Online Homework System

Assignment Worksheet
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Name: ____________________________
Class:
Class #: ____________________________
Section #: ____________________________
Instructor: `Nathaniel Stevens`
Assignment: `Quiz 6`

Question 1: (5 points)

Consider the following balanced incomplete block design (BIBD).

	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8	Block 9	Block 10	Block 11	Block 12
Condition 1	√	X	X	√	√	X	√	√	√	X	X	X
Condition 2	X	√	X	√	X	√	X	X	√	X	√	√
Condition 3	√	√	√	X	X	X	X	√	X	√	X	√
Condition 4	X	X	√	X	√	√	√	X	X	√	√	X

Let m, b, m^*, r, and λ be defined as in class. Using the table above, determine each of their values, and indicate them in the appropriate boxes below.

- m: ____________ 4 (# of rows)
- b: ____________ 12 (# of columns)
- m^*: ____________ 2 (# of checks in a column)
- r: ____________ 6 (# of checks in a row)
- λ: ____________

$$2 = \frac{r(m^*-1)}{m-1}$$

Question 2: (1 point)

$r = \frac{\lambda(m-1)}{m^*-1}$ $b = \frac{mr}{m^*}$

Interest lies in experimenting with *one* design factor (with $m = 4$ levels) while controlling for the influence of *one* nuisance factor (by blocking). Unfortunately, only $m^* = 3$ experimental conditions can be carried out in a single block. Since a randomized complete block design (RCBD) is not possible, a balanced incomplete block design (BIBD) may be used as an alternative. Does there exist a BIBD with $b = 5$ blocks?

(a) Yes

(b) No

Try $\lambda = 1$: $r = 1.5$

Try $\lambda = 2$: $r = 3$, $b = 4$

Try $\lambda = 3$: $r = 4.5$

Try $\lambda = 4$: $r = 6$, $b = 8$

Nothing between these

Question 3: (4 points)

A partially complete 4x4 Latin Square is shown below. By selecting the appropriate letters from the drop-down menus, complete the Latin Square.

C	A	D	B
B	D	A	C
A	C	B	D
D	B	C	A

Question 4: (2 points)

Suppose that a 3x3 Latin Square design is performed to study the significance of *one* design factor while controlling for the influence of *two* nuisance factors. The following "full" logistic regression model is fit to the response observations, which are collected from $n = 75$ units assigned to each block:

$$\log\left(\frac{\pi}{1-\pi}\right) = \alpha + \beta_1 x_1 + \beta_2 x_2 + \gamma_1 z_1 + \gamma_2 z_2 + \delta_1 w_1 + \delta_2 w_2$$

where the x's represent the design factor, the z's represent nuisance factor 1, and the w's represent nuisance factor 2. Suppose we wish to determine whether blocking by nuisiance factor 1 was necessary. Which of the following "reduced" models should the "full" model be compared to, in order to make this determination?

(a) $\log\left(\frac{\pi}{1-\pi}\right) = \alpha + \beta_1 x_x + \beta_2 x_2$

(b) $\log\left(\frac{\pi}{1-\pi}\right) = \alpha + \gamma_1 z_1 + \gamma_2 z_2 + \delta_1 w_1 + \delta_2 w_2$

(c) $\log\left(\frac{\pi}{1-\pi}\right) = \alpha + \beta_1 x_1 + \beta_2 x_2 + \delta_1 w_1 + \delta_2 w_2$ ← $H_0: \gamma_1 = \gamma_2 = 0$

(d) $\log\left(\frac{\pi}{1-\pi}\right) = \alpha + \beta_1 x_1 + \beta_2 x_2 + \gamma_1 z_1 + \gamma_2 z_2$

The comparison above would be carried out using a likelihood ratio test. Which of the following is the appropriate null distribution?

(a) $F_{(2,668)}$

(b) $\chi^2_{(3)}$

(c) $F_{(3,668)}$

(d) $\chi^2_{(2)}$

$p-1=2$

Question 5: (3 points)

n P

A latin square design was used to determine whether a continuous response variable is significantly influenced by a design factor (with 3 levels) while controlling for the influence of two nuisance factors. Response observations were collected on 50 experimental units in each block. A partially complete ANOVA table for this experiment is shown below.

Fill in the missing cells of this table. Round your mean squares and test statistics to 1 decimal place. Be sure to round your answers *before* using them in subsequent calculations.

Source	SS	df	MS	Test Stat.
Condition	90	$p-1 = 2$	$SS_C/2 = 45$	
Nuisance Factor 1	35	$p-1 = 2$	$SS_{B_1}/2 = 17.5$	
Nuisance Factor 2	45	$p-1 = 2$	$SS_{B_2}/2 = 22.5$	
Error	860	$N-3p+2 = 443$	$SSE/443 = 1.9$	
Total	1,030			

$MS_C/MS_E = 23.7$

$MS_{B_1}/MS_E = 9.2$

$MS_{B_2}/MS_E = 11.8$

$N-1 = np^2-1$
$= 449$

Question 6: (1 point)

Suppose that a 5x5 Latin Square Design was used to investigate the significance of *one* design factor while controlling for the influence of *two* nuisance factors. Response observations were collected for each of the $n = 5$ experimental units in each block. The resulting ANOVA table is shown below.

Source	SS	df	MS	Test. Stat.	P-value
Design Factor	330	4	82.5	7.73	0.00002
Nuisance Factor 1	68	4	17	1.59	0.18188
Nuisance Factor 2	150	4	37.5	3.51	0.00971
Error	1195	112	10.67		
Total	1743	124			

less than $\alpha = 0.05$ so we reject hypothesis of overall equality.

Based on this analysis of variance and a significance level of 5%, is it reasonable to believe that the expected response is the same in all 5 experimental conditions?

(a) Yes

(b) No