Math 107 – Test 5
April 17, 2009
(100 points)

Pledged Key

26 pts **1.** Winning team data were collected for teams in different sports, with the results given below. At $\alpha = .10$, test the claim that the proportion of home wins is the same for all three sports.

	Basketball	Baseball	Football	
Home team wins	129 (120)	53 (60)	58 (60)	240
Visiting team wins	71 (80)	47 (40)	42 (40)	160
	200	100	100	400

$\frac{240 \cdot 200}{400} = 120$ $\frac{240 \cdot 100}{400} = 60$ $\frac{160 \cdot 200}{400} = 80$ $\frac{160 \cdot 100}{400} = 40$

Check the assumptions $120, 60, 80, 40 \geq 5$

Null Hypothesis The proportion of home wins is the same for all three sports. (claim)

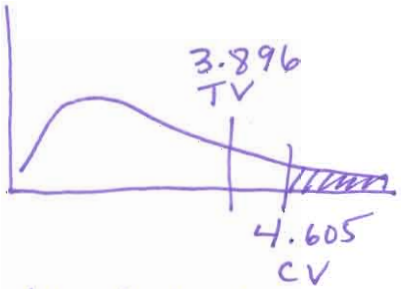
Critical Value 4.605 (d.f. = 2, $\alpha = .10$)

Test Value 3.896

Show the set-up for your calculations and the graph for the critical value.

$$\chi^2 = \frac{(129-120)^2}{120} + \frac{(53-60)^2}{60} + \frac{(58-60)^2}{60} + \frac{(71-80)^2}{80} + \frac{(47-40)^2}{40} + \frac{(42-40)^2}{40}$$

≈ 3.896



Decision and reason: Fail to reject H_0 because the test value is not in the rejection region.

Summary:

There is not enough evidence to reject the claim that the proportion of home wins is the same for all three sports.

28 pts **2.** Data were obtained from car crash experiments. New cars were crashed into a fixed barrier at 35 mph, and the chest deceleration data are given below. Test the claim that different weight categories of cars have different chest decelerations. **Use a non-parametric test** with $\alpha = .05$.

Subcompact		Compact		Midsize		Full-size	
42	2	46	8	45	6	39	1
47	9	51	12.5	45	6	44	3.5
49	10.5	54	15	49	10.5	44	3.5
55	16	57	17.5	51	12.5	45	6
59	20	57	17.5	53	14	58	19
	57.5		70.5		49		33

Check the assumptions independent, all sample sizes at least 5.

Null Hypothesis All weight categories have the same chest decelerations.

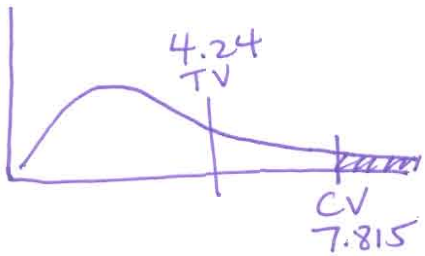
Critical Value 7.815 χ^2 d.f. = 3, $\alpha = .05$

Test Value 4.24

Show the set-up for your calculations and the graph for the critical value.

$$H = \frac{12}{20 \cdot 21}\left(\frac{57.5^2}{5} + \frac{70.5^2}{5} + \frac{49^2}{5} + \frac{33^2}{5}\right) - 3 \cdot 21$$

≈ 4.24



Decision and reason: Fail to reject H_0 because the test value is not in the rejection region.

Summary: There is not enough evidence to support the claim that different weight categories of cars have different chest decelerations.

Why is it inappropriate to follow this test with pairwise Wilcoxon tests?

We did not find a difference. Also, sample sizes are not at least 10.

25 pts **3.** Samples of head breadth were obtained by measuring skulls of Egyptian males from three different epochs. The measurements are listed below. Changes in head shape over time suggest that interbreeding occurred with immigrant populations. Use a 0.05 significance level to test the claim that the different epochs do not all have the same mean.

4000 B.C.	131	138	125	132	135	132	134	129	138
1850 B.C.	129	134	136	137	137	129	136	138	134
150 A.D.	128	138	136	139	141	142	137	145	137

What are the assumptions for this test? (You do not need to check them yourself.)

interval or ratio data — approximately normal
independent samples — equal variances

Null Hypothesis $\mu_{4000\,BC} = \mu_{1850\,BC} = \mu_{150\,AD}$

Critical Value 3.40 ($d.f.N = 2$, $d.f.D = 24$, $\alpha = .05$)

Test Value 4.05

Show the ANOVA table and the graph for the critical value.

	SS	df	MS	F
Between	138.7	2	69.4	4.05
Within	411.1	24	17.13	
Total	549.8	26		

Decision and reason Reject H_0 because the test value is in the rejection region.

Summary:

There is enough evidence to support the claim that different epochs do not all have the same mean.

21 pts **4.** Do pairwise Scheffé tests to determine where the difference in skull size lies.

Critical Value for the Scheffé Test $2(3.40) = 6.80$

Test Value comparing 4000 B.C. and 1850 B.C. is $F_s = .83$. Decision Fail to reject H_0

Test Value comparing 4000 B.C. and 150 A.D. is $F_s = 7.79$. Decision Reject H_0

Test Value for 1850 B.C. and 150 A.D.: $F_s =$ 3.60 Decision Fail to reject H_0

Show the set-up for your calculations.

$$F_s = \frac{(134.4 - 138.1)^2}{17.13\left(\frac{1}{9} + \frac{1}{9}\right)} \approx 3.60$$

Overall Summary: There is a significant difference in skull sizes between 4000 BC. and 150 A.D. The other comparisons do not show a significant difference.