

STAT303 Sec. 508-510
Fall 2010
Exam #3
Form A

April 11, 2011

1. **Don't even open this until you are told to do so.**
2. There are 20 multiple-choice questions on this exam, each worth 5 points. There is partial credit. Please mark your answers **clearly**. Multiple marks will be counted wrong.
3. You will have 60 minutes to finish this exam.
4. If you have questions, please write out what you are thinking on the back of the page so that we can discuss it after I return it to you.
5. If you are caught cheating or helping someone to cheat on this exam, you both will receive a grade of **zero** on the exam. You must work alone.
6. When you are finished please make sure you have marked your CORRECT section (Tuesday 12:45 is 508, 2:20 is 509, and 3:55 is 510) and FORM and 20 answers, then turn in JUST your scantron.
7. Good luck!

1. Which of the following expressions is equivalent to 'how likely am I to get a sample proportion of 25% or more if the distribution of the proportions is $p_{30} \sim N(0.35, 0.087^2)$ '?

- A. $P(Z > p_{30})$
- B. $P(p_{30} > (0.25 - 0.35)/\sqrt{(0.35(1 - 0.35)/30)})$
- C. $P(p_{30} > (0.35 - 0.25)/\sqrt{(0.25(1 - 0.25)/30)})$
- D. $P(Z > (0.25 - 0.35)/\sqrt{(0.35(1 - 0.35)/30)})$
- E. Words and math don't equate.

2. Are Nano iPods more reliable than the early version, Mini iPods? Which set of hypotheses would we use to test this given that the π 's are the percent FAILURE for each model?

- A. $H_0: \pi_{Nano} = \pi_{Mini}$ vs. $H_A: \pi_{Nano} \neq \pi_{Mini}$
- B. $H_0: \pi_{Nano} = \pi_{Mini}$ vs. $H_A: \pi_{Nano} > \pi_{Mini}$
- C. $H_0: \pi_{Nano} = \pi_{Mini}$ vs. $H_A: \pi_{Nano} < \pi_{Mini}$
- D. $H_0: \pi_{Nano} = 0.5$ vs. $H_A: \pi_{Nano} \neq 0.5$
- E. A and D are the same test.

3. Ok, here is some output for comparing Nano's to Mini's (this may or may not be the same hypothesis test as the previous question). In this, however, we compared the proportion of successes (non-failures)?

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p1 - p2: difference in proportions
H0 : p1 - p2 = 0
HA : p1 - p2 not = 0
Difference C1 T1 C2 T2 Diff.
p1 - p2    318 330 356 385 0.0390
                SE    Z-Stat P-value
                0.01744  2.23  0.0255
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What is the correct conclusion given the first sample is Nano's (so the second sample is Mini's)?

- A. Since the p -value is 0.0255, we can conclude that there is a relationship between reliability and model of iPod.
 - B. Since the p -value is 0.0255, we can conclude that the Nano has a different reliability percentage than the Mini.
 - C. Since the p -value is 0.01275, we can conclude that the Nano is more reliable than the Mini.
 - D. All of the above are correct conclusions.
 - E. Only two of the above are correct conclusions.
4. Suppose $p_{125} \sim N(0.4, 0.098^2)$ and $p_{230} \sim N(0.35, 0.087^2)$ what is the distribution of $p_{125} - p_{230}$?
- A. $p_{125} - p_{230} \sim N(0.05, 0.131^2)$
 - B. $p_{125} - p_{230} \sim N(0.05, 0.017^2)$
 - C. $p_{125} - p_{230} \sim N(0.05, 0.185^2)$
 - D. $p_{125} - p_{230} \sim N(0.75, 0.185^2)$
 - E. We can't say the distribution is normal since the first sample size is only 25.

5. In the fall of 2003, a magazine article reported that about 85% of adults drink milk. A local dairy farmers' association is planning a new marketing campaign for the tri-county area they represent. They randomly polled 800 people in the area. In this sample, 674 people said that they drink milk. Do the local dairy farmer's have reason to believe that the true percentage of adults who drink milk is really less than 85%?

- A. We can't tell if the data is normal, so we can't run a z -test.
- B. The p -value is 0.27, so there is insufficient proof that the true percentage of adults who drink milk is really less than 85%.
- C. The p -value is 0.6, so there is sufficient proof at the 10% level that the true percentage of adults who drink milk is really less than 85%.
- D. The p -value is 0.6, so there is insufficient proof that the true percentage of adults who drink milk is really less than 85%.
- E. The p -value is 0.27, so there is sufficient proof at the 5% level that the true percentage of adults who drink milk is really less than 85%.

6. Say the p -value for the previous test was actually 0.38 (this has nothing to do with the data above). How should the farmer's interpret this value?

- A. Their poll was only 38% accurate.
- B. Assuming the adult milk drinking population stays constant, repeated polling would produce a sample proportion of 85% or less about 38% of the time.
- C. Assuming the adult milk drinking population stays constant, repeated polling would produce a sample proportion of 85% or less 38% of the time when the true proportion was about 84%.
- D. Assuming the adult milk drinking population stays constant, repeated polling would produce a sample proportion of about 84% or less 38% of the time even though the true proportion was at least 85%.
- E. Assuming the adult milk drinking population stays constant, repeated polling would produce a sample proportion of at least 84% about 38% of the time when the true proportion was 85%.

7. If the farmer's find that the true percentage of adult milk drinkers is less than 85%, they will double their marketing budget to increase this number. Which of the following would be a Type I error?
- The farmer's spend the extra money but they didn't need to because the true percent was over 85%.
 - The farmer's don't spend the extra money but the true percent was under 85%.
 - The farmer's spend the extra money but they didn't need to because the true percent was under 85%.
 - The farmer's don't spend the extra money because they found the true percent was over 85%.
 - The farmer's spend the extra money but mad cow disease ruins their production so they lose even more money.
8. What is the correct range of the p -value for testing $H_0 : \pi_1 = \pi_2$ vs. $H_A : \pi_1 \neq \pi_2$ given these three confidence intervals?
- 90%: (0.0564, 0.460)
 95%: (0.0178, 0.499)
 99%: (-0.0578, 0.574)
- $p\text{-value} > 0.10$
 - $0.10 > p\text{-value} > 0.05$
 - $0.05 > p\text{-value} > 0.01$
 - $p\text{-value} < 0.01$
 - Although you don't need a hypothesized value to determine the p -value for MEANs, you do have to have one for testing proportions.
9. What is the best interpretation for the 95% confidence interval in the previous problem, (0.0178, 0.499)?
- 95% of the time, in repeated sampling from the same population, the true proportion, π , will be positive since this interval only contains positive values.
 - The probability of getting a positive true proportion, π , is 95%.
 - If we repeatedly sampled the same population, we would get positive intervals like this one 95% of the time.
 - If we repeatedly sampled the same population, we would be 95% confident that all of our intervals would contain the true proportion, π .
 - Two of the above are correct interpretations.
10. If $p_{60} \sim N(0.25, 0.0559^2)$, how likely are we to get a sample proportion of 30% or less?
- 0.8945
 - 0.8133
 - 0.1867
 - 0.1055
 - 1
11. Suppose we test $H_0 : \pi = 0.20$ vs. $H_A : \pi \neq 0.20$. Our number of successes is 15 out of 50, so our p -value is 0.0768. Which of the following is true?
- 0.3 would be in a 95 and 99% confidence interval, but not in a 90%.
 - We can claim that the true proportion is 20% at the 1 and 5% levels.
 - The p -value is 0.1536 for the two-sided, not equal, test, so we can't say the true proportion is 20%.
 - All of the above are true.
 - None of the above are true.
12. If we had gotten only 12 successes in the test above, what would happen?
- The p -value would stay the same since it's the same test.
 - The p -value would increase because the alternative is now more believable.
 - The p -value would decrease because the alternative is now more believable.
 - The p -value would decrease because the alternative is now less believable.
 - The p -value would increase because the alternative is now less believable.
13. If we tested $H_0 : \pi \leq 0.20$ vs. $H_A : \pi > 0.20$ instead, which of the following situations would cause a Type II error?
- the p -value is 0.005 and the true π is 15%
 - the p -value is 0.005 and the true π is 25%
 - the p -value is 0.35 and the true π is 15%
 - the p -value is 0.35 and the true π is 25%
 - We don't compare the p -value to π .
14. What are the z critical values, the $z_{\alpha/2}$, for a 25% confidence interval?
- ± 0.32
 - ± 0.354
 - ± 0.675
 - ± 0.40
 - ± 0.375

Model	OK	Failed	Total
Click Wheel	1117	272	1389
Photo	470	158	628
with Color	865	108	973
Video	830	68	898
Mini	356	29	385
Shuffle	468	19	487
Nano	318	12	330
Total	4424	666	5090

Statistic	DF	Value	P-value
Chi-square	6	231.89491	<0.0001

15. Assuming this table is representative of all 70 million iPods sold in the last 5 years, how likely are you to get a 'bad' Photo iPod?

- A. 158/628
- B. 158/666
- C. 158/5090
- D. 628/5090
- E. 666/5090

16. If your iPod failed, how likely was it a Nano?

- A. 12/5090
- B. 12/330
- C. 12/666
- D. 330*666/5090
- E. 12/(330*666)

17. Does there seem to be a difference in the failure rates for the different models?

- A. All we can say is that they independent or not.
- B. The χ^2 test proves there is some relationship between the failure rates and the different models, so the two things are not related (there's no difference).
- C. The χ^2 test proves there is no difference between the failure rates and the different models.
- D. The χ^2 test proves there is some relationship between the failure rates and the different models, so yes, there is some difference.
- E. The χ^2 test provides insufficient evidence to claim the two things are independent, so yes, the failure rates are different for the different models.

18. The size of a sample, n , affects

- A. whether the sample proportion is biased or not because $p = x/n$.
- B. whether the shape of the sampling distribution of the sample proportion, p , is normal or not.

- C. whether we use the standard error of the sample proportion, p , or the standard deviation.
- D. All of the above are true.
- E. Only two of the above are true.

19. Mars Candy Co. submits that within each package of Milk Chocolate M&M's there should be approximately 24% blue, 14% brown, 16% green, 20% orange, 12% red, and 14% yellow M&M's.

Hypothesis test results:

p : proportion of successes for population

H_0 : $p = 0.14$

H_A : $p \text{ not } = 0.14$

Proportion	Count	Total	Sample Prop.	Std. Err.
p	8	100	0.08	0.034698702
			Z-Stat	P-value
			-1.73	0.0838

- A. Since the p -value is 0.0838 is greater than 0.05 the conclusion is fail to reject the null. Therefore, the manufacturer's claim that 14% of the candies are yellow is supported.
- B. Since the p -value is 0.8 is greater than 0.05 the conclusion is fail to reject the null. Therefore, the manufacturer's claim that 14% of the candies are yellow is supported.
- C. Since the p -value is 0.0838 is greater than 0.05 the conclusion is fail to reject the null. Therefore, we cannot refute the manufacturer's claim that 14% of the candies are yellow.
- D. The conditions for normality are not met.
- E. The claim that they melt in your mouth and not in your hand remains inconclusive at best.

20. If I reject at the 10% significance level, then

- A. I would also reject at the 1 and 5% levels.
- B. I would fail to reject at the 1 and 5% levels.
- C. I have very strong evidence against the null hypothesis.
- D. Two of the above are correct.
- E. None of the above are correct.

1D,2C,3E,4A,5B,6D,7A,8C,9D,10B,11E,12E,13D,14A,15C,16C,17D,18B,19C,20E