standard deviation (σ)

(8 points; 8 minutes)

7. The Department of Fish and Game monitors the health of fish populations in the Pacific Ocean. In the past, the variability (sigma) of salmon weights has been 2.37 pounds. Recently, a sample (consider it to be effectively "random") of 41 salmon had the statistics given in the box below. Use this information to test the claim that the variability of salmon weights is now at least 0.5 pounds more than it was "in the past". (Use a 5% significance level for this test.)

"more than"

claim: $\sigma_{now} \geq \sigma_{old} + 0.5$ "at least"

H_0: $\sigma \geq 2.87$ $(2.37 + 0.5)$

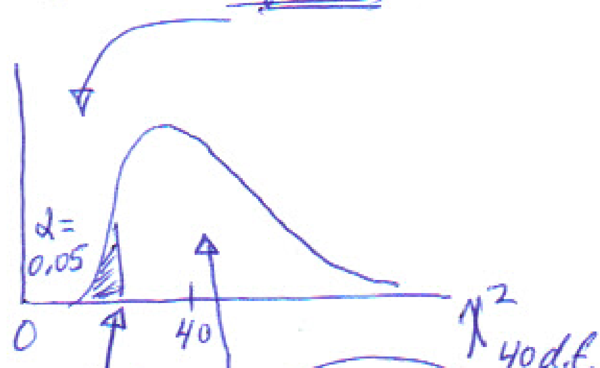
H_1: $\sigma < 2.87$

$\alpha = 0.05$ left tail

Statistics for Salmon Sample
n = 41
$\overline{X}$ = 7.72 pounds
s = 2.88 pounds

deg. of freedom = 40

$$\frac{(n-1)s^2}{\sigma_0^2} = \frac{(40)(2.88)^2}{(2.87)^2} = 40.28$$



Do Not reject H_0:

(8 points; 8 minutes)

9. A random sample of rocks from the surface of Earth's Moon found that 43 had measurable amounts of Lithium in them and 198 did not. On Earth, 15% of the rocks have measurable amounts of lithium in them. Use the data for the Moon rocks to test the claim that the proportion of Moon rocks that contain Lithium is greater than the proportion of Earth rocks that contain Lithium. Use alpha = 3% for the significance level of this test.

claim: $p_{Moon} > p_{Earth} = 0.15$

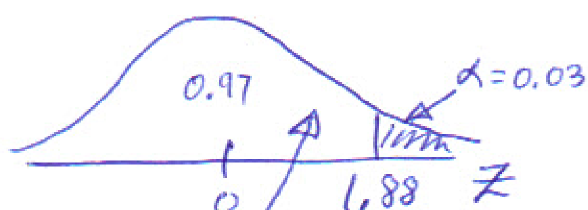
43 yes + 198 No = 241 total
$\hat{p} = 43/241 = 0.1784$

H_0: $p \leq 0.15$

H_1: $p > 0.15$

$\alpha = 0.03$ right tail

$$\frac{\hat{p} - p_0}{\sqrt{\frac{p_0 q_0}{n}}} = \frac{0.1784 - 0.15}{\sqrt{\frac{(.15)(.85)}{241}}}$$



$$= \frac{0.0284}{0.023} = 1.235$$

Do not reject H_0:

only AZ counts

(7 points; 7 minutes)

12. Use the data given here for a random sample of Basketball fans to make an 82% confidence interval for the proportion of all basketball fans in Arizona whose favorite team is the Sacramento Kings.

$82\%\ CI(p) = \hat{p} \pm Z_{\alpha/2}\sqrt{\hat{p}\hat{q}/N}$

Favorite Basketball Team	Home State: AZ	CA	WA	Total
Phoenix Suns	140	60	30	230
Sacramento Kings	40	270	10	320
Seattle Sonics	20	70	160	250
Total	200	400	200	800

$\hat{p} = \dfrac{40 \text{ for kings}}{200 \text{ AZ}}$

$= 0.2$

$\hat{q} = 0.8$

$N = 200$

confidence $= 0.82$

$\alpha = 1 - \text{confid}$

$\alpha = 1 - 0.82 = 0.18$

$\alpha/2 = 0.09$

$Z_{\alpha/2} = 1.34$

	.04
-1.3	.0901

$= 0.2 \pm 1.34\sqrt{\dfrac{(.2)(.8)}{200}}$

$= 0.2 \pm 0.038$

$[0.162 < p < 0.238]$

(9 points; 10 minutes)

13. The Department of Fish and Game monitors the health of fish populations in the Pacific Ocean. A random sample of 5 tuna were captured and weighed. Use the data given here to test the claim that the mean weight of all tuna is less this year than it was last year, when records show that the average weight was 70.4 pounds. Use a "Type I Error Rate" of 0.025.

claim: $\mu_{Now} < \mu_{last\ year}$

: $\mu < 70.4$

$H_0: \mu \geq 70.4$

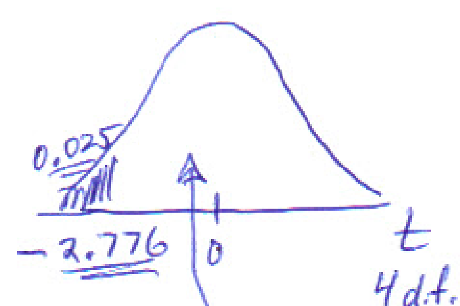
$H_1: \mu < 70.4$

$\alpha = 0.025$ left tail

Weights* of Tuna	
Fish #	Weight
1	83.5
2	68.5
3	58.6
4	84.0
5	43.4

* weights in pounds

from calculator



$\bar{x} = 67.6$

$s = 17.24$

$n = 5$

$df = 4$

$\dfrac{\bar{x} - \mu_0}{s/\sqrt{n}} = \dfrac{67.6 - 70.4}{17.24/\sqrt{5}} = \dfrac{-2.8}{7.71} = -0.363$

Do Not reject H_0!

(8 points : 8 minutes)

12. The (American) roulette wheel has 38 slots numbered 00, 0, and 1-36. The 00 and 0 are green, and the 1-36 are half black and half red. A player who bets on black (or red) has a 47% chance of winning (18/38 = 0.47) if the wheel is "fair".

Alfred (a recent graduate with a statistics degree) went to Las Vegas to play roulette. He made 600 bets, all on black, and he wins 264 times. Alfred used these results to test the Casino's claim that the roulette wheel is "fair". Alfred decided to use a 1% significance level for his test.

Show how Alfred did the test and what he concluded.

$N = 600 \quad \text{WINS} = 264$

$\hat{p} = \frac{264}{600} = 0.44$

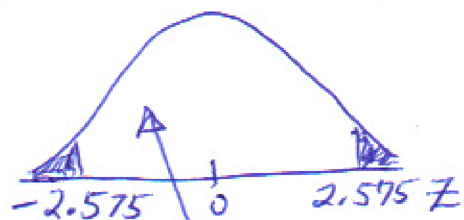
winning a bet on black

Claim: $p = 0.47$

H_0: $p = 0.47$

H_1: $p \neq 0.47$

$\alpha = 0.01$ in 2 tails



$$\frac{\hat{p} - p_0}{\sqrt{\frac{p_0 q_0}{n}}} = \frac{0.44 - 0.47}{\sqrt{\frac{(0.47)(0.53)}{600}}} = \frac{-0.03}{0.0204} = -1.47$$

Do Not reject H_0:

(8 points : 8 minutes)

9. A manufacturer and its customers set a target for the standard deviation of the weights of a part used in fighter aircraft. If the variation is too small it will be too expensive. If the variation is too big, the parts will not fit correctly. The mean weight is to be 7.45 kilograms (kg), with a standard deviation of 0.05 kg. The manufacturer makes a test sample of the parts, which have the sample statistics given in the box. Use the sample results to test the claim that the standard deviation of all the parts that will be manufactured will satisfy the target. (Let α = 0.10)

σ

Statistics for the sample of parts
$\bar{x}$ = 7.42
s = 0.054
n = 31

$df = 30$

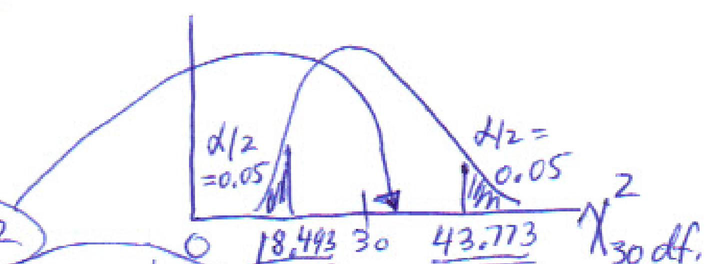
Claim: $\sigma = 0.05$

H_0: $\sigma = 0.05$

H_1: $\sigma \neq 0.05$

$\alpha = 0.10$ in 2 tails

$$\frac{(n-1)s^2}{\sigma_0^2} = \frac{(30)(0.054)^2}{(0.05)^2} = 34.992$$



Do not reject H_0: