Online Homework System

Name: _____

Class:

Class #: _____

Section #: _____

Instructor: Nathaniel Stevens

Assignment: Quiz 8

Question 1: (1 point)

We discussed an experiment run by TinyCo that dealt with the "Bananimial" -- a hybrid creature resulting from the fusion of a banana and which type of animal?

    (a) Cat

    (b) Dog

    (c) Monkey

    (d) Gorilla

Question 2: (2 points)

Suppose that a factorial experiment was used to investigate the influence of two factors A and B on a response variable Y. Suppose also that a regression model is fit to the resulting data where the linear predictor involves the following indicator variables:

- x_1, that represents Factor A (which has 2 levels)
- x_2 and x_3, that represent Factor B (which has 3 levels)

To test whether the main effect of factor B is significant, which of the following linear predictors constitutes the "reduced" model?

(a) $\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_1 x_2 + \beta_5 x_1 x_3 + \beta_6 x_2 x_3$

(b) $\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_1 x_2 + \beta_5 x_1 x_3$

(c) $\beta_0 + \beta_1 x_1$ ← *this arises from "full" when $H_0: \beta_2 = \beta_3 = 0$ is true*

(d) $\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3$ *this would be the "full" model*

(e) $\beta_0 + \beta_2 x_2 + \beta_3 x_3$

To test whether the main effect of factor B depends significantly on the levels of factor A, which of the following linear predictors constitutes the "full" model?

(a) $\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_1 x_2 + \beta_5 x_1 x_3 + \beta_6 x_2 x_3$

(b) $\beta_0 + \beta_2 x_2 + \beta_3 x_3$

(c) $\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3$

(d) $\beta_0 + \beta_1 x_1$

(e) $\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_1 x_2 + \beta_5 x_1 x_3$

Question 3: (5 points)

3 indicators   *3 indicators*   *3 indicators*

Suppose that a factorial experiment with $m = 64$ conditions, and $n = 100$ units in each condition, is conducted. Suppose also that these conditions arose by considering all possible combinations of the levels of factors A (4 levels), B (4 levels), and C (4 levels). Interest lies in determining whether the A:B:C interaction is significant.

- If the response variable was binary, a likelihood ratio test with a χ^2 null distribution would be used to determine the significance of the A:B:C interaction. In the box below, enter the degrees of freedom associated with this test.

  _____ ← *$3 \times 3 \times 3 = 27$ terms would be eliminated from a "full" model*

  In such a likelihood ratio test, which of the following test statistic values would provide evidence to suggest that the A:B:C interaction effect *is not significant*?

  (a) Positive values of t very close to zero   ← *the likelihood ratio would be close to 1 and so the log of this ratio would be close to 0.*

  (b) Positive values of t very far from zero

  (c) Both (a) and (b)

  (d) Values of t very close to 1

- If the response variable was continuous, a partial *F*-test would be used to determine the significance of the A:B:C interaction. In the boxes below, enter the numerator and denominator degrees of freedom associated with this test.

  Numerator df: _____ ← *27 as above*

  Denominator df: _____ ← *$N - (\text{\# of } \beta\text{'s in full model}) = 6400 - 64 = 6336$*   (*$n \times m$*)

  In such a partial *F*-test, which of the following test statistic values would provide evidence to suggest that the A:B:C interaction effect *is significant*?

  (a) Positive values of t very close to zero

  (b) Positive values of t very far from zero

  (c) Both (a) and (b)

  (d) Values of t very close to 1

  large positive values of t are considered "extreme"

  • Intercept : 1 β
  • ME : $3+3+3 = 9$ β's
  • AB int : $3 \times 3 = 9$ β's
  • AC int : $3 \times 3 = 9$ β's
  • BC int: $3 \times 3 = 9$ β's
  • ABC int: $3 \times 3 \times 3 = 27$ β's

Question 4: (1 point)

Suppose that a two-level factorial experiment involving K factors is conducted. Which of the following best describes the primary purpose of this experiment?

(a) To determine which configuration of the K factors' levels is optimal

(b) To determine which among the K factors statistically significantly influence the response

Question 5: (1 point)

The efficacy of two-level factorial experiments for purposes of screening is largley due to:

(a) The Pareto principle

(b) The principle of effect heredity

(c) The principle of effect sparsity

Question 6: (1 point)

A 2^2 factorial experiment has how many unique conditions. State your answer in the space below.

_____ $2^2 = 4$