I

11.12 a) $H_0: \mu_A = \mu_B = \mu_C$

H_A: Not H_0

$F = 5.70$, $P = 0.025$

Conclude there is evidence to suggest at least one mean is different than the others.

b) 99% CI on $\mu_A - \mu_B$

$60.50 - 54.667 \pm 3.250 \sqrt{14.9\left(\frac{1}{4}+\frac{1}{3}\right)}$

$(-3.75, 15.41)$

This CI suggests the population means from A & B are not different

c) 99% CI on μ_A

$60.5 \pm 3.250 \sqrt{\frac{14.9}{4}}$

$(54.23, 66.77)$

II

Chapter 11 Homework 11/25/08
Analysis of Variance

Problem 11.13 Page 460 – 466

Source	df	SS	MS	F	P
Location	3	19.740	6.580	57.38	0.000
Error	20	2.293	0.115		
Total	23	22.033			

This follows a $F(3,20)$ distribution

Means

Location	mean	n
1	6.0167	6
2	5.6500	6
3	5.3500	6
4	3.6500	6

b) $H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$
H_A: Not H_0
Decision: Reject H_0 Conclude: There is sufficient evidence to suggest that at least one pop. mean is different than the others ($p \approx 0$)

d) Construct a 99% CI on $\mu_1 - \mu_4$

$$\bar{X}_1 - \bar{X}_4 \pm t_{df\,error,\,\frac{\alpha}{2}} \sqrt{mse\left(\frac{1}{n_1} + \frac{1}{n_2}\right)} \qquad t_{20,0.005} = 2.845$$

$$6.0167 - 3.6500 \pm 2.845 \sqrt{0.115\left(\frac{1}{6} + \frac{1}{6}\right)}$$

(1.81, 2.92)

III

AOV 2 [redacted]

SPSS Printout for Mendenhall 11.14 page [redacted]

H(o): Mu(1) = Mu(2) = Mu(3) = Mu(4)
H(a): Not H(o)
Reject H(o).
There is sufficient evidence to suggest that at least one population mean is different than the others (F=63.656, p=0.000).

95% CI on Mu(2) – Mu(3):
6.4400 – 4.7800 ± 2.131 $\sqrt{0.04103(1/5+1/5)}$ **= (1.3869, 1.9331)**

Descriptives

OXYGEN

	N	Mean
1.00	5	6.0800
2.00	5	6.4400
3.00	5	4.7800
4.00	4	6.0250
Total	19	5.8211

ANOVA

OXYGEN

		Sum of Squares	df	Mean Square	F	Sig.
Trts	Between Groups	7.836	3	2.612	63.656	.000
Error	Within Groups	.615	15	4.103E-02		
	Total	8.452	18			

= 0.04103

11.34 A randomized block design was employed to determine if there exists a difference in 3 treatment means. A significant ($p = .000$) difference was seen among the 3 treatment means. The Bonferroni procedure was used to compare among all the pairwise means at the $\alpha = .06$ familywise level since there are 3 possible pairwise contrasts we have:

$$\frac{.06}{3} = \alpha^* = .02$$

$$\frac{\alpha^*}{2} = .01$$

so our t multiplier is $t(8, .01) = 2.896$

The difference we need to declare significance is

$$2.896\sqrt{.028\left(\frac{1}{5} + \frac{1}{5}\right)} = .3064838$$

$\bar{X}_A = 2.5$

$\bar{X}_B = 3.76$

$\bar{X}_C = 3.52$

2.5	3.52	3.76
A	C	B

$C \xleftrightarrow{.24} B$

$A \xleftrightarrow{1.02} C$

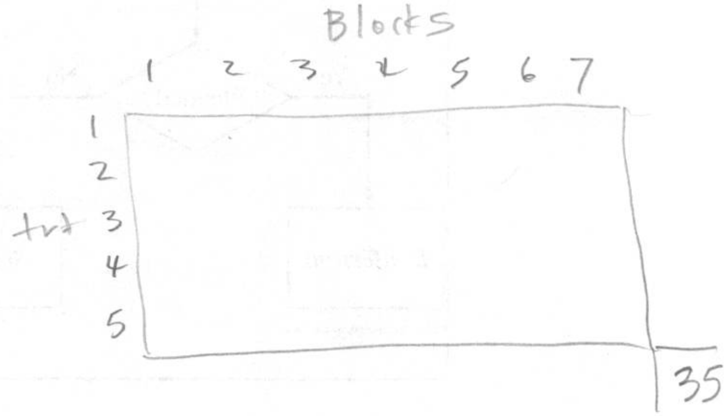
$A \xleftrightarrow{1.26} B$

It appears that means B & C are the only pair that is <u>not</u> significantly different at the 6% level of familywise confidence. (Note $\alpha = .06$ was chosen because our t-table would have the exact value we would need to compute the "yardstick" value.

968 V

11.35

source	df	SS	MS	F	P
trts	4	14.2	3.55	9.68	< .005
blocks	6	18.9	3.15	8.59	< .005
Error	24	8.8	0.37		
total	34	41.9			



a. There are 7 blocks

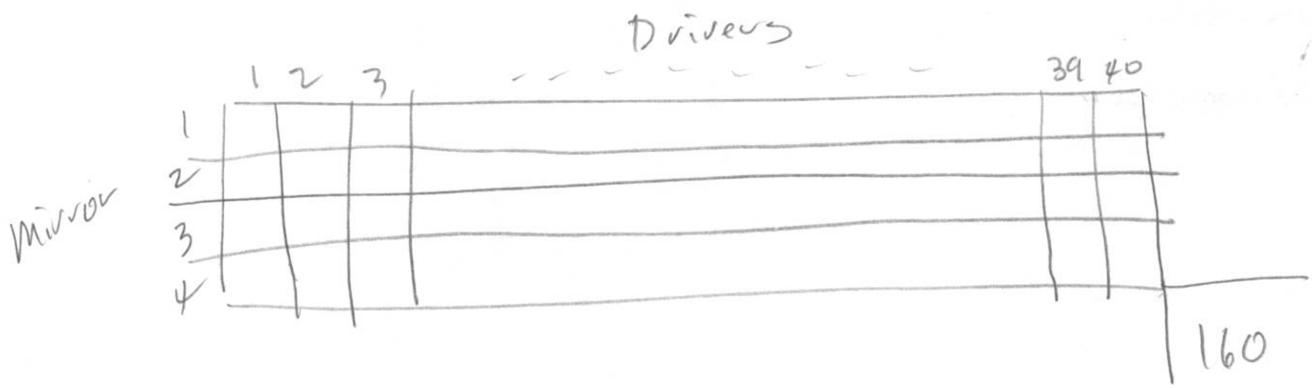
b. There are n=7 in each trt mean calculation

c. There are n=5 obs in each block

E. There is evidence to suggest differences in both block and trt means.

11.38 Revised — Originally I considered 40 total observations making for $40/4 = 10$ total drivers. Perhaps the author really meant a total of 40 drivers $= 40 \times 4 = 160$ observations.

Source	df	SS	MS	F	P
Mirrors	3	46.98	15.66	6.96	$P < .005$
Drivers	39	328.38	8.42	3.74	$P < .005$
Error	117	263.25	2.25		
Total	159	638.61			



b. Conclude there is evidence to conclude there exists a difference in mirror type means ($P < .005$)

c. Conclude there is evidence to suggest that the driver means are different ($P < .005$)

d. One type of mirrors perhaps has significantly different glare characteristics. From the info given we can not identify which type that may be.

11.39 c) VI

$q_{.01}(3,6) = 6.33$

$w = 6.33 \sqrt{\frac{1.8889}{4}} = 4.349889$

12.0	12.5	16.0
(3)	(1)	(2)
C	A	B

Using $\alpha = .01$ the Tukey procedure implies that none of the soil prep means are different. This is not surprising since the p-value from the anova was greater than .01 ($p = .012$)

d) 95% CI on $\mu_A - \mu_B$: $12.5 - 16.0 \pm \underset{t(6,.025)}{2.447}\sqrt{1.8889(\frac{1}{4}+\frac{1}{4})}$

$(-5.878, -1.1219)$

Extra... Suppose we wished to produce a set of 3 94% familywise Bonferroni corrected confidence intervals. $\alpha = .06$ $\alpha^* = \frac{\alpha}{3} = \frac{.06}{3} = .02$

We would need 3 98% confidence intervals:

$\bar{X}_i - \bar{X}_j \pm t(6, \frac{.02}{2}) \sqrt{mse(\frac{1}{n_i} + \frac{1}{n_j})}$

$\mu_A - \mu_B$: $12.5 - 16.0 \pm 3.143\sqrt{1.8889(\frac{1}{4}+\frac{1}{4})}$ $(-6.554, -.446)$

$\mu_B - \mu_C$: $16.0 - 12.0 \pm 3.143\sqrt{1.8889(\frac{1}{4}+\frac{1}{4})}$ $(0.945, 7.054)$

$\mu_A - \mu_C$ $12.5 - 12.0 \pm 3.143\sqrt{1.8889(\frac{1}{4}+\frac{1}{4})}$ $(-2.554, 3.554)$

We would conclude that soil prep B & C have statistically different means at $\alpha = .06$ level of familywise confidence

11.49 a) An interaction is implied. The profiles for factor A demonstrate non-parallel profiles.

b) Ho: No interaction between A and B
HA: Iteraction between A & B
Conclude there exists evidence to suggest an interaction of A & B. This implies we should focus on simple effects. We should estimate the differences in B at level 1 of A and differences in B at level 2 of A. We should avoid main effect discussion.

c) If significant interaction exists between factors A & B, then the main effects by themselves do not helpful information. They have helpful information if interaction does <u>NOT</u> exist
The main effects are not significant here because of the total "switch over" of the means, that is, level 2 of A is greater than level 1 when B=1 and vise versa for the A level means when B=2.

VIII

11.51 a)

source	df
training cond	$2-1=1$
Ability	$3-1=2$
$t * A$	$(2-1)(3-1)=2$
error	$n-ab = 60-6 = 54$ $ab(r-1) = 2(3)(10-1) = 54$
total	$n-1 = 60-1=59$

$$\begin{array}{r} 159 \\ \times 2 \\ \hline 117 \end{array}$$

	H	M	L
Active	n=10 17.895	n=10 5.031	n=10 1.728
passive	n=10 9.508	n=10 5.648	n=10 1.610

b) $F(\text{training}) = 103.7009/28.3015 = 3.66$

$F(\text{ability}) = 760.5889/28.3015 = 26.87$

$F(t*a) = 124.9905/28.3015 = 4.42$

c) There appears to be a significant interaction between the ability and condition factors ($p = .0167$) It appears that the greatest difference in ability levels is at the high training condition. A 95% CI on this diff would be

$17.895 - 9.508 \pm 1.96\sqrt{28.3015\left(\frac{1}{10}+\frac{1}{10}\right)}$

$(3.72, 13.05)$

11.56 a) $H_0: \mu_A = \mu_B = \mu_C = \mu_D = \mu_E$

H_A: Not H_0

IX

$F = 11.67$, $p \approx 0$

Conclude that there is evidence to suggest that at least one population mean is different than the others.

b) 95% CI on $\mu_A - \mu_D$. They do not suggest a level of significance so we will use $\alpha = .05$

$$0.625 - 0.926 \pm 2.074\sqrt{0.026\left(\tfrac{1}{4} + \tfrac{1}{5}\right)}$$

$$.625 - .926 \pm .2243$$

$$(-.5193, -.0707)$$

11.59 a) There exists evidence to suggest a difference in stimulus means

b) $q_{.05}(5, 12) = 4.51$ $\quad w = 4.51\sqrt{\frac{.007083}{4}}$
$= 0.1897821$

1.050	C
1.025	D
.800	B
.700	A
.525	E

.525 .5 .325 .25 .275 .225

It appears that the means C & D, A & B, and A & E are not sign different using the Tukey procedure at $\alpha = .05$

c) The blocking appears to have been helpful since the blocking source was $p = .007$

11.65 a) This experiment is a 2x3 factorial arrangement of treatments.

b) There appears to not be an interaction between plant and temperature

Ho: No interaction of plant and temp

HA: Interaction of plant and temp

$F = 0.45$, $p = 0.642$

This implies that we can focus on marginal means and associated main effects.