Stat 300
Fall 2024
Exam 4, December 5

No books, notes, scratch paper, phones.
Please show all your work and clearly mark your answers.
Formula sheet is allowed.
If a problem is too hard, move on to an easier one.

Page	Pts	Possible
1		22
2		22
3		22
4		22
5		12
Total		100

Name (printed): Key

Name (signature): _____

Score for the class so far: _____ out of _____ points

Percent: _____ % Approx letter grade:

To earn a grade of I would need about
of the points in the rest of the class.

Write a 1-sentence summary for each problem.
For every hypothesis test, write your null and alternative hypothesis.

1) You are told that 15% of Sacramento residents say that "I Want a Hippopotamus for Christmas" is their favorite December holiday song. Assume this number is correct. If 160 Sacramentans are surveyed, what is the probability that at least 20% of the sample prefer Hippopotamus? (10 pts)

$$z = \frac{(.2 - .15)}{\sqrt{\frac{.15(1-.15)}{160}}} = 1.77$$

✓ normalcdf
3.8269%

ASR = 3.8%

There is a 4% chance that in a sample of 160 Sacramentans, at least 20% will prefer Hippopotamus.

z = 1.96

2) Find a 95% confidence interval for the difference in proportions of all male and female Papa Murphy's customers who like pineapple on pizza. (12 pts)

Male: 39 out of 110 higher
Female: 28 out of 140 lower

$\hat{p}_M - \hat{p}_F$

.3545

.2

.0432 ✓ .2658 ✓ check for 0

.1545 ± .1113

We are 95% confident that the proportion of all male customers who like pineapple on pizza is between 4.32 and 26.58 percentage points higher than the proportion for females.

$\hat{p} = \frac{29}{40} = .725$

3) A sample of 40 fish in the Pocket Canal find that 29 have high levels of mercury.
a) Test the claim, at a 10% significance level, that more than 40% of all Pocket Canal fish have high levels of mercury. (12 pts)

$H_0: p = .4$
$H_a: p > .4$

$z = 4.195$
Reject H_0
Accept H_a.

check GC

We have very strong evidence that more than 40% of all PC fish have high mercury.

b) Test the claim, at a 10% significance level, that less than 40% of all Pocket Canal fish have high levels of mercury.

No way. $\hat{p} > 40\%$

We do not have evidence that less than 40% of all PC fish have high mercury.

We showed the opposite in part (a).

4) Find a 90% confidence interval for the proportion of CRC students who finished Fall Semester with more than 12 units. Use sample data: (10 pts)

# of units	# of students
0–4	9
4.1–8	34
8.1–12	41
12.1–16	61
16.1+	13

$\hat{p} = \frac{74}{158} = 46.84\%$

$ME = 1.645\sqrt{\frac{\hat{p}(1-\hat{p})}{158}} = 6.53\%$

We are 90% confident that between 40.31% and 53.37% of all CRC students finished Fall with more than 12 units.

check GC

p_1 p_2

5) A sample of young people (18–29) and old people (52–65) are asked "can you drive a stick-shift car?" Ten out of 60 young people answer yes, and 16 out of 50 old people say yes. Do we have evidence, at the 1% level, that a higher proportion of old people can drive a stick-shift car? (10 pts)

$H_0: p_1 = p_2$

$H_a: p_1 < p_2$

$\hat{p}_1 = 16.67\%$

$\hat{p}_2 = 32\%$

$\hat{p} = 23.63\%$

$z = -1.88$ ✓ on GC

$ATL = 3\%$ Not low enough

We do not have enough evidence, at the 1% level, that the proportion of all old people who drive stick shift is higher than young people.

6) A 90% confidence interval for the proportion of all California residents who have access to Apple TV is 68.8% to 75.4%. (12 pts)

a) What sample proportion was used to create this confidence interval?

b) What margin of error was used to create this confidence interval?

c) What sample size was used to create this confidence interval?

a) 72.1%

b) 3.3%

} check on GC ✓

$0.033 = 1.645\sqrt{\frac{.721(1-.721)}{n}}$

$(.02006)^2 = \frac{.721(1-.721)}{n}$

500 people

7) A slot machine is supposed to give a jackpot 11% of the time. The casino boss wants to check that this percentage is correct. In a sample of 700 spins, the jackpot happens 94 times. Check the claim at the 10% significance level. (10 pts)

$H_0: p = 11\%$ $\hat{p} = .134$

$H_a: p \neq 11\%$

$z = 2.05$

$ATR = 2.018\%$

$p = 4.036\%$

GC ✓

Reject H_0, Accept H_a

We have some evidence that the machine is malfunctioning.

8)a) Find a 98% confidence interval for the proportion of all Siberian Huskies with different-colored eyes. In a sample, 32 out of 90 have different-colored eyes. (12 pts)

b) Test the hypothesis that 40% of all Siberian Huskies have different-colored eyes. Use $\alpha = 2\%$.

c) Discuss the relationship between your answers to (a) and (b).

a) $\hat{p} = .3555$

$ME = .1173$

23.82% ✓

47.28% ✓

GC ✓

We are 98% confident that between 23.82% and 47.28% of all SHs have different-colored eyes

b) $H_0: p = 40\%$

$H_a: p \neq 40\%$

$z = -.86$

GC ✓

$ATL = 18.5\%$

$p = 39\%$

☹ We do not have evidence that the prop of all SH w/ DCE is different than 40%. It might be 40%.

c) So, 40% is in the C.I., so we cannot reject that in (b).

9) A sample of 14 teenagers is asked, at age 16, "how much time do you spend on your phone, per day?" The same people are asked the same question, 2 years later. Test the claim that the average time spent on the phone has changed for all (now 18-year-old) teenagers from when they were 16.

$\alpha = 5\%$

(12 pts)

Subject	Hours (16 yrs)	Hours (18 yrs)
1	11.0	8.9
2	6.0	3.0
3	10.3	10.2
4	3.7	4.1
5	10.7	8.9
6	3.2	4.1
7	12.9	12.8
8	11.1	10.9
9	11.5	13.4
10	10.0	8.1
11	4.4	3.3
12	10.2	7.6
13	5.6	3.6
14	12.3	13.2

$\mu_d = \mu_{18} - \mu_{16}$

$H_0: \mu_d = 0$

$H_a: \mu_d \neq 0$

$\bar{x} = -.77$

$s > 1.5$

$n = 14$

$t = -1.92$

$5\% < p < 10\%$

$p = 7.69\%$ GC

We do not have evidence that average phone time has changed from 16 to 18 for all 18-yr-olds.