statistics
Review Ch. 9 #2 (difference of proportions)

1. A researcher is testing $H_0: p_1 = p_2$ vs $H_a: p_1 \neq p_2$. In Sample 1, 40 out of 100 people said "Yes." In Sample 2, 60 out of 200 people said "Yes." What is the combined proportion $\hat{p}_c$?

   (a) 0.50 (b) 0.33 (c) 0.40 (d) 0.30 (e) 0.35

2. Which of the following is a required condition for a two-sample z-test for the difference in proportions?

   (a) The population distributions must be approximately Normal.
   (b) $n_1 p_1 \geq 10$ and $n_2 p_2 \geq 10$ using the hypothesized proportions.
   (c) The two samples must be independent of each other.
   (d) The sample sizes n_1 and n_2 must be equal.
   (e) The population standard deviations must be known.

3. A school board is considering a new dress code. They survey 50 teachers (40 in favor) and 100 students (60 in favor). A 99% confidence interval for $p_T - p_S$ is $(0.015, 0.385)$. Based on this interval, what can be concluded about the test $H_0: p_T = p_S$ vs $H_a: p_T \neq p_S$ at the $\alpha = 0.01$ level?

   (a) Fail to reject H_0 because 0 is not in the interval.
   (b) Reject H_0 because 0 is not in the interval.
   (c) Fail to reject H_0 because 0.20 is in the interval.
   (d) Reject H_0 because the interval is entirely positive.
   (e) No conclusion can be made because the sample sizes are unequal.

4. A Type II error in the context of comparing two proportions would be:

   (a) Concluding the proportions are different when they are actually the same.
   (b) Concluding the proportions are the same when they are actually different.
   (c) Finding a p-value that is smaller than the alpha level.
   (d) Using a pooled proportion when a confidence interval was requested.
   (e) Failing to reject the null hypothesis when the null hypothesis is true.

5. A test of $H_0: p_1 = p_2$ vs $H_a: p_1 > p_2$ yields a p -value of 0.024 . Which statement is the most appropriate conclusion?

   (a) The probability that H_0 is true is 0.024 .
   (b) If H_a is true, the probability of getting this sample result is 0.024 .
   (c) If H_0 is true, the probability of getting a difference in proportions as large as or larger than the one observed is 0.024 .
   (d) There is a 97.6% chance that p_1 is greater than p_2.
   (e) Reject H_0 at the $\alpha = 0.01$ significance level.

6. Which of the following represents the correct Standard Error used in the denominator of a two-sample z-test for $p_1 - p_2$?

(a) $\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$ (b) $\frac{\hat{p}_1(1-\hat{p}_1)}{\sqrt{n_1}} + \frac{\hat{p}_2(1-\hat{p}_2)}{\sqrt{n_2}}$ (c) $\sqrt{\hat{p}_c(1-\hat{p}_c)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$ (d) $\sqrt{\frac{\hat{p}_c(1-\hat{p}_c)}{n_1+n_2}}$

(e) $\frac{\hat{p}_1-\hat{p}_2}{\text{SE}}$

7. To increase the Power of a test comparing two proportions, a researcher could:

(a) Decrease the sample sizes n_1 and n_2.
(b) Decrease the significance level α from 0.05 to 0.01 .
(c) Increase the significance level α from 0.05 to 0.10 .
(d) Choose an alternative hypothesis closer to the null value.
(e) Use a two-tailed test instead of a one-tailed test.

8. In a test of $H_0: p_1 = p_2$ vs $H_a: p_1 < p_2$, a test statistic of $z = -2.15$ is calculated. What is the P -value?

(a) 0.0316 (b) 0.0158 (c) 0.9842 (d) 0.0079 (e) 0.4842

9. When checking the Large Counts condition for a 2 -sample z-test, which values of n and p are typically used?

(a) $n_1, \hat{p}_1$ and $n_2, \hat{p}_2$ (b) $n_1, p_{\text{hypothesized}}$ and $n_2, p_{\text{hypothesized}}$ (c) $n_1, \hat{p}_c$ and $n_2, \hat{p}_c$

(d) $(n_1 + n_2)$ and $\hat{p}_c$ (e) Only the sample sizes n_1 and n_2 are needed.

10. A researcher finds a 90% confidence interval for $p_A - p_B$ is $(0.02, 0.08)$. Which of the following must be true for a test of $H_0: p_A = p_B$ vs $H_a: p_A \neq p_B$ at $\alpha = 0.10$?

(a) The P-value > 0.10 . (b) The P -value < 0.10. (c) The P -value < 0.05.

(d) The P-value $= 0.05$. (e) The test statistic z is negative.

11. Which of the following is the most likely consequence of decreasing the significance level α from 0.05 to 0.01 ?

(a) Power increases, and P (Type II error) increases.
(b) Power decreases, and P(Type II error) increases.
(c) Power increases, and P(Type II error) decreases.
(d) Power decreases, and P(Type II error) decreases.
(e) The p-value of the test will decrease.

12. An SRS of 100 students at School X shows 30% favor a new schedule. An SRS of 100 students at School Y shows 40% favor it. What is the standard error for a test of $H_0: p_X = p_Y$?

(a) $\sqrt{\frac{0.3(0.7)}{100}+\frac{0.4(0.6)}{100}}$ (b) $\sqrt{\frac{0.35(0.65)}{100}+\frac{0.35(0.65)}{100}}$ (c) $\sqrt{\frac{0.7(0.3)}{200}}$

(d) $\frac{0.3(0.7)}{100}+\frac{0.4(0.6)}{100}$ (e) $0.35 \pm 1.96(\text{SE})$

13. A study is conducted to see if a new vaccine is more effective than an old one ($p_{\text{new}} > p_{\text{old}}$). The test yields $z = 1.25$. At $\alpha = 0.05$, the researcher should:

(a) Reject H_0 because $1.25 > 0.05$.
(b) Fail to reject H_0 because the p -value (0.1056) is greater than 0.05 .
(c) Reject H_0 because the p -value (0.1056) is greater than 0.05 .
(d) Fail to reject H_0 because 1.25 is less than 1.645.
(e) Both (b) and (d) are correct.

14. A 2 -sample z-test for $p_1 - p_2$ is performed and H_0 is rejected at $\alpha = 0.05$. Which of the following is NOT a possible p-value for this test?

(a) 0.049 (b) 0.001 (c) 0.051 (d) 0.025 (e) 0.033

15. A cereal brand wants to see if a prize inside the box increases sales. In 50 stores with the prize, 20% of stock was sold. In 50 stores without the prize, 15% of stock was sold. If the test yields a p-value of 0.08 , what would be a Type I error in this context?

(a) Concluding the prize increases sales when it actually does.
(b) Concluding the prize doesn't increase sales when it actually does.
(c) Concluding the prize increases sales when it actually does not.
(d) Concluding sales are 5% higher regardless of the prize.
(e) Failing to reject the null hypothesis.

16. A factory manager compares the defect rate of two machines. Machine 1 had 5 defects in 200 items, and Machine 2 had 12 defects in 300 items. To test if Machine 2 has a higher defect rate, which is the correct alternative hypothesis?

(a) $H_a: p_1 - p_2 > 0$ (b) $H_a: \hat{p}_1 < \hat{p}_2$ (c) $H_a: p_1 < p_2$ (d) $H_a: p_1 \neq p_2$ (e) $H_a: p_1 = p_2$

17. A department store compares the return rate of items bought online (p_1) vs. in-store (p_2). A 95% confidence interval for $p_1 - p_2$ is (0.04,0.10). Which of the following P -values is most likely for the test $H_0: p_1 = p_2$ vs $H_a: p_1 \neq p_2$?

(a) 0.450 (b) 0.150 (c) 0.070 (d) 0.002 (e) 0.950

1. b 2. c 3. b 4. b 5. c 6. c 7. c 8. b 9. c 10. b 11. b 12. b

13. b or d 14. c 15. c 16. c 17. d