6166 - EXAM 3 - FALL 2016 - Version 10

Q.1. $t=3,\ b=10$

ANOVA

Source	df	F(.05)
Keyboard (Trt)	$3-1=2$	3.55
Programmer (BLK)	$10-1=9$	
Error	$2(9)=18$	
Total	$3(10)-1=29$	

Q.2. $n=400$ $y=60$ $\hat{\pi}=.15$ $z_{.025}=1.96$

$\hat{\sigma}_{\hat{\pi}} = \sqrt{\frac{.15(1-.15)}{400}} = .0179$ $ME = 1.96(.0179) = .0350$

95% CI for π: $.1500 \pm .0350 \equiv (.1150, .1850)$

Q.3. $H = \frac{12}{N(N+1)} \sum_i \frac{T_i^2}{n_i} - 3(N+1)$ $n_1=n_2=n_3=10$ $N=30$ $T_1=232, T_2=166, T_3=67$

$T_1^2+T_2^2+T_3^2 = 85869$ $H = 110.799 - 3(31) = 17.799$ RR: $H \geq \chi^2_{.05,2} = 5.991$

Q.4. $t=4,\ b=18,$ $df_\varepsilon = N = 3(17) = 51$ $F_{.05,3,51} \approx 2.790$

Source	df	SS	MS	F	$F_{.05,3,51}$	Reject H_0?
Trts	$4-1=3$	59839	19946.3	18.72	2.790	Yes
Blocks	$18-1=17$	40017	2353.9			
Error	$17(3)=51$	54342	1065.5			
Total	$4(18)-1=71$	154198				

$q(.05,4,51) \approx 3.758$ $\sqrt{\frac{MSE}{b}} = \sqrt{\frac{1065.5}{18}} = \sqrt{59.19} = 7.69$ $w = 3.757(7.69) = 28.9$

T_3 T_4 T_1 T_2

123.7 145.4 188.4 191.7

$RE = \frac{17(2353.9) + 18(3)(1065.5)}{(4(18)-1)(1065.5)} = \frac{40017 + 57537}{75650.5} = \frac{97554}{75650.5} = 1.29$

Subjects/trt $= 1.29(18) = 23.21 \approx 24 \Rightarrow$ Total # subjects $= 4(24) = 96$

Q.5. $\bar{y}_{..} = 1543.3$ $n_i = 60$ $N = 180$ $df_{between} = 2$ $df_{within} = 177$

$SS_{between} = 60\left[(1630-1543.3)^2 + (1620-1543.3)^2 + (1380-1543.3)^2\right]$

$= 60\left[7516.89 + 5882.89 + 26666.89\right] = 60(40066.67) = 2404000$

$\Rightarrow MS_{between} = 1202000$

$SS_{within} = 59(810^2 + 240^2 + 680^2) = 59(1613300) = 95184700$

$\Rightarrow MS_{within} = 537766.7$

$\Rightarrow F_{obs} = 2.235$ RR: $F_{obs} \geq F_{.05,2,177} \approx 3.05$

Q.6.

Player	Size 1	Size 2	Size 3
1	1802 (1)	2140 (2)	2218 (3)
2	1340 (1)	1755 (3)	1748 (2)
3	1663 (1)	2116 (3)	2036 (2)
4	1705 (1)	2105 (2)	2167 (3)
5	1288 (1)	1748 (3)	1696 (2)
	$T_1 = 5$	$T_2 = 13$	$T_2 = 12$

T.S. $F_r = \frac{12}{5(3)(3+1)}\left\{5^2 + 13^2 + 12^2\right\} - 3(5)(3+1) = 67.6 - 60 = 7.6$

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

Q.7. $\hat{\pi}_1 = \frac{120}{600} = .200$ $\hat{\pi}_2 = \frac{80}{600} = .1333$ $\hat{\pi}_1 - \hat{\pi}_2 = .0667$

$\hat{\pi} = \frac{120+80}{600+600} = \frac{200}{1200} = .1667$ $\sqrt{.1667(.8333)\left(\frac{1}{600}+\frac{1}{600}\right)} = .0215$

T.S. $z_{obs} = \frac{.0667}{.0215} = 3.10$ RR: $|z_{obs}| \geq 1.96$ Reject H_0.

6166 - EXAM 3 - Fall 2016 - Version 2A

Q.1. $t=4,\ b=8$

ANOVA

Source	df	F(.05)
Keyboard (Trt)	$4-1=3$	3.072
Programmer (BLK)	$8-1=7$	—
Error	$3(7)=21$	—
TOTAL	$4(8)-1=31$	

Q.2. $n=1000$ $y=160$ $\hat{\pi}=0.16$ $z_{.025}=1.96$

$\hat{\sigma}_{\hat{\pi}} = \sqrt{\frac{.16(1-.16)}{1000}} = .0116$ $\quad ME = 1.96(.0116) = .0227$

95% CI for π: $.1600 \pm .0227 \equiv (.1373, .1827)$

Q.3. $H = \frac{12}{N(N+1)} \sum_i \frac{T_i^2}{n_i} - 3(N+1)$ $\quad n_1=n_2=n_3=10$ $N=30$ $T_1=227$, $T_2=177$, $T_3=61$

$T_1^2 + T_2^2 + T_3^2 = 86579$ $\quad H = 111.715 - 3(31) = 18.715$ $\quad RR: H \geq \chi^2_{.05,2} = 5.991$

Q.4 $t=4,\ b=18$ $\quad df_E = N = 3(17) = 51$ $\quad F_{.05,3,51} \approx 2.790$

Source	df	SS	MS	F	F.05	Reject H_0?
Trts	$4-1=3$	8415	2805	2.64	2.790	No
Blocks	$18-1=17$	61822	3636.6	—	—	—
Error	$17(3)=51$	54279	1064.3	—	—	—
Total	$18(4)-1=71$	124516	—			

$q(.05,4,51) \approx 3.757$ $\quad \sqrt{\frac{MSE}{b}} = \sqrt{\frac{1064.3}{18}} = \sqrt{59.13} = 7.69$ $\quad W = 3.757(7.69) = 28.9$

T_4	T_3	T_1	T_2
115.9	128.0	140.4	143.0

$RE = \frac{17(3636.6) + 18(3)(1064.3)}{(4(18)-1)(1064.3)} = \frac{61822.2 + 57472.2}{75565.3} = \frac{119294.4}{75565.3} = 1.58$

Subjects / Trt $= 18(1.58) = 28.4 \approx 29 \Rightarrow$ Total # Subjects $= 4(29) = 116$

Q.5. $\bar{y}_{..} = 1970$ $\quad n_i = 100$ $\quad N = 300$ $\quad df_{Between} = 2$ $\quad df_{Within} = 297$

$SS_{Between} = 100\left[(2190-1970)^2 + (1860-1970)^2 + (1860-1970)^2\right] = 100(48400 + 12100 + 12100)$

$= 100(72600) = 7260000 \Rightarrow MS_{Between} = 3630000$

$SS_{Within} = (100-1)\left[1100^2 + 950^2 + 1050^2\right] = 99(3215000) = 318285000$

$\Rightarrow MS_{Within} = 1071666.7$

$\Rightarrow$ TS: $F_{obs} = \frac{MSB}{MSW} = 3.387$ $\quad RR: F_{obs} \geq F_{.05,2,297} \approx 3.026$ $\quad p < .05$

Version 2A - Page 2

Q.6. $b = 5,\ k = 3$

Player	Size 1	Size 2	Size 3
1	1340 (1)	1755 (3)	1748 (2)
2	1573 (1)	1963 (2)	2036 (3)
3	1141 (1)	1558 (3)	1493 (2)
4	1288 (1)	1748 (3)	1696 (2)
5	1745 (1)	2142 (3)	2078 (2)

$T_1 = 5 \qquad T_2 = 14 \qquad T_3 = 11$

T.S. $F_r = \frac{12}{5(3)(3+1)}\left[5^2 + 14^2 + 11^2\right] - 3(5)(3+1) = 68.4 - 60 = 8.4$

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

Q.7. $\hat{\pi}_1 = \frac{20}{200} = 0.10 \qquad \hat{\pi}_2 = \frac{30}{200} = 0.15 \qquad \hat{\pi}_1 - \hat{\pi}_2 = 0.10 - 0.15 = -0.05$

$\hat{\pi} = \frac{20+30}{200+200} = \frac{50}{400} = 0.125 \qquad \sqrt{0.125(0.875)\left(\frac{1}{200} + \frac{1}{200}\right)} = .0331$

T.S. $z_{obs} = \frac{-.05}{.0331} = -1.51 \qquad$ RR: $|z_{obs}| \geq z_{.025} = 1.96$

Fail to Reject H_0.

6166 - EXAM 3 - FALL 2016 - VERSION 2B

Q.1. $t = 5$, $b = 6$

Source	df	F(.05)
Keyboard (Trt)	$5-1=4$	2.866
Programmer (BLK)	$6-1=5$	
ERROR	$(4)(5)=20$	
TOTAL	$5(6)-1=29$	

Q.2. $n = 500$ $y = 40$ $\hat{\pi} = \frac{40}{500} = 0.08$ $z_{.025} = 1.96$

$\hat{\sigma}_{\hat{\pi}} = \sqrt{\frac{.08(1-.08)}{500}} = .0121$ $ME = 1.96(.0121) = .0238$

95% CI for π: $.0800 \pm .0238 = (.0562, .1038)$

Q.3. $H = \frac{12}{N(N+1)} \sum_i \frac{T_i^2}{n_i} - 3(N+1)$ $n_1 = n_2 = n_3 = 10$ $N = 30$ $T_1 = 242$, $T_2 = 132.5$, $T_3 = 90.5$

$T_1^2 + T_2^2 + T_3^2 = 84310.5$ $H = 108.79 - 3(31) = 15.79$ RR: $H \geq \chi^2_{.05,2} = 5.991$

Q.4. $t = 4$, $b = 18$ $df_E = 3(17) = 51$ $F_{.05,3,51} \approx 2.790$

Source	df	SS	MS	F	F(.05)	Reject H_0?
Trts	$4-1=3$	3030	1010	0.645	2.790	No
Blocks	$18-1=17$	25065	1474	—	—	—
Error	$3(17)=51$	79814	1565	—	—	—
Total	$4(18)-1=71$	107909				

$q(.05, 4, 51) \approx 3.758$ $w = 3.758\sqrt{\frac{1565}{18}} = 3.758(9.324) = 35.04$

T_3	T_4	T_1	T_2
115.9	128.0	140.4	143.0

$RE = \frac{17(1474) + 18(5)1565}{(4(18)-1)(1565)} = \frac{25065 + 84510}{111115} = \frac{109575}{111115} = 0.99$

Subjects / Trt: $18(.99) \approx 18 = n$ Total Subjects $= 18(4) = 72$

Q.5 $\bar{y}_{..} = 1350$ $n_i = 40$ $N = 120$ $df_{between} = 3-1 = 2$ $df_{within} = 120-3 = 117$

$SS_{between} = 40\left[(1460-1350)^2 + (1330-1350)^2 + (1260-1350)^2\right] = 40\left[12100 + 400 + 8100\right]$

$= 40(20600) = 824000 \Rightarrow MS_{between} = 412000$

$SS_{within} = (40-1)\left[720^2 + 620^2 + 690^2\right] = 39(1378900) = 53777100$

$\Rightarrow MS_{within} = 459633.3$

T.S. $F_{obs} = \frac{412000}{459633.3} = 0.896$ RR: $F_{obs} \geq F_{.05,2,117} \approx 3.074$ $P > .05$

Version 2B - P.2

Q.6.

Player	Size 1	Size 2	Size 3
1	1705 (1)	2105 (2)	2167 (3)
2	1340 (1)	1755 (3)	1748 (2)
3	1141 (1)	1558 (3)	1493 (2)
4	1288 (1)	1748 (3)	1696 (2)
5	1802 (1)	2140 (2)	2218 (3)
	$T_1 = 5$	$T_2 = 13$	$T_3 = 12$

T.S. $F_r = \frac{12}{5(3)(3+1)}\left[5^2+13^2+12^2\right] - 3(5)(3+1) = 67.6 - 60 = 7.6$

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

Q.7. $\hat{\pi}_1 = \frac{40}{200} = 0.20$ $\hat{\pi}_2 = \frac{30}{200} = 0.15$ $\hat{\pi}_1 - \hat{\pi}_2 = 0.20 - 0.15 = 0.05$

$\hat{\pi} = \frac{40+30}{200+200} = \frac{70}{400} = .175$, $\sqrt{.175(.825)\left(\frac{1}{200}+\frac{1}{200}\right)} = .0380$

T.S. $z_{obs} = \frac{.05}{.0380} = 1.32$ RR: $|z_{obs}| \geq z_{.025} = 1.96$

Fail to Reject H_0.

6166 - EXAMS - FALL 2016 VERSION 1A

TOTAL = 157

Q.1 $t=6, b=5$

ANOVA

Source	df (2 each)	F(.05) (3)
Keyboard (Trt)	6-1=5	2.711
Programmer (Blk)	5-1=4	—
Error	5(4)=20	—
Total	6(5)-1=29	

Q.2 $n=800$ $y=120$ $\hat{\pi}=0.15$ $z_{.025}=1.96$ (2)

$\hat{\sigma}_{\hat{\pi}} = \sqrt{\frac{.15(1-.15)}{800}} = .0126$ (3) (6) $\quad ME = 1.96(.0126) = .0247$

95% CI for π: $0.15 \pm .0247 \equiv (.1253, .1747)$ (3)

Q.3. $H = \frac{12}{N(N+1)} \sum_i \frac{T_i^2}{n_i} - 3(N+1)$ $\quad n_1=n_2=n_3=10$ $N=30$ $\quad T_1=215$, $T_2=148.5$ $T_3=101.5$

$T_1^2 + T_2^2 + T_3^2 = 78579.5$ (8) $\quad H = 101.393 - 93 = 8.393$ $\quad RR: H \geq \chi^2_{.05,2} = 5.991$ (4)

(38)

Q.4. $t=4$, $b=18$ $\quad df_E = N = 3(17) = 51$ $\quad F_{.05,3,51} \approx 2.790$

Source	df (2 each)	SS (3)	MS (2 each)	F (2)	$F_{.05}$ (3)	Reject H_0? (3)
Trts	4-1=3	23362	7787.3	8.15	2.790	Yes
Blks	18-1=17	18500	1088.2	—	—	—
Error	3(17)=51	48705	955	—	—	—
Total	18(4)-1=71	90567	—			

(3) $q(.05, 4, 51) \approx 3.758$ $\quad \sqrt{\frac{MSE}{b}} = \sqrt{\frac{955}{18}} = 7.28$ (3) $\Rightarrow W = 3.758(7.28) = 27.4$ (3)

(3)

T_3	T_4	T_2	T_1
133.3	140.8	165.0	177.9

$RE = \frac{17(1088.2) + 18(3)(955)}{(4(18)-1)(955)} = \frac{70070}{67805} = 1.03$ (4)

(2)

Subjects/Trt $= 18(1.03) = 18.60 \simeq 19 \Rightarrow$ Total # Subjects $= 4(19) = 76$ (2)

(Y3)

Q.5. $\bar{y}_{..} = 216.7$ $\quad n_i = 30$ $\quad N = 90$ $\quad df_{Between} = 2$ (2) $\quad df_{Within} = 87$ (2)

(8) $SS_{Between} = 30\left[(180-216.7)^2 + (290-216.7)^2 + (180-216.7)^2\right] = 30\left[1346.89 + 5372.89 + 1346.89\right]$

$= 30\left[8066.67\right] = 242000 \Rightarrow MS_{Between} = 121000$ (2)

(8) $SS_{Within} = (30-1)\left[310^2 + 390^2 + 310^2\right] = 29(344300) = 9984700$

$\Rightarrow MS_{Within} = 114767$ (2)

(33) T.S. $F_{obs} = \frac{MSB}{MSW} = 1.054$ (3) $\quad RR: F_{obs} \geq F_{.05,2,87} \approx 3.100$ (3) $\quad P > .05$ (3)

Version 1A - P. 2

Q.6.

Player	Size 1	Size 2	Size 3	Ranks
1	1288 (1)	1748 (3)	1696 (2)	
2	1705 (1)	2105 (2)	2167 (3)	
3	1141 (1)	1558 (3)	1493 (2)	
4	1340 (1)	1755 (3)	1748 (2)	
5	1573 (1)	1963 (2)	2036 (3)	
	$T_1 = 5$	$T_2 = 13$	$T_3 = 12$	(5)

(8)

T.S. $F_r = \frac{12}{5(3)(3+1)}\left[5^2 + 13^2 + 12^2\right] - 3(5)(3+1) = 67.6 - 60 = 7.6$ (8)

RR: $F_r \geq \chi^2_{.05,2} = 5.991$ (3)

Q.7. $\hat{\pi}_1 = \frac{100}{500} = 0.20$ (3) $\hat{\pi}_2 = \frac{80}{500} = 0.16$ (3) $\hat{\pi}_1 - \hat{\pi}_2 = 0.20 - 0.16 = 0.04$ (3)

$\hat{\pi} = \frac{100+80}{500+500} = \frac{180}{1000} = .180$ $\sqrt{.180(.820)\left(\frac{1}{500}+\frac{1}{500}\right)} = .0243$ (6)

T.S. $z_{obs} = \frac{.04}{.0243} = 1.65$ (3) RR: $|z_{obs}| \geq z_{.025} = 1.96$ (3) Fail to reject H_0. (3)

(43)