Math 247: Test 3 (Wright, Fall 2019) **Name:** KEY

In-Class Test:__________/ 100 **Class Time:** __________

1. (3 pts) Determine which of the following variables is continuous and which is discrete (circle the answer):

   X = the number you get when you roll a die. DISCRETE CONTINUOUS

   X = the temperature of a healthy woman DISCRETE CONTINUOUS

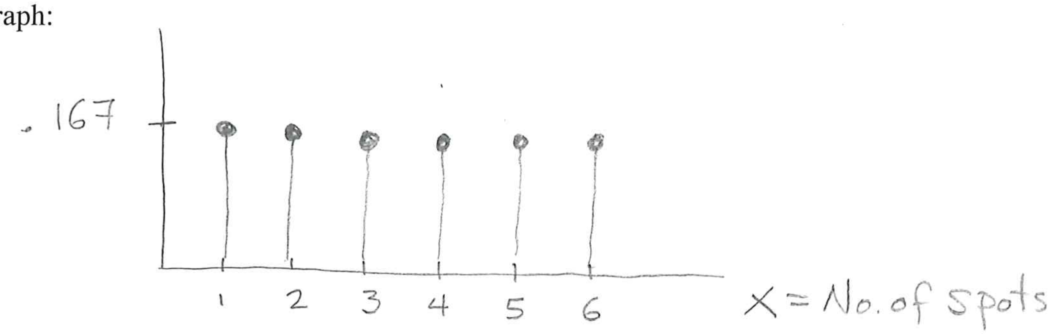
2. (8 pts) Suppose you roll a six-sided die. Let X = the number of spots showing.

   Make a table and a graph for the probability distribution of X.

X = number of spots	1	2	3	4	5	6
P(x)	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$

Note: $\frac{1}{6} = .167$

Graph:



3. (8 pts) Suppose you conducted a survey by walking around campus and asking 50 students whether they support free community college.

5 (a) Would this be a random sample of Cuesta students? Explain why it is, or is not, a random sample.

No, this is not a random sample of Cuesta students because not every student is equally likely to be chosen. Many groups would also be missed by this (online students, for example).

Note: This is not a "sample of convenience" either!

3 (b) If you used this as a sample to represent all SLO county residents, would your results likely have…

positive bias negative bia no bias can't tell

4. (4 pts) If you scored right at the top 3% on an exam, which of the following would be true (there may be more than one correct answer…circle the correct answer(s)).

   (a) Your score was at the 3rd percentile.

   (b) Your score was at the 97th percentile.

   (c) You scored a 97% on the exam

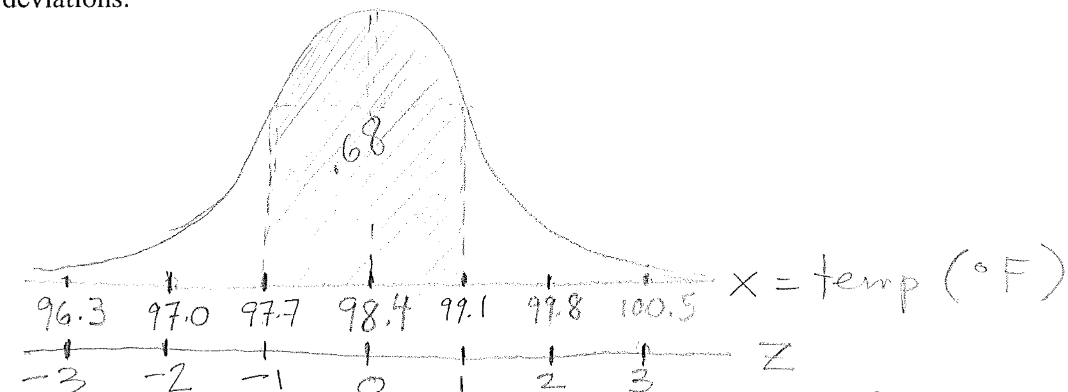
   (d) You scored a 3% on the exam

   (e) You did better than 97% of the other people who took the exam.

5. (18 pts) A study of human body temperatures using healthy women showed a mean of 98.4°F and a standard deviation of about 0.70°F. Assume the tempeatures are approximately Normally distributed.

6 (a) Sketch a normal curve N(98.4, 0.7) showing the distribution of temperatures. Incude the z-axis, and tick marks based on standard deviations.

$\mu = 98.4$ °F
$\sigma = .70$ °F



1 (b) Shade the region that represents the percentage of healthy women with termperatures between 97.7 °F and 99.1°F

2 (c) Which of the following is the best estimate of this percentage? (Circle the best answer)

(i) 50% (ii) 68% (iii) 16% (iv) 32%

4 (d) Find the z-score for a temperature of 97.0°F.

$$Z = \frac{x-\mu}{\sigma} = \frac{97-98.4}{.7}$$

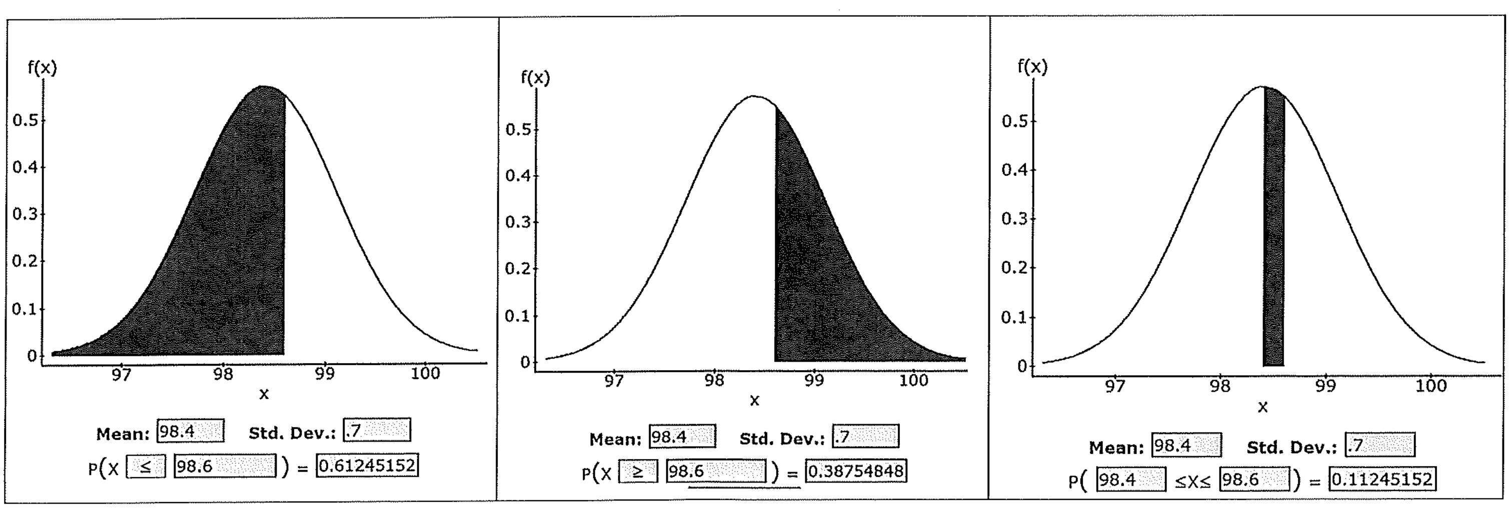
$$Z = -2$$

2 (e) Is this an unusual temperature for a healthy woman to have? Explain how you can tell using the z-score.

Yes, since 97.0°F is 2 S.D.'s below the mean, this is an unusual temp for a healthy woman.

3 (f) Find the probability that a healthy woman would have a temperature of 98.6°F or higher by choosing the appropriate graph below:

Answer: $P(x \geq 98.6) = .388 = 38.8\%$



6. (4 pts) Statistical inference includes which of the following (circle the correct answer):

(a) ~~Using a sample to prove that something is true about a population with 100% certainty~~

(b) ~~Using a sample to prove that something is false about a population with 100% certainty~~

(c) Using a data from a sample to find out something about a population without ever having 100% certainty of the results.

(d) ~~Using a sample to prove something about the sample.~~

7. (6 pts) Suppose in conducting a study, you've done everything correctly in gathering data, in doing the analysis via hypothesis testing, then in forming a conclusion based on the P-value.

There is still the possibility, due to sampling variability, that the evidence led you to a conclusion that is incorrect.

If the evidence led you to reject the null hypothesis, you could have made a Type I error.

If the evidence led you to not reject the null hypothesis, you could have made a Type II error.

8. (8 pts) What are the 3 conditions that have to be satisfied to be able to use the Central Limit Theorem for propotions?

1. Random sample and independent observations

2. Large sample. $E = np \geq 10$ (Expected successes at least 10)
At least 10 expected counts in each group.
$E = n(1-p) \geq 10$ (Expected failures at least 10)

3. Large population
Population at least 10 times the sample size.

This Theorem tells us that the Sampling Distribution of $\hat{p}$ is approximately NORMAL as long as the conditions are met.

9. (3 pts) What doe a P-value from a hypothesis test tell us?

The P-value tells us a probability.

The probability is based on the assumption that the null hypothesis is true.

Given that the null is true, the P-value tells us how likely it would be to get a value as or more extreme as the observed value (technically, the "test statistic") due to just sampling variability.

10. (4 pts) What is the relationship between the P-value for a one-tailed test and the P-value for a two-tailed test, assuming you are using the same hypotheses and data?

The P-value for the TWO-Tailed test is 2 times the P-value for the One-Tailed test.

one-tailed (Ex. Right-tail)  P-value

two-tailed  P-value

11. (40 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 significantly more than 10% of the population would suffer from this side effect. To test this, a researcher draws a random sample of 200 people who suffer from migraine headaches and gives them the drug. 26 people in the sample report having nausea.

Conduct all 4 steps of the hypothesis test to see whether the data provides evidence that more than 10% of all potetial users will experience nausea from this drug. Use a significance level of .05.

(8) Step 1: Hypothesize

(For full credit, write hypotheses using words and symbols)

$H_0: p = .10$ 10% of the population will get nausea from the drug

$H_a: p > .10$ More than 10% of the population will get nausea from the drug

p = proportion of ALL users who would get nauseated.

(10) Step 2: Prepare (Plan!)

(For full credit, include what a "success" is and what the population is in this problem.)

"Success" = a person getting nausea from drug

"Population" = people with migraines

Set $\alpha = .05$

Choose test: One Proportion z-Test

Check Conditions:

1. Random sample? Stated

   Independent observations? Assume

2. Large sample? Expected count at least 10 per group?

   Success: $E = np_0 = 200(.10) = 20 \geq 10$ yes

   Failure: $E = n(1-p_0) = 200(.90) = 180 \geq 10$ yes

3. Large population?

   $Pop \geq 10(200) = 2000$

   Yes, there are at least 2000 people who suffer from migraines.

(13) Step 3: Compute

For full credit on this step, do all work by hand, up to finding the P-value. Include a sketch of the sampling distribution for $\hat{p}$. Show your work in finding the test-statistic. Shade in the area that represents the P-value.

$n = 200$

$x = 26$

$\hat{p} = \frac{26}{200} = .13$

$p_0 = .10$

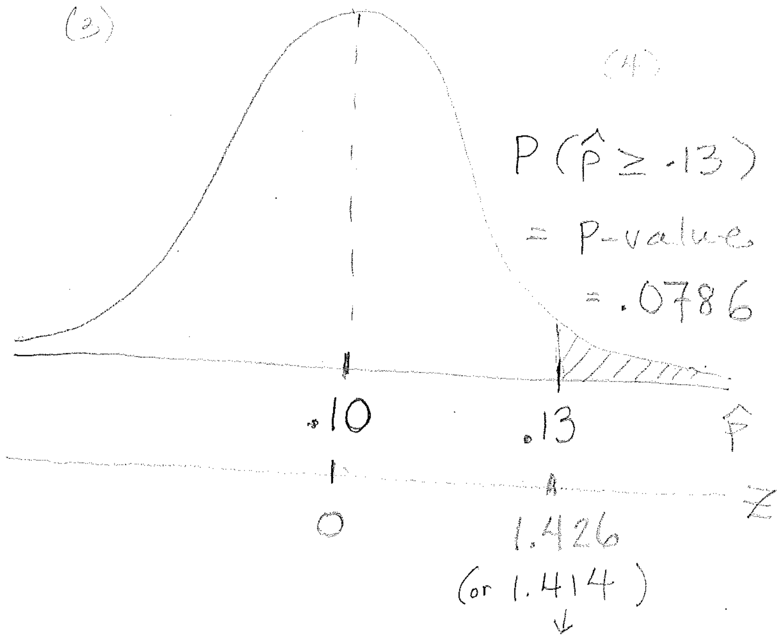
$SE = \sqrt{\frac{.10(1-.10)}{200}} \approx .021$

(4) $z = \frac{\hat{p} - p_0}{SE} = \frac{.13 - .10}{.021}$

Test Stat: $z = 1.426$

Rounding error!

(2)



Output from StatCrunch for reference.

Hypothesis test results:

Proportion	Count	Total	Sample Prop.	Std. Err.	Z-Stat	P-value
p	26	200	0.13	0.021213203	1.4142136	0.0786

(6) Step 4: Interpret (Conclude)

P-value $= .0786 > .05 = \alpha$

Fail to reject H_0

We do not have convincing evidence that significantly more than 10% of users of the drug will experience nausea.

(3) Follow up: Based on the evidence, will the FDA reject the drug or cautiously accept the drug? Explain your reasoning.

They will cautiously accept the drug. Even though more than 10% of users in the SAMPLE experienced nausea, the percentage (13%) was low enough to not be significantly different from 10%.