Math 3339

Section 27204
MWF 10-11:00am AAAud 2

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Office Hours:
M & Th noon – 1:00 pm & T 1:00 – 2:00 pm
and by appointment

Data for gas mileage (in mpg) for different vehicles was entered into a software package and part of the ANOVA table is shown below:

Source	DF	SS	MS
Vehicle	6	505	252.50
Error	84	321	3.82
Total	90	826	

N - 1

F Pval

=1-pf(66.1,6,84

P(F > ___) = 1 - pf(

df = 1, n - 1

If a LSRL was fit to this data, what would the value of the coefficient of determination be?

Degrees of freedom for pvalue is df1 = 6 (M-1) and df2 = 84 (N-M

F is test statistic $= \frac{ms(reg)}{ms(resid)} = \frac{252.5}{3.82}$

r correlation

r^2 coeff. of determination - % of variance explained by the model

$r^2 = 1 - \frac{SS(resid)}{SS(total)} = 1 - \frac{321}{826}$

Popper 33 (answer under EMCF)

1. Nitrites are often added to meat products as preservatives. In a study of the effect of these chemicals on bacteria, the rate of uptake of a radio-labeled amino acid was measured for a number of cultures of bacteria, some growing in a medium to which nitrites had been added. Here are the summary statistics from this study.

Group	n	$\bar{x}$	s
Nitrite	30	7880	1115
Control	30	8112	1250

This is an example of :

a. Matched pairs
b. Two sample t test
c. Two sample z test
d. None of these

Mixed Hypothesis Testing Examples:

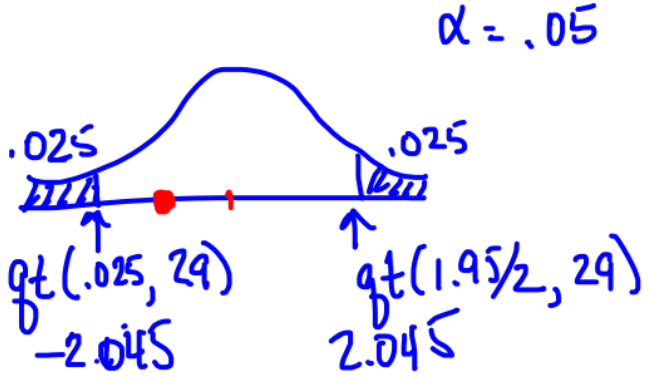
Let's perform the hypothesis test for popper #1 above.

Nitrites are often added to meat products as preservatives. In a study of the effect of these chemicals on bacteria, the rate of uptake of a radio-labeled amino acid was measured for a number of cultures of bacteria, some growing in a medium to which nitrites had been added. Here are the summary statistics from this study.

$H_0: \mu_N = \mu_C$

$H_a: \mu_N \neq \mu_C$

Group	n	$\bar{x}$	s
Nitrite	30	7880	1115
Control	30	8112	1250



test stat: $t = \dfrac{7880 - 8112}{\sqrt{\frac{1115^2}{30} + \frac{1250^2}{30}}} = -.759$

pvalue: $p(t < -.759) \cdot 2 = pt(-.759, 29) \cdot 2 = .457 > \alpha$

Fail to reject H_0 (no sig diff between the two means)

You would like to know how effective a diet program is at helping people lose weight. 20 over-weight people are randomly selected to participate in the program. They are weighed before and after the program and the results are listed below. Do these results give evidence that the diet program is effective? matched pairs t-test

(Before - After = D)

$H_0: \mu_D = 0$

$H_a: \mu_D > 0$ →

Diff > 0

Participant	1	2	3	4	5	6	7	8	9	10
Before	185	220	190	158	227	211	260	156	201	300
After	175	215	195	155	230	207	258	159	201	290
Participant	11	12	13	14	15	16	17	18	19	20
Before	180	270	293	183	205	151	291	166	150	232
After	172	272	290	185	200	146	287	166	149	230

$$t = \frac{3.25 - 0}{6.24/\sqrt{20}}$$

Popper 33 (answer under EMCF)

use $p = .5$

2. A politician wants to know what percentage of the voters support her position on the issue of forced busing for integration. What voter sample should be obtained to determine with 90% confidence the support level to within 4%?

a. 21 b. 25 c. 423 d. 601 e. 1691

$ME \leq .04$

$z^* = \text{qnorm}(1.9/2) = 1.645$

$$ME = z^* \cdot \sqrt{\frac{.5(1-.5)}{n}} = 1.645\sqrt{\frac{.5(.5)}{n}}$$

$$1.645\frac{(.5)}{\sqrt{n}} < .04$$

$$20.5625 < \sqrt{n}$$

$$20.5625^2 < n$$

Each person in a random sample of 1,026 adults in the United States was asked the following question. "Based on what you know about the Social Security system today, what would you like Congress and the President to do during this next year?

The response choices and the percentages selecting them are shown below.

Completely overhaul the system	19%
Make some major changes	39%
Make some minor changes	30%
Leave the system the way it is now	11%
No opinion	1%

41%

$.39 \pm qnorm(1.95/2)\sqrt{\frac{.39(.61)}{1026}}$

a. Find a 95% confidence interval for the proportion of all United States adults who would respond "Make some major changes" to the question. Give an interpretation of the confidence interval and give an interpretation of the confidence level.

b. An advocate for leaving the system as it is now commented, "Based on this poll, only 39% of adults in the sample responded that they want some major changes made to the system, while 41% responded that they want only minor changes or no changes or no changes at all. Therefore, we should not change the system." Explain why this statement, while technically correct, is misleading.

Popper 33 (answer under EMCF)

3. Suppose we have two SRSs from two distinct populations and the samples are independent. We measure the same variable for both samples. Suppose both populations of the values of these variables are normally distributed but the means and standard deviations are unknown. For purposes of comparing the two means, we use
   a. Two-sample t procedures
   b. Matched pairs t procedures
   c. z procedures
   d. none of these

According to the Census Bureau data for the school year of 2001-2002, a High School student population of 3043 students consisted of 1693 Caucasian, 1087 Hispanic, 173 Black, 90 Other (Asian, Native American, …). Suppose that a random sample of 96 students completing AP Statistics and Calculus resulted in the accompanying data on ethnic group: 67 Caucasian, 28 Hispanic, 4 Black, and 7 Other. Does this data provide evidence that the proportion of students in AP Statistics and Calculus for these ethnic groups' categories differs from the respective proportions in the school student population?

χ^2 test Goodness of fit

OBS.	67	28	4	7	$df = 3$
EXP.	$\left(\frac{1693}{3043}\right)\cdot 96$	$\left(\frac{1087}{3043}\right)\cdot 96$	$\left(\frac{173}{3043}\right)\cdot 96$	$\left(\frac{90}{3043}\right)\cdot 96$	

$$\chi^2 = \sum \frac{(O-E)^2}{E} \cdot = \square$$

$$P(\chi^2 > \square) = 1 - \text{pchisq}(\square, 3)$$

In a recent publication, it was reported that the average highway gas mileage of tested models of a new car was 33.4 mpg and approximately normally distributed. A consumer group conducts its own tests on a simple random sample of 12 cars of this model and finds that the mean gas mileage for their vehicles is 31.4 mpg with a standard deviation of 3.3 mpg. Perform a test at the $\alpha=0.05$ level to determine if these data support the contention that the true mean gas mileage of this model of car is different from the published value.

One sample means t-test

Do you have an insatiable craving for chocolate or some other food? Since many North Americans apparently do, psychologists are designing scientific studies to examine the phenomenon. According to the New York Times (Feb. 22, 1995), one of the largest studies of food cravings involved a survey of 1000 McMaster University (Canada) students. The survey revealed that 97% of the women in the study acknowledged specific food cravings while only 67% of the men did. Assume that 600 of the respondents were women and 400 were men. Is there sufficient evidence to claim that the true proportion of women who acknowledge having food cravings exceed the corresponding proportion for men?

2 sample prop (z test)

Popper 33 (answer under EMCF)

4. For a fixed confidence level, when the sample size increases, the length of the confidence interval for a population mean decreases.
   a. True
   b. False

5. For a fixed confidence level, when the mean increases, the length of the confidence interval for a population mean decreases.
   a. True
   b. False