

$$n_1 = \dots = n_4 = 3$$

QA.1 $SST = 32.87$ $SSE = 0.93$ $N = 4(3) = 12$ $t = 4$

P.1.a. $MST = \frac{SST}{t-1} = \frac{32.87}{3} = 10.96$ $MSE = \frac{SSE}{N-t} = \frac{0.93}{8} = 0.11625$

$$F_{0.05} = \frac{MST}{MSE} = 94.28 \quad \text{RD: } F_{0.05} \geq F_{.05, 3, 8} = 4.066 \quad (\text{Yes})$$

P.1.b. $q(.05, t=4, df=8) = 4.529$ $\sqrt{\frac{MSE}{n}} = \sqrt{\frac{0.11625}{3}} = .197$

$$W_{ij} = 4.529(.197) = \del{4.529} 0.892$$

T_{t+4}	T_{t+2}	T_{t+3}	T_{t+1}
3.36	5.50	7.26	7.48

P.1.c. $t(.025, C = \frac{4(3)}{2} = 6, df=8) = 3.479$ $\sqrt{\frac{2MSE}{n}} = 0.279$

$$B_{ij} = 3.479(.279) = 0.969 \quad (\text{Same Conclusions})$$

QA.2. $t = 4$ $n_i = 5$ $N = 4(5) = 20$

$$MST = \frac{1200}{4-1} = 400 \quad MSE = \frac{2400}{20-4} = 150 \quad F_{0.05} = \frac{400}{150} = 2.67$$

~~0.05~~ $t(.025, 6, 16) = 3.008$ $\sqrt{\frac{2MSE}{n}} = \sqrt{\frac{2(150)}{5}} = 7.746$

$$\Rightarrow B_{ij} = 3.008(7.746) = 23.30$$

QA.3. $N = 3(30) = 90$ $t = 3$ $df_{TRT} = 3 - 1 = 2$ $df_E = 90 - 3 = 87$

QA.4. $t = 5$ $n_i = 7 \Rightarrow N = 35$ $df_T = 5 - 1 = 4$, $df_E = 35 - 5 = 30$
 $df_{TOTAL} = 35 - 1 = 34$

QA.5. FALSE

<u>QA.6.</u>	T_i	<u>SS TREATMENTS</u>	<u>SS Error</u>
1		$3(7.48 - 5.90)^2 = 7.4892$	$(3-1)(0.44)^2 = 0.3872$
2		$3(5.50 - 5.90)^2 = 0.4800$	$(3-1)(0.27)^2 = 0.1458$
3		$3(7.26 - 5.90)^2 = 5.5488$	$(3-1)(0.19)^2 = 0.0722$
4		$3(3.36 - 5.90)^2 = 19.5348$	$(3-1)(0.46)^2 = 0.3200$
		<u>32.8728</u>	<u>0.9252</u>

J.S. $F_{obs} = \frac{MST}{MSE} = \frac{32.8728 / (4-1)}{0.9252 / (12-4)} = 94.95$

RA: $F_{obs} \geq F_{.05, 3, 8} = 4.066$ smaller

QA.7. $t = 5$, $n_i = 5 \Rightarrow N = 25$ $SSE = 250$ $MSE = \frac{250}{25-5} = 12.5$

$t_{.025, \frac{5(4)}{2}, df=20} = 3.153$ $B_{ij} = 3.153 \sqrt{\frac{2(12.5)}{5}} = 7.05$

QA.8. $H = \frac{12}{N(N+1)} \sum_i \frac{T_i^2}{n_i} - 3(N+1) = \frac{12}{24(25)} \left[\frac{110^2}{8} + \frac{100^2}{8} + \frac{90^2}{8} \right] - 3(25)$

$= \frac{12(3775)}{24(25)} - 3(25) = 75.5 - 75 = 0.5$

RA: $H \geq \chi^2_{.05, 3-1} = 5.991$

QA.9 Same as QA.1

$$\begin{aligned} \text{QA.10. } SST &= 39(20.84 - 20.91)^2 + 9(19.98 - 20.91)^2 + 6(31.74 - 20.91)^2 \\ &= 0.1911 + 7.7841 + 703.7334 = 711.7086 \end{aligned}$$

$$\begin{aligned} SSE &= (39-1)(4.76^2) + (9-1)(4.19^2) + (6-1)(3.20^2) \\ &= 860.9888 + 140.4488 + 51.2 = 1052.6376 \end{aligned}$$

$$MST = \frac{711.7086}{3-1} = 355.8543 \quad MSE = \frac{1052.6376}{54-3} = 20.64$$

$$F_{0.55} = \frac{355.8543}{20.64} = 17.24 \quad F_{.05, 2, 51} \approx 3.183$$

$$t(.025, \frac{3(3-1)}{2}, df=51) \approx 2.477$$

$$1 \text{ v } 2 \quad B_{ij} = 2.477 \sqrt{20.64 \left(\frac{1}{39} + \frac{1}{9} \right)} = 4.16 \quad \text{NSD}$$

$$1 \text{ v } 3 \quad B_{ij} = 2.477 \sqrt{20.64 \left(\frac{1}{39} + \frac{1}{6} \right)} = 4.93 \quad \mu_3 > \mu_1$$

$$2 \text{ v } 3 \quad B_{ij} = 2.477 \sqrt{20.64 \left(\frac{1}{9} + \frac{1}{6} \right)} = 5.93 \quad \mu_3 > \mu_2$$

$$\text{QA.11. } N = 13 + 15 + 14 = 42$$

$$TS: H = \frac{12}{42(43)} \left[\frac{326^2}{13} + \frac{375^2}{15} + \frac{202^2}{14} \right] - 3(43)$$

$$= \frac{12(20464.64835)}{42(43)} - 3(43) = 135.98 - 129 = 6.98$$

$$R_2: H \geq \chi^2_{.05, 3-1} = 5.991 \quad \text{Reject } H_0$$

QA.12. $\sum_i (\bar{y}_i - \bar{y}_{..})^2 = (70-75)^2 + (75-75)^2 + (80-75)^2 = 50$

$$\sum_i S_i^2 = 8^2 + 6^2 + 10^2 = 200$$

#reps/trt	SSTRT	SSEerr	MSTAT	MSE
2	2(50) = 100	(2-1)(200) = 200	100/2 = 50	200/3 = 66.67
6	6(50) = 300	(6-1)(200) = 1000	300/2 = 150	1000/15 = 66.67
10	10(50) = 500	(10-1)(200) = 1800	500/2 = 250	1800/27 = 66.67

$$F_2 = \frac{50}{66.67} = 0.75 \quad F(.05, 2, 3) = 9.552$$

$$F_6 = \frac{150}{66.67} = 2.25 \quad F(.05, 2, 15) = 3.682$$

$$F_{10} = \frac{250}{66.67} = 3.75 \quad F(.05, 2, 27) = 3.354$$

$$\boxed{6 < F \leq 10}$$

QA.13. $t=5$ $n_i=6$ $N=30$ $SSE=2000$ $\bar{y}_{..}=30$

$$SST = 6[0+25+100+25+100] = 6(250) = 1500 \text{ (Not needed)}$$

$$t(.05, 5, 30-5) = 4.153 \quad \sqrt{\frac{MSE}{n}} = \sqrt{\frac{2000/25}{6}} = \cancel{10.22} 3.65$$

$$W_{ij} = 4.153(3.65) = 15.16 \quad \mu_3 > \mu_5$$

$$t(.025, 10, 25) = 3.078 \quad \sqrt{\frac{2 \cdot MSE}{n}} = \sqrt{\frac{2(80)}{6}} = 5.164$$

$$B_{ij} = 3.078(5.164) = 15.89 \quad \mu_3 > \mu_5$$

QA.14.

K=3 sectors N=45

$$TS: H = \frac{12}{45(46)} \left[\frac{466^2}{21} + \frac{312^2}{16} + \frac{257^2}{8} \right] - 3(46)$$

$$= \frac{12(24680.8869)}{45(46)} - 3(46) = 143.08 - 138 = 5.08$$

$$RR: H \geq \chi^2_{.05, 2} = 5.991$$

QB.1 t=4 varieties b=12 liters

Source	df	SS	MS	F	F(.05)
Variety	4-1=3	600	200	6.67	≈ 2.892
Litter	12-1=11	1410	128.18	-	
Error	3(11)=33	990	30	-	
TOTAL	48-1=47	3000	-		

$$t(.025, (4)(3)/2, 33) \approx 2.810 \sqrt{\frac{2(30)}{12}} = 2.236$$

$$B_{ij} = 2.810(2.236) = 6.283$$

Comparison

A v B	$-7 \pm 6.283 = (-13.283, -0.717)$	$\mu_B > \mu_A$
A v C	$-1 \pm 6.283 = (-7.283, 5.283)$	NSD
A v D	$-6 \pm 6.283 = (-12.283, 0.283)$	NSD
B v C	$6 \pm 6.283 = (-0.283, 12.283)$	NSD
B v D	$1 \pm 6.283 = (-5.283, 7.283)$	NSD
C v D	$7 \pm 6.283 = (0.717, 12.283)$	NSD

QB.2. $t=4$ $b=8$

Source	df	SS	MS	F_{obs}	$F(.05)$
Fertilizer	$4-1=3$	395.8	131.93	137.43	3.072
Location	$8-1=7$	329.3	47.04		
Error	$3(7)=21$	20.2	0.96		
Total	$32-1=31$	745.3	—		

$$t(.025, \frac{4(3)}{2}, 21) = 2.912 \quad \sqrt{\frac{2(0.96)}{8}} = 0.490$$

$$B_{ij} = 2.912 (0.490) = 1.43$$

27.1 29.0 33.7 35.9

All pairs are significantly different

QB.3. $df_{Treatments} = 4-1=3$ $df_{blocks} = 8-1=7$ $df_e = 3(7)=21$

$$df_{TOTAL} = 4(8) - 1 = 31$$

QB.4. $SS_{TREAT} = 4[4+1+9] = 56$ $df_{TREAT} = 2$ $MS_{TREAT} = 28$

$$SS_{BLOCKS} = 3[9+36+100+49] = 582 \quad df_{BLOCKS} = 3 \quad MS_{BLOCKS} = 194$$

$$SSE = 658 - 56 - 582 = 20 \quad MSE = \frac{20}{2(3)} = 3.33$$

$$F_{obs} = \frac{28}{3.33} = 8.4 \quad F(.05, 2, 6) = 5.143 \quad \text{Reject } H_0$$

QB.4 Continued

ENP7

$$RE(RLB, CR) = \frac{(b-1)MSB + b(t-1)MSE}{(bt-1)MSE} = \frac{(4-1)(194) + 4(3-1)(3.33)}{(4(3)-1)(3.33)}$$

$$= \frac{608.67}{36.67} = 16.60$$

$$W_{ij} = Q(.05, 3, 6) \sqrt{\frac{MSE}{b}} = 4.339 \sqrt{\frac{3.33}{4}} = 3.96$$

17 18 22
T₁ T₂ T₃

QB.5.

P.5.a. $F_{obs} = \frac{4000/2}{6800/57} = \frac{2000}{1200} = 1.667$ $F(.05, 2, 57) = 3.175$

Reject if $F_{obs} \geq 3.175$

P.5.b. $F_{obs} = \frac{2400/2}{11000/22} = \frac{1200}{500} = 2.40$ Reject if $F_{obs} \geq F(.05, 2, 22) = 3.443$

P.5.c. Jack: $t(.025, 3, 57) = \overset{2.484}{\cancel{2.005}}$ $\sqrt{\frac{2MSE}{20}} = \sqrt{\frac{2(1200)}{20}} = 10.95$

$B_{ij} = \overset{2.484}{\cancel{2.005}} (10.95) = \overset{27.20}{\cancel{21.91}}$

Jill: $t(.025, 3, 22) = 2.591$ $\sqrt{\frac{2MSE}{12}} = \sqrt{\frac{2(500)}{12}} = 9.129$

$B_{ij} = 2.591 (9.129) = 23.65$

Q18.6

P.6.a. $SS_{TREATS} = 15 \left[(.1613 - .0851)^2 + (.1260 - .0851)^2 + (-.0320 - .0851)^2 \right]$
 $= 15 (.0058 + .0017 + .0137) = 0.3180 \quad df_{TREATS} = 3-1 = 2$

$SS_{Error} = 2.3309 - 0.3180 - 0.9865 = 1.0264 \quad df_E = 2(14) = 28$

$MS_{TREATS} = \frac{.3180}{2} = .1590 \quad MS_{Error} = \frac{1.0264}{28} = .03666$

$MS_{BLOCKS} = \frac{.9865}{15-1} = .0705$

$F_{obs} = \frac{MS_{TREATS}}{MS_{Error}} = \frac{.1590}{.03666} = 4.337 \quad F_{.05, 2, 28} = 3.340$

Reject H_0

P.6.b. $q(.05, 3, 28) = 3.499 \quad \sqrt{\frac{MSE}{6}} = \sqrt{\frac{.03666}{15}} = .0494$

$\Rightarrow W_{ij} = 3.499(.0494) = 0.1730$

-.0320 .1260 .1613

Q18.7.

Ranks

Subject	Treat 1	2	3	4	5	6
1	5	3	6	4	1	2
2	5	6	1	4	3	2
3	6	4.5	2	1	4.5	3
4	4.5	1	4.5	3	6	2
5	4.5	2	4	6	3	5
	1	2	4	6	3	5
RANK SUM	21.5	16.5	17.5	18	17.5	14

→

QB.7.

$$F_n = \frac{12}{b k (k+1)} \sum_i T_i^2 - 3b(k+1) \quad k=6, b=5$$

$$F_n = \frac{12}{5(6)(7)} [21.5^2 + 16.5^2 + 17.5^2 + 18^2 + 17.5^2 + 14^2] - 3(5)(7)$$

$$= \frac{12(1867)}{5(6)(7)} - 3(5)(7) = 106.69 - 105 = 1.69$$

$$RR: F_n \geq \chi^2_{.05, 6-1} = 11.1$$

QB.8.

$k=4, b=24$

$\bar{y} = 23.4$

Source	df	SS	MSE	$F_{.05}$	$F_{.05}$
Subject	23	14183.5	616.67	3.873	~2.736
Brand	3	1976.75	658.92		
Error	69	11740.25	170.15		
Total	95	27900.5			

P < .05

$$q_{.05, 4, 69} \approx 3.724 \quad \sqrt{\frac{MSE}{b}} = \sqrt{\frac{170.15}{24}} = 2.663$$

$$W_{ij} = 3.724(2.663) = 9.92$$

1	2	3	4
15.6	25.0	26.5	26.5

$$RE = \frac{23(616.67) + 24(3)(170.15)}{(24(4) - 1)(170.15)} = \frac{26434.21}{16164.25} = 1.64 \Rightarrow 1.64(24) = 39.2 \approx 40\% \text{ error}$$

QB.9

$b=8, k=3$

Player	30x20	40x30	50x40
1	1	3	2
2	1	2	3
3	1	2	3
4	1	3	2
5	1	3	2
6	1	3	2
7	1	2	3
8	1	3	2
Sum	8	21	19

Ranks

$$F_r = \frac{12}{8(3)(4)} [8^2 + 21^2 + 19^2] + 3(8)(4)$$

$$= \frac{12(866)}{8(3)(4)} - 3(8)(4) = 108.25 - 96 = 12.25$$

$$Rn: F_r \geq \chi_{.05, 2}^2 = 5.991$$

$$P < .05$$

QC. 1.

Source	df	SS	MS	F	F(.05)
Seed Rate	5-1=4	522.74	130.69	27.93	3.259
Field Row	4	99.13	24.78	—	—
Field Col	4	38.60	9.65	—	—
Error	4(3)=12	56.14	4.68	—	—
Total	25-1=24	716.61	—	(P < .05)	

Comparisons = $\frac{5(4)}{2} = 10$

$t(.025, 10, 12) = 3.428$

$\sqrt{\frac{2MSE}{t}} = \sqrt{\frac{2(4.68)}{5}} = 1.37$

$B_{ij} = 3.428(1.37) = 4.69$

1	2	3	5	4
47.13	51.72	55.73	58.88	59.17

$$PE(LS, CR) = \frac{MSR + MSC + (t-1)MSE}{(t+1)MSE} = \frac{24.78 + 9.65 + 4(4.68)}{6(4.68)}$$

$$= \frac{53.15}{28.08} = 1.89$$

QC.2. $MS_{error} = \frac{240}{4(3)} = 20$ $MS_{row} = \frac{1000}{4} = 250$ $MS_{col} = 100$

$RE(LS, CN) = \frac{250 + 100 + 4(20)}{6(20)} = \frac{430}{120} = 3.583$

$t(.025, \frac{5(4)}{2}, 12) = 3.428$ $\sqrt{\frac{2MSE}{t}} = \sqrt{\frac{2(20)}{5}} = \sqrt{8} = 2.828$

$B_j = 3.428(2.828) = 9.70$

4	1	5	3	2
60	80	85	90	100

QC.3 $RE = 3 \Rightarrow$ would need $RE(t) = 3(5) = 15$ / treatment

QC.4.

Source	df	SS	MS	F_{obs}	$F(.05)$
Week	3	729.2	243.1	—	—
Label	3	414.7	138.2	—	—
County	3	1937.7	645.9	9.74	4.757
Error	6	397.9	66.3	—	—
Total	15	3479.4	—	—	—

Reject H_0

$t(.05, 4, 6) = 4.896$ $\sqrt{\frac{MSE}{t}} = \sqrt{\frac{66.3}{4}} = 4.07$

$W = 4.896(4.07) = 19.93$

A	N2	F	C
89.5	90.5	94.25	116.5

$\mu_C > \mu_F, \mu_C > \mu_{N2}, \mu_C > \mu_A$

QD. 1.

Source	df	SS	MS	F	F _{.05}
Player	10-1=9	3874.30	431.03	$\frac{431.03}{35.96} = 11.99$	F _{.05,9,9} = 3.179
Home	2-1=1	1.30	1.30	$\frac{1.30}{35.96} = .036$	5.117
P * H	9(1)=9	323.67	35.96	0.73	~1.909
Error	10(2)(17-1)=320	15787.29	49.34		
Total	10(2)(17)-1=339	19991.56	—		

$H_0: \sigma_{ab}^2 = 0 \quad H_a: \sigma_{ab}^2 > 0 \quad F = 0.73 \quad P > .05$

$H_0: \alpha_1 = \alpha_2 = 0 \quad F = 0.036 \quad P > .05$

$H_0: \sigma_b^2 = 0 \quad H_a: \sigma_b^2 > 0 \quad F = 11.99 \quad P < .05$

$$\hat{\sigma}_{ab}^2 = \frac{MS_{AB} - MSE}{r} = \frac{35.96 - 49.34}{17} = -0.79 \Rightarrow \hat{\sigma}_{ab}^2 = 0$$

$$\hat{\sigma}_b^2 = \frac{MS_B - MS_{AB}}{2r} = \frac{431.03 - 35.96}{2(17)} = 11.62$$

$$\hat{\sigma}^2 = MSE = 49.34$$

QD. 2

$$SS_{BASE} = 2(60)[(40.6 - 40.4)^2 + (40.2 - 40.6)^2] = 9.60 \text{ df}_{BASE} = 1$$

$$SS_{METH} = 2(60)[(42.6 - 40.4)^2 + (38.2 - 40.4)^2] = 1161.6 \text{ df}_{METH} = 1$$

$$SS_{BXM} = 60[(46.4 - 40.6 - 42.6 + 40.4)^2 + (34.8 - 40.6 - 38.2 + 40.4)^2 + (38.8 - 40.2 - 42.6 + 40.2)^2 + (41.6 - 40.2 - 38.2 + 40.4)^2] = 3110.4 \text{ df}_{BXM} = 1$$



QD.2 Continued

Source	df	SS	MS	F	$F_{.05}$	P
Base	1	9.60	9.60	0.16	~ 3.880	$> .05$
Meth	1	1161.6	1161.6	19.69	~ 3.880	$< .05$
BxM	1	3110.4	3110.4	52.72	~ 3.880	$< .05$
Error	236	13924	59	—		
Total	239	18205.6	—			

QD.3. $H_0: \sigma_{ab}^2 = 0$ $H_A: \sigma_{ab}^2 > 0$ TS: $F_{AB} = \frac{MS_{AB}}{MSE} = \frac{.675}{.75} = 0.90$

RR: $F_{AB} \geq F_{.05, 36, 50} \sim 1.65$ No interaction

$H_0: \alpha_i = 0$ $i=1, \dots, 5$ TS: $F_A = \frac{MS_A}{MS_{AB}} = \frac{10.75}{0.675} = 15.93$

RR: $F_A \geq F_{.05, 4, 36} \approx 2.640$ oil effect exists

$H_0: \sigma_b^2 = 0$ $H_A: \sigma_b^2 > 0$ TS: $F_B = \frac{1.12}{0.675} = 1.66$

RR: $F_B \geq F_{.05, 9, 36} \approx 2.159$ not significant

QD.4

Source	df	SS	MS	F	$F_{.05}$	Reject H_0 ?
Weave Type	$4-1=3$	3224.82	1074.94	99.44	~ 2.872	Yes
Test Speed	$3-1=2$	3186.53	1593.27	147.39	~ 3.266	Yes
Interaction	$3(2)=6$	20.98	3.50	0.32	~ 2.370	No
Error	$4(3)(4-1)=36$	389.28	10.81	—		
TOTAL	$4(3)(4)-1=47$	6821.62	—			

QD.5. $SSB = 3(3) \left[(24.37 - 24.87)^2 + (25.37 - 24.87)^2 \right] = 4.50$

Source	df	SS	MS	F	F _{.05}	P-value
A	3-1=2	12.91	6.46	50.47	3.885	<.05
B	2-1=1	4.50	4.50	35.16	4.747	<.05
AxB	2(1)=2	0.57	0.29	2.27	3.885	>.05
Error	3(2)(3-1)=12	1.53	0.128			
Total	3(2)(3)-1=17	19.51				

w/in Screw speed $q(.05, 3, 12) = 3.773, \sqrt{\frac{0.128}{3}} = 0.207$

$W_{ij} = 3.773(0.207) = 0.781$

$\frac{3(2)-3}{2} : t(.025, 3, 12) = 2.779, \sqrt{\frac{2(-.128)}{3}} = 0.292, B_{ij} = 2.779(.292) = 0.812$

QD.6 a=3 (Fixed), b=20 (Random), r=2 reps/trt

Source	df	SS	MS	F	F _{.05}	Reject?
Operators	3-1=2	2.6	1.3	1.3/0.71=1.83	~3.249	No
Parts	20-1=19	1185.4	62.4	62.4/0.71=87.89	1.867	Yes
OxP	2(19)=38	27.1	0.71	0.72	1.603	No
Error	3(20)(2-1)=60	59.5	0.99			
TOTAL	3(20)(2)-1=19	1274.6				

$W_{ij} = q(.05, 3, 38) \sqrt{\frac{MSAB}{20(2)}} = 3.451 \sqrt{\frac{0.71}{40}} = 0.460$

Q.N. 7.

EOP. 16

- a) 5 b) 4 c) 4 d) $\sqrt{20} = 4.47$ e) .1495
 f) .0065 g) $\frac{5(5-1)}{2} = 10$

Q.N. 8. a = 16 b = 4 r = 6

Source	df	
Accession	16 - 1 = 15	$SEM = \frac{SD}{\sqrt{n}}$ $\Rightarrow SD = \sqrt{n} SEM$ $\Rightarrow S^2 = n(SEM)^2$
Salinity	4 - 1 = 3	
A x S	15(3) = 45	
Error	16(4)(6-1) = 320	
Total	16(4)(6) - 1 = 383	

$$\Rightarrow SSE = (6-1) [6(2.2)^2 + \dots + 6(3.5)^2]$$

Q.N. 9. Variety: a = 4 (Fixed) Rate: b = 5 (Random) r = 2 $\bar{y}_{..} = 5.0$
 $SSA = 5(2) [1 + 4 + 4 + 1]$

Source	df	SS	MS	F	F.05
Variety	4 - 1 = 3	100	33.33	33.33 / 0.32 = 104.1	3.496
Rate	5 - 1 = 4	24.01	6.00	6.00 / 0.32 = 18.75	3.259
V x R	3(4) = 12	3.83	0.32	0.26	2.278
Error	4(5)(2-1) = 20	24.21	1.21		
Total	4(5)(2) - 1 = 39	152.05			

No Interaction (P > .05)



QD. 9. Continued

ENDP. 17.

$$q(-.05, 4, 12) = 4.199 \quad \sqrt{\frac{MSAB}{br}} = \sqrt{\frac{0.32}{5(2)}} = 0.179$$

$$t(.025, \frac{4(3)}{2}, 12) = 3.153 \quad \sqrt{\frac{2MSAB}{br}} = 0.253$$

$$W_{ij} = 4.199(0.179) = 0.752 \quad B_{ij} = 3.153(0.253) = 0.798$$

QD. 10.

a) 12 @ A_{High} , @ A_{Low} , ...

$$SSA = 12 [(5.03 - 4.96)^2 + (4.89 - 4.96)^2] = 6.35$$

$$SSB = 12 [(0.61)^2 + (-0.61)^2] = 8.93$$

$$SSC = 12 [(0.47)^2 + (-0.47)^2] = 5.30$$

SSA is incorrect

QD. 11

$$a=b=2$$

$$r=16$$

$$SSA = 2(16)[.49 + .49] = 31.36$$

$$SSB = 2(16)[(-2.15)^2 + (2.15)^2] = 295.84$$

Source	df	SS	MS	F_{obs}	$F(.05)$
Age	1	31.36	31.36	2.37	4.00
Film	1	295.84	295.84	22.33	4.00
A×F	1	1.44	1.44	0.11	4.00
Error	60	794.7	13.25		
Total	63	1123.34			

Interaction: $p > .05$, Age $p > .05$, Film $p < .05$

QD. 12.

Reader: $a=3$

Illum: $b=4$

$r=5$

EDP. 18.

Source	df	SS	MS	F	F(.05)
Reader	2	70.70	35.35	4.65	4.017 3.193
Illum	3	148.11	49.37	6.50	2.888
Read*Illum	6	2.15	0.36	0.05	2.296
Error	48	365.02	7.60	—	—
Total	59	585.98	—	—	—

Significant Reader and Illumination Main Effects
No Interaction

$$F(.05, 3, 48) = 3.420 \quad \sqrt{\frac{7.60}{4(5)}} = 0.616$$

$$W_{ij}^{\text{Reader}} = 3.420 (0.616) = 2.108$$

$$t(.05, \frac{4(3)}{2}, 48) \approx 2.753 \quad \sqrt{\frac{2(7.60)}{3(5)}} = 1.007$$

$$B_{ij}^{\text{Illum}} = 2.753 (1.007) = 2.771$$