Math 247: Test 3 **Name:** KEY

Review:_____/ 10 Test:_____/ 90 Final score _____/100

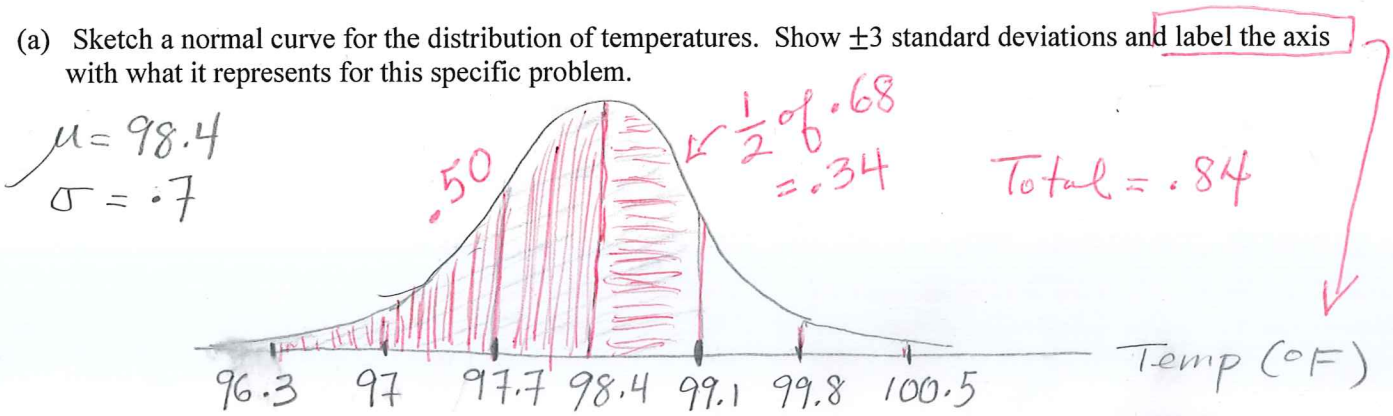
1. (5 pts) What is a P-value? A P-value is the probability of getting an observed value IF the null hypothesis is true.

2. (4 pts) Is $\hat{p}$ (a statistic) or a parameter? (Circle the answer.)

3. (4 pts) Statistical inference means we take information from a Sample and use it to make conclusions about a population

4. (12 pts) Temperatures. Healthy women have a mean body temperature of 98.4°F, with a standard deviation of .7°F

4 (a) Sketch a normal curve for the distribution of temperatures. Show ±3 standard deviations and label the axis with what it represents for this specific problem.

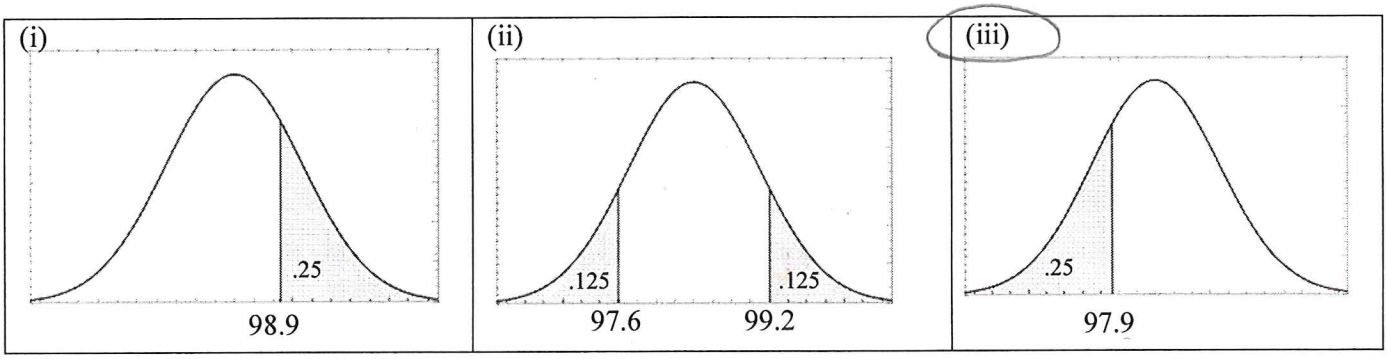


2 (b) Shade the region that represents the percentage of healthy women with temperatures below 99.1°F.

2 (c) Which of the following is the best estimate of the percentage of women with temperatures below 99.1°F (Circle the best answer)

(i) 50% (ii) 68% no (iii) 32% (iv) 84%

4 (d) Using the same original information (go back to the top), select the curve below that gives the 25th percentile for women's temperatures and use to answer the question (include units!):



The 25th percentile for the body temperature of healthy women is 97.9°F (unclear)

5. (6 pts) During the presidential primaries last year, a poll found that 45% of Democrat voters in Indiana favored Bernie Sanders while 48% favored Hillary Clinton. The margin of error was 4.5%. Which of the following would be the correct inference we can make from these results?

-6 (a) Clinton was ahead, from a statistical standpoint.

-6 (b) Sanders was ahead, from a statistical standpoint.

-2 (c) Clinton and Sanders were favored by exactly the same proportion of voters, from a statistical standpoint.

(d) We can't tell from this data who was ahead, from a statistical standpoint.

6. (15 pts) The Public Policy Institute of California conducted a poll with 1,023 people and found that 73% of California residents in the sample thought community college should be free.

9 (a) Find the 90% confidence interval for the population proportion of California residents who think community college should be free. z* values are provided.

Confidence Level	z^*
80%	1.282
90%	1.645
95%	1.960
99%	2.576

1 $n = 1023$

1 $\hat{p} = .73$

1 $z^* = 1.645$

2 $SE \approx \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

$= \sqrt{\frac{.73(.27)}{1023}}$

$= .014$

4 CI: $\hat{p} \pm z^* SE$

$.73 \pm 1.645(.014)$

$.73 \pm .023$

$(.73 - .023, .73 + .023)$

$(.707, .753)$

4 (b) Interpret the confidence interval from (a) in the context of the problem.

We are 90% confident that between 70.7% and 75.3% of all Californians favor free community college.

2 (c) If the sample size were larger, would the margin of error be larger or smaller?

7. (12 pts) According to studies done in the 1940s, 29% of people dream in color. Suppose a researcher wanted to check whether this proportion has changed (is now different from 29%) and drew a random sample of 200 people to see how many reported dreaming in color.

3 (a) What would the null and alternative hypotheses be for a Hypothesis Test? Write the hypotheses in symbols and also in words.

$H_0: p = .29$ The proportion of color dreamers is the same now as in 1940's

$H_a: p \neq .29$ The proportion has changed.

↑ Two-tailed test

6 (b) Check whether the assumptions for the Central Limit Theorem are satisfied by this sample. For credit, give a justification (explain) for your answer on each assumption. Don't simply write "yes" or "no".

(1) Random Sample? Yes, stated in problem

(2) Independent? Assuming no family members (genetic link) then yes.

Joey: Best answer! "One person dreaming in color does not affect the others dreaming in color"

(3) Large sample? $np_0 = 200(.29) = 58 \geq 10$? yes

$n(1-p_0) = 142 \geq 10$? yes

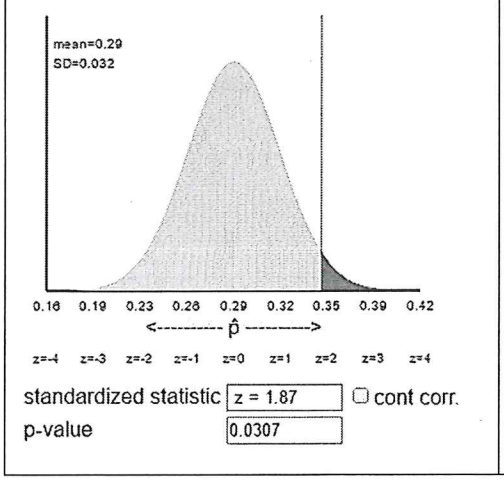
(4) Large population? $10 \cdot n = 10(200) = 2000$

The population of all people > 2000? yes!

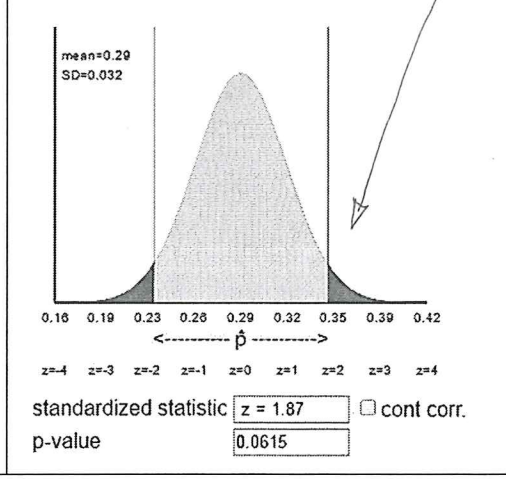
3 (c) If 70 people in the sample ~~people in the sample~~ reported dreaming in color, which of the following would represent the correct computation step for the hypothesis test?

$\hat{p} = \frac{70}{200} = .35$ and Two-Tailed Test

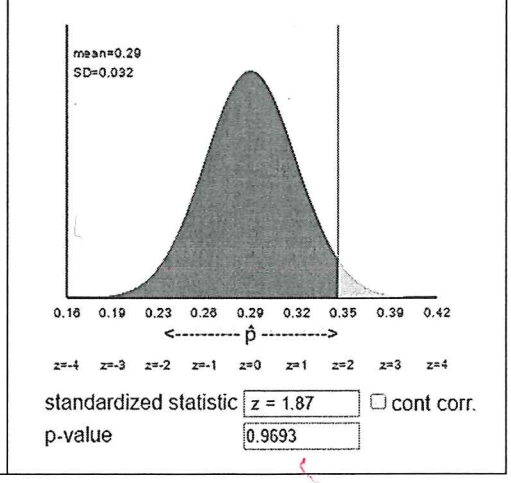
(i)



(ii)



(iii)



8. (14 pts) A new drug is being proposed for the treatment of migraine headaches. Unfortunately, some users in early tests of the drug reported mild nausea as a side effect. The FDA will reject the drug if there is significant evidence that more than 15% of the population would suffer from this side effect. To test this, a researcher draws a random sample of 400 people who suffer from migraine headaches and gives them the drug. Sixty-eight people in the sample report having nausea.

8 (a) Conduct steps 1 and 3 of a Hypothesis Test to see whether the FDA will reject the drug. (The P-value will be given in the next part of this problem.) You do not have to check the assumptions for conducting the test; i.e., skip step 2. Use a significance level of .05.

For full credit, include a sketch of the sampling distribution for $\hat{p}$ with two axes. Shade in the area that represents the P-value.

Parking Lot

$p_0 = .15$
$n = 400$
$X = 68$ success (nausea)
$\hat{p} = \frac{68}{400} = .17$

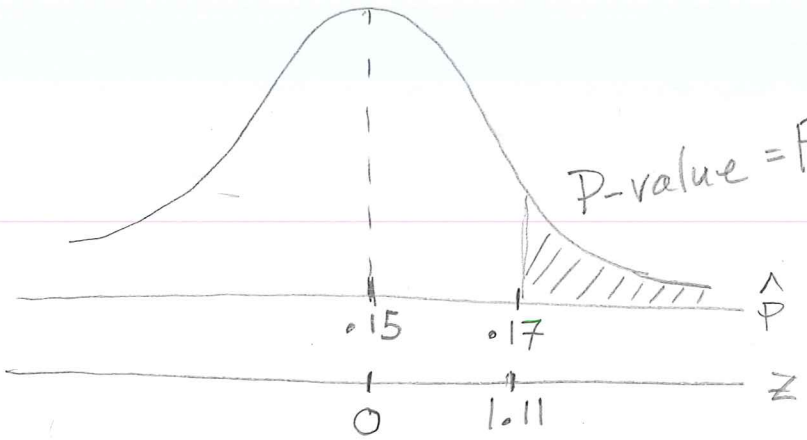
(1) $H_0: p = .15$
$H_a: p > .15$

(3) $SE = \sqrt{\frac{p_0(1-p_0)}{n}} = \sqrt{\frac{.15(.85)}{400}}$

$SE = .018$

$z = \frac{\hat{p} - p_0}{SE} = \frac{.17 - .15}{.018}$

$z = 1.111$



6 (b) Using technology, the P-value is found to be .1313. Finish the Hypothesis Test using this information.

(4) 2 (a) Fail to reject H_0 ($.1313 > .05$)

4 (b) There is not significant evidence that more than 15% of users will experience nausea as a side effect from this drug.

(Practically speaking, the drug could now be approved by the FDA, but I'm guessing the real tests would be stricter than this.)

9. (7 pts) Suppose you wanted to test balance in athletes vs. non-athletes. You believe that athletes have better balance. You test a random sample of athletes at Cuesta by having them stand on one foot with their eyes closed and find the proportion who can balance thus for 1 minute. Then you test a second random sample on non-athletes at Cuesta in the same way.

3 (a) Which type of Hypothesis Test would you use for this problem?

One Proportion z-Test Two Proportions z-Test

4 (b) Hypotheses: (You can use just symbols, but label the proportions according to the group they represent.)

none ⇒ -3

H_0: $p_{athletes} = p_{non\text{-}athletes}$

H_a: $p_{athletes} > p_{non\text{-}athletes}$

p_a = proportion of athletes who can balance for 1 minute

p_n = proportion of non-athletes who can balance for 1 minute

10. (11 pts) A Gallup poll found in February, 1999, 60% of people in a sample of 560 said they favored stricter gun control. In April, 1999, after the shootings at Columbine High School, Gallup found that 66% of people in a sample of 560 favored gun control.

The hypotheses for the test of whether this poll provided significant evidence that opinion had changed are

H_0 : $P_{before} = P_{after}$ proportion of people who favored stricter gun control before Columbine was the same as the proportion after Columbine

H_a : $P_{before} \neq P_{after}$ the proportions have changed; either a lower proportion favor stricter gun control or a higher proportion does.

4 (a) Write what these hypotheses mean in words (write your answer next to the hypotheses).

3 (b) Is this a One-Tailed or Two-Tailed Hypothesis Test?

4 (c) The P-value for the hypothesis test is .003. Interpret the P-value in the context of the problem (i.e., finish the Hypothesis Test).

(2) (a) Reject H_0 ($.003 < .05$)

(2) (b) There was a significant change in the proportion of people who favored stricter gun control.