Inference Practice

The following problems will be solved using the methods from chapters 11 and 12. Chapter 11 involves *means* and chapter 12 has procedures for *proportions*. Remember that the exam will include more than hypothesis test and confidence intervals. Review your notes for Type I and Type II errors, sample size calculations, checking for conditions, and other content.

1. The US Department of Transportation reports that 77% of all fatally injured automobile drivers were intoxicated. A random sample of 27 records in Kit Carson County, Colorado showed that 15 involved a drunk driver. What is a 99% confidence interval for the population proportion? Is this good evidence that the proportion is different from 77%?

2. An automobile manufacturer advertises that one of its models achieves 30 miles per gallon for highway driving. Six non-professional drivers are chosen at random and each drives one of the cars from Phoenix to Los Angeles. The resulting gas mileages are:

   27.2, 29.3, 31.2, 28.4, 30.3, 29.6

   Do these data contradict the manufacturer's claim? Complete a hypothesis test.

3. Do teachers find their work rewarding? In a random sample of 395 elementary teachers, 224 indicated that they were satisfied with their jobs. For high school teachers, 126 out of 266 indicated that they are satisfied. Based on this data, is it reasonable to assume that elementary teachers are more satisfied than high school teachers?

4. In a study of memory recall, 8 students from a large psychology class were selected at random and given 10 minutes to memorize 20 nonsense words. Each was asked to list as many of the words as they could remember both 1 hour later and 24 hours later. The numbers of words recalled are listed below.

Subject	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*
1 Hour	14	12	18	7	11	9	16	15
24 Hours	10	4	14	6	9	6	12	12

   Use a confidence interval to determine whether this is good evidence that the difference in the number of words that the students recall (1 hour - 24 hours) is more than 3?

5. A person released from prison before completing his/her original sentence is placed under supervision of a parole board. If that person violates specified conditions of good behavior, the board can order a return to prison. A random sample of individuals who served time in prison for either impulsive or pre-meditated murder produced the following data:

Crime	Impulsive Murder	Premeditated Murder
Total number of individuals	42	40
Number with no parole violation	13	22

   Is this good evidence that there is a difference between the type of crime and whether an individual will violate probation? Complete a hypothesis test.

. Inference Practice

① $p = .77$

$\hat{p} = \frac{15}{27} = .556$

$27(.556) = 15$

$27(1-.556) = 12$

$.556 \pm 2.576\sqrt{\frac{.77 \cdot .23}{27}}$

$(.347, .765)$

We are 99% Confident that the true mean number is between 34.7% and 76.5%. 77% is outside our confidence interval, therefore there is good evidence that the proportion is not 77%

② One Sample t-Test

$H_0: \mu = 30$

$H_a: \mu \neq 30$

$\bar{x} = 29.3$

$S_x = 1.41$

$n = 6$

$t = \frac{29.3 - 30}{\frac{1.41}{\sqrt{6}}} = -1.216$

Two-Tail Test

$1 - tcdf(-1.216, 1.216, 5) = .278$

$P(\mu = 30) .278$

Since $.278 > .05$ we Fail to reject the claim that the model averages 30 miles per gallon

③ Two Sample Z-Test for proportions

Elementary	High School
$X_1 = 224$	$X_2 = 126$
$n_1 = 395$	$n_2 = 266$
$\hat{p}_1 = \frac{224}{395} = .567$	$\hat{p}_2 = \frac{126}{266} = .474$

$$\hat{p} = \frac{224 + 126}{395 + 266} = .53$$

H_0: $p_1 - p_2 = 0$ or $p_1 = p_2$

H_a: $p_1 - p_2 > 0$ $p_1 > p_2$

Assumptions

$395(.567) > 5$

$395(1-.567) > 5$

$266(.474) > 5$

$266(1-.474) > 5$

$$Z = \frac{.567 - .474}{\sqrt{.53 \cdot .47\left[\frac{1}{395} + \frac{1}{266}\right]}} = 2.35$$

$P(Z > 2.35) = .009$

Since $.005 < .5$, we reject the null hypothesis. There is statistical evidence that Elementary teachers are more satisfied with their jobs than high school teachers

⑤ 2-proportion Z Test

Impulsive	Premeditated
$*x_1 = 29$	$x_2 = 18$
$n_1 = 42$	$n_2 = 40$
$\hat{p}_1 = \frac{29}{42} = .69$	$\hat{p}_2 = .45$
$.69 \cdot 42 > 5$	$.45 \cdot 40 > 5$
$(1-.69) \cdot 42 > 5$	$(1-.45) \cdot 40 > 5$

$\hat{p} = \frac{29+18}{42+40} = .573$

$H_0: p_1 - p_2 = 0$ or $p_1 = p_2$

$H_a: p_1 - p_2 \neq 0$ $p_1 \neq p_2$

Two-Tail Test

$$Z = \frac{.69 - .45}{\sqrt{.573 \cdot .427 \left[\frac{1}{42} + \frac{1}{40}\right]}} = 2.196$$

$2 \cdot P(Z > 2.196) = .028$

Since $.028 < .05$, We reject the null hypothesis in favor of the alternative hypothesis. There is statistical evidence that there is a difference between the type of crime and whether they will violate their parole

(4) Matched Pairs Design

1-Hour	24-Hour	Difference
14	10	4
12	4	8
18	14	4
7	6	1
11	9	2
9	6	3
16	12	4
15	12	3

$\bar{X}$: Difference in the number of words

$\bar{X} = 3.625$ $S_x = 2.066$

95% Confidence Interval

$df = 7$ $t^* = 2.365$

$3.625 \pm 2.365 \cdot \frac{2.066}{\sqrt{8}}$

$(1.9, 5.35)$

We are 95% Confident that the difference in the number of words memorized is between 1.9 and 5.35. Since 3 is within the Confidence Interval we would fail to reject the claim that the number of words is 3