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STAT 307-001

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Final Exam – Exercise 1

$\boxed{\text{Design 1}}$	A	B	C	D	E = ABC	F = BCD
(1)	-1	-1	-1	-1	-1	-1
ae	1	1	1	-1	1	-1
bc	-1	1	1	-1	-1	-1
df	-1	-1	-1	1	-1	1
abd	1	1	-1	1	-1	-1
abf	1	1	-1	-1	-1	1
acd	1	-1	1	1	-1	-1
acf	1	-1	1	-1	-1	1
bde	-1	1	-1	1	1	-1
bef	-1	1	-1	-1	1	1
cde	-1	-1	1	1	1	-1
cef	-1	-1	1	-1	1	1
abce	1	1	1	-1	1	-1
adef	1	-1	-1	1	1	1
bcdf	-1	1	1	1	-1	1
abcdef	1	1	1	1	1	1

I = ABCE = BCDF = ADEF
A = BCE = ~~ABCDF~~ = DEF
B = ACE = CDF ~~= ABDEF~~
C = ABE = BDF ~~= ACDEF~~
D = ~~ABCDE~~ = BCF = AEF
E = ABC = ~~BCDEF~~ = ADF
F = ~~ABCEF~~ = BCD = ADE

Resolution IV
Minimum aberration ×
(Aberration: 3)

$\boxed{\text{Design 2}}$	A	B	C	D	E = ABCD	F = ACE
b	-1	1	-1	-1	-1	-1
d	-1	-1	-1	1	-1	-1
af	1	-1	-1	-1	-1	1
cf	-1	-1	1	-1	-1	1
ef	-1	-1	-1	-1	1	1
abc	1	1	1	-1	-1	-1
abe	1	1	-1	-1	1	-1
acd	1	-1	1	1	-1	-1
ade	1	-1	-1	1	1	-1
bce	-1	1	1	-1	1	-1
cde	-1	-1	1	1	1	-1
abdf	1	1	-1	1	-1	1
acef	1	-1	1	-1	1	1
bcdf	-1	1	1	1	-1	1
bdef	-1	1	-1	1	1	1
abcdef	1	1	1	1	1	1

I = ABCDE = ACEF = BDF
A = BCDE = CEF ~~= ABDF~~
B = ACDE = ~~ABCEF~~ = DF
C = ABDE = AEF ~~= BCDF~~
D = ABCE = ~~ACDEF~~ = BF
E = ABCD = ACF ~~= BDEF~~
F = ~~ABCDEF~~ = ACE = BD

Resolution III
Minimum aberration √
(Aberration: 1)

The first design is slightly preferred over the second design. Although the second design is a minimum-aberration design and the first one is not, the first design has a resolution of IV, while the second design has a resolution of III. Because of the higher resolution, main effects are not aliased with other main effects or two-factor interactions in the first design. All of the main effects are aliased with interaction terms containing three factors or more, allowing higher-order interaction terms to be aliased with the main effects.

Final Exam – Exercise 2

$\boxed{\text{2a.}}$ $b = 6, \quad g = 6, \quad k = 4, \quad r = 4, \quad \lambda = \dfrac{r(k - 1)}{g - 1} = \dfrac{(4)((4) - 1)}{(6) - 1} = \dfrac{(4)(3)}{5} = \dfrac{12}{5} = 2.4$

This design is <u>unbalanced</u> because the balanced incomplete block design (BIBD) parameter λ is not an integer.

$\boxed{\text{2b.}}$ $b = 7, \quad g = 7, \quad k = 3, \quad r = 3, \quad \lambda = \dfrac{r(k - 1)}{g - 1} = \dfrac{(3)((3) - 1)}{(7) - 1} = \dfrac{(3)(2)}{6} = \dfrac{6}{6} = 1$

This design is <u>balanced</u> because the balanced incomplete block design (BIBD) parameter λ is an integer and k is less than g $(3 < 7)$.

Final Exam – Exercise 3

	A	B	C	D = BC	E = AB
b	-1	1	-1	-1	-1
ac	1	-1	1	-1	-1
ad	1	-1	-1	1	-1
ce	-1	-1	1	-1	1
de	-1	-1	-1	1	1
abe	1	1	-1	-1	1
bcd	-1	1	1	1	-1
abcde	1	1	1	1	1

I = ACDE = BCD = ABE
A = ~~CDE = ABCD = BE~~
B ~~= ABCDE = CD = AE~~
C ~~= ADE = BD = ABCE~~
D ~~= ACE~~ = BC ~~= ABDE~~
E = ~~ACD = BCDE~~ = AB

3a. I = ACDE = BCD = ABE

3b. A = CDE = ABCD = BE

3c.

(1):	b,	ac,	ad,	ce,	de,	abe,	bcd,	abcde
a:	ab,	c,	d,	ace,	ade,	be,	abcd,	bcde
b:	(1),	abc,	abd,	bce,	bde,	ae,	cd,	acde
c:	bc,	a,	acd,	e,	cde,	abce,	bd,	abde
d:	bd,	acd,	a,	cde,	e,	abde,	bc,	abce
e:	be,	ace,	ade,	c,	d,	ab,	bcde,	abcd
acde:	abcde,	de,	ce,	ad,	ac,	bcd,	abe,	b
bcd:	cd,	abd,	abc,	bde,	bce,	acde,	(1),	ae

Final Exam – Exercise 4

	A	B	C	D	E	F
b	-1	1	-1	-1	-1	-1
ad	1	-1	-1	1	-1	-1
cd	-1	-1	1	1	-1	-1
abc	1	1	1	-1	-1	-1
aef	1	-1	-1	-1	1	1
cef	-1	-1	1	-1	1	1
bdef	-1	1	-1	1	1	1
abcdef	1	1	1	1	1	1

I = ACDF = BDE = **ABCEF**
I = ACDF = ABC = **BDF**
I = BDE = ABC = **ACDE**
I = ABCEF = ABC = **EF**

4a. ABCEF, BDF, ACDE, EF

4b. (1): b, ad, cd, abc, aef, cef, bdef, abcdef

Final Exam – Exercise 5

5a. There is clearly a violation of the homoscedasticity (constant variance) assumption for ANOVA. The large differences in standard deviations between sites are seen in the summary statistics. These differences become greater when the standard deviations are squared to calculate variances.

5b. A <u>logarithmic transformation</u> to the count response variable would be appropriate. When looking at **Plot 3**, although the data may not appear to be significantly more well-fit to the line, the data are closer together due to the transformation, as indicated by the shorter scaling on the axes. Additionally, the value for standard deviation ("S") is the lowest of the four plots (0.132469) and the value for adjusted correlation ("R-Sq(adj)") is the highest of the four plots (97.7%), indicating that the transformation is a good fit for the data.