Math 3339

Section 27204
MWF 10-11:00am AAAud 2

Bekki George
bekki@math.uh.edu
639 PGH

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

Exam 2:
8 m/c at 6 pts each (48 pts) ←
4 f/r at 13 pts each (52 pts)

Know all continuous distributions, confidence intervals for single mean and single proportion, probabilities involving *f* and *F*, probabilities involving normal distribution, gamma, exponential, Errors (type I, type II), p-values, … Hyp. tests.

EMAIL ME QUESTIONS TO ADD TO THE NOTES!

For 13 on the practice test online (attached below), why is p-hat and p* both 0.83?

used to find n

Question 13

Your answer is CORRECT.

A simple random sample of 100 8th graders at a large suburban middle school indicated that 83% of them are involved with some type of after school activity. Find the 99% confidence interval that estimates the proportion of them that are involved in an after school activity.

$n = 100 \quad \hat{p} = .83$

$99\% \text{ CI} \rightarrow z^* = \text{qnorm}(1.99/2)$

$.83 \pm z^* \sqrt{\frac{.83(.17)}{100}}$

a) (0.733, 0.927)

b) (0.653, 0.927)

c) (0.633, 0.877)

d) (0.783, 0.788)

e) (0.733, 0.727)

f) None of the above

for a "regular" distr.

Explain when to use pnorm(x, mean, **standard deviation**) vs pnorm(x, mean, **standard deviation/sqrt(n)**)?

$P(X < \_\_)$

s.d. for a sampling distribution

$P(\bar{X} < \_\_)$

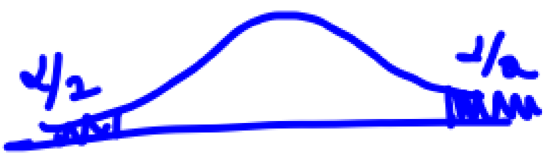
20. In a recent publication, it was reported that the average highway gas mileage of tested models of a new car was 33.5 mpg and approximately normally distributed. A consumer group conducts its own tests on a simple random sample of 12 cars of this model and finds that the mean gas mileage for their vehicles is 31.6 mpg with a standard deviation of 3.4 mpg.

a c. Perform a test 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.

b d. Perform a test to determine if these data support the contention that the true mean gas mileage of this model of car is less than the published value.

c e. Explain why the answers to part a and part b are different.

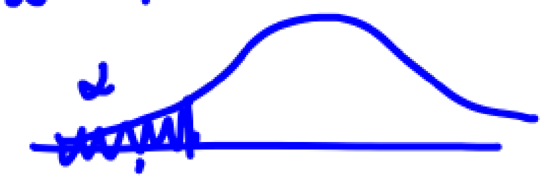
a. $H_a: \mu \neq 33.5$



pvalue: 0.079

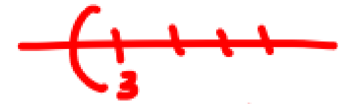
$> \alpha$

b. $H_a: \mu < 33.5$



pvalue .0395

$< \alpha$



Binomial $P(X<5) = \underline{P(X \le 4)}$ $P(X \ge 3)$

approx using normal $P(X < 4.5)$ $P(X \ge 2.5)$

1 - pnorm(2.5 _

An association of college bookstores reported that the average amount of money spent by students on textbooks for the Fall 2013 semester was \$325.16. A random sample of 75 students at the local campus of the state university indicated an average bill for textbooks for the semester in question to be \$312.34 with a standard deviation of \$76.42. Do these data provide significant evidence that the actual average bill is different from the \$325.16 reported? Test at the 5% significance level.

One sample mean t-test

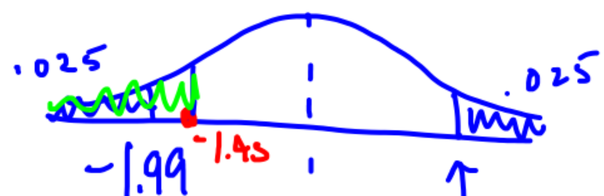
95% CI

$312.34 \pm 1.99\left(\frac{76.42}{\sqrt{75}}\right)$

$H_0: \mu = 325.16$ $n = 75$ $s = 76.42$

$H_a: \mu \neq 325.16$ $df = 74$

$$t = \frac{312.34 - 325.16}{76.42/\sqrt{75}} = -1.453$$



qt(.975, 74)
1.99

pvalue $= 2 \cdot p(t < -1.453) = .15 > \alpha \Rightarrow$ FR H_0

Based on $\alpha = .05$, we fail to reject the null hypothesis which says the mean money spent by student in Fa13 is \$325.16.

Confidence Intervals for the Variance and Standard Deviation
Of A Normal Population (*not on test*)

χ^2 chi squared

Suppose that instead of estimating the population mean μ, we wish to estimate the population *variance* σ^2.

sample (stand. deviation)^2

Let $S^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(X_i - \bar{X}\right)^2$ be the sample variance from a random sample of size *n* taken from a $N\left(\mu,\sigma^2\right)$ distribution. Then a $\left(1-\alpha\right)$ confidence interval for σ^2 is

$$\left[\frac{\left(n-1\right)S^2}{\chi^2_{\alpha/2}}, \frac{\left(n-1\right)S^2}{\chi^2_{1-\alpha/2}}\right]$$

where χ^2 has $n-1$ degrees of freedom.

Note: If an interval for *standard deviation* is desired, take the square root.

Example: A sample of $n = 16$ completion times for a particular task for a lab technician led to a sample mean of 4.3 minutes and a sample standard deviation of 0.6 minutes. Determine a 95% confidence interval for the standard deviation of her completion time.

df = 15

$\alpha = .05$

qchisq($\alpha/2$, df) or $1-\alpha/2$

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> qchisq(.05/2,15)
[1] 6.262138
> qchisq(1-.05/2,15)
[1] 27.48839
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$$\left(\frac{(n-1)s^2}{27.488}, \frac{(n-1)s^2}{6.262} \right) = \left(\frac{15(.6)^2}{27.488}, \frac{15(.6)^2}{6.262} \right)$$

Int. for variance: (.1964, .862)

st. deviation: (.443, .928)

Popper 24

1. It is fourth down and a yard to go for a first down in an important football game. The football coach must decide whether to go for the first down or punt the ball away. The null hypothesis is that the team will not get the first down if they go for it. The coach will make a Type I error by doing what?
   a. Deciding not to go for the first down when his team will get the first down.
   b. Deciding not to go for the first down when his team will not get the first down.
   c. Deciding to go for the first down when his team will get the first down.
   d. Deciding to go for the first down when his team will not get the first down.
   e. None of the above.

2. A research scientist, Dr. Knowall, claims aliens on planet Meshort reach an average height of 30 cm. Dr. Dontbelieve randomly samples 50 Meshort aliens and finds some of them to be taller than 30 cm. Which of the following would match Dr. Dontbelieve's hypotheses statements?

a. H_o: $\mu \neq 30$ cm, H_a: $\mu = 30$
b. H_o: $\mu = 30$ cm, H_a: $\mu > 30$
c. H_o: $\mu = 30$ cm, H_a: $\mu \neq 30$
d. H_o: $\mu = 30$ cm, H_a: $\mu < 30$
e. H_o: $\mu < 30$ cm, H_a: $\mu = 30$

3. A one-sided significance test gives a p-value of .04. From this we can

a. Reject the null hypothesis with 99% confidence.
b. Reject the null hypothesis with 95% confidence.
c. Say that the probability that the null hypothesis is false is .04.
d. Say that the probability that the null hypothesis is true is .04.

4. You have measured the systolic blood pressure of a random sample of 25 employees of a company located near you. A 95% confidence interval for the mean systolic blood pressure for the employees of this company is (122, 138). Which of the following statements gives a valid interpretation of this interval?

a. 95% of the sample of employees have a systolic blood pressure between 122 and 138.

b. 95% of the population of employees have a systolic blood pressure between 122 and 138.

c. If the procedure were repeated many times, 95% of the resulting confidence intervals would contain the population mean systolic blood pressure.

d. The probability that the population mean blood pressure is between 122 and 138 is .95

5. A 95% confidence interval for the mean reading achievement score for a population of third grade students is (44.2, 54.2). Suppose you compute a 99% confidence interval using the same information. Which of the following statements is correct?
   a. The intervals have the same width.
   b. The 99% interval is shorter.
   c. The 99% interval is longer.
   d. None of the above.