STAT 420 Spring 2014

HOMEWORK 9: DUE APRIL 29 BY 7:00PM

Exercise 1

The grade point averages of students participating in college sports programs at Anytown State University are compared.[1]

	$i=1$	$i=2$	$i=3$	$i=4$	$i=5$	Mean ($\bar{y}_{\cdot j}$)	Var (s_j^2)
Football ($j=1$)	2.3	2.9	3.1	3.1	3.6	3.0	0.220
Basketball ($j=2$)	2.8	3.3	3.8	3.1	3.5	3.3	0.145
Hockey ($j=3$)	1.9	2.6	3.1	2.0	2.4	2.4	0.235

Consider the model $y_{ij} = \mu_j + e_{ij}$ with $e_{ij} \overset{\text{iid}}{\sim} \mathrm{N}(0, \sigma^2)$. At $\alpha = 0.05$, can one conclude that there is a difference in the mean GPA of the three groups? State the null and alternative hypotheses, construct the ANOVA table, and state your conclusion at $\alpha = 0.05$. Do NOT use a computer for this problem.

Exercise 2

Do NOT use a computer for this problem. The data below represent the attendance for STAT 408, STAT 420–N1, and STAT 420–D1 for a random sample of 5 days for each class during Spring 2012 semester.

	$i=1$	$i=2$	$i=3$	$i=4$	$i=5$	Mean ($\bar{y}_{\cdot j}$)	Var (s_j^2)
STAT 408 ($j=1$)	39	40	47	49	50	45	26.5
STAT 420 N1 ($j=2$)	49	53	56	57	60	55	17.5
STAT 420 D1 ($j=3$)	48	49	53	55	60	53	23.5

(a) Test $H_0 : \mu_1 = \mu_2 = \mu_3$ at $\alpha = 0.10$ using the ANOVA F test. Construct an ANOVA table and state your conclusion (Reject H_0 or Do NOT Reject H_0). What is the p-value for this test?

(b) Use a 90% confidence level and Scheffé s multiple comparison procedure to compare the average attendance for both sections of STAT 420 versus the average attendance for STAT408. (Construct a 90% interval for an appropriate contrast.)

(c) Test $H_0 : \tilde{\mu}_1 = \tilde{\mu}_2 = \tilde{\mu}_3$ at $\alpha = 0.10$ using the Kruskal-Wallis test. What is the p-value for this test?

[1] These data do NOT represent the professor's opinion of hockey and hockey players; go Blackhawks!

Exercise 3

Do NOT use a computer for this problem. Each of three cars is driven with each of four different brands of gasoline. The number of miles per gallon driven for each of the $ab = (3)(4) = 12$ different combinations is recorded in the table below.

	Gasoline				
Car	1	2	3	4	$\bar{y}_{i\cdot}$
1	31	32	23	26	28
2	36	38	28	34	34
3	23	29	27	21	25
$\bar{y}_{\cdot j}$	30	33	26	27	29

Consider the model

$$y_{ij} = \mu + (\text{car})_i + (\text{gas})_j + e_{ij} \qquad i \in \{1,2,3\} \;\; j \in \{1,2,3,4\}$$

where $e_{ij} \overset{\text{iid}}{\sim} \mathrm{N}(0, \sigma^2)$ and the effect terms sum to zero: $\sum_{i=1}^{3} (\text{car})_i = 0$ and $\sum_{j=1}^{4} (\text{gas})_j = 0$.

(a) Create an ANOVA table for these data.

(b) Test for differences in cars. Use a 5% level of significance.
$H_0 : (\text{car})_1 = (\text{car})_2 = (\text{car})_3$

(c) Test for differences in brands of gasoline. Use a 5% level of significance.
$H_0 : (\text{gas})_1 = (\text{gas})_2 = (\text{gas})_3 = (\text{gas})_4$