STATISTICS 642 - ASSIGNMENT 9

DUE DATE: 8am Central, THURSDAY, April 21, 2022

Name (**Typed**) _____

Email Address (**Typed**) _____

- Due 8am Central, THURSDAY, April 21, 2022
- Read Handout 10
- Supplemental Reading: Chapter15 in Design & ANOVA Book

- **Hand in the following Problems:**

Problem I. (30 points) For each of the three designs given below identify the following characteristics:

c1. The fraction of the full design

c2. The number of required generators (defining contrasts)

c3. The number of implicit generators (contrasts)

c4. The number of aliases for each estimable effect

c5. The number of EU's (runs) required

1. Design - 2^{6-2}
2. Design - 2^{7-3}
3. Design - 2^{7-4}

Problem II. (16 points) Construct a 2^{7-3} fractional factorial design using $ABCF$, $CDEF$, and $ADFG$ as the design generators.

1. Identify the treatments to be used in the study.
2. What are the implicit generators (generalized interactions)?
3. What is the resolution of the design? Justify your answer.
4. Show the alias structure for all main effects and two-factor interactions.

Problem III. (8 points) A 2^{5-2} fractional factorial experiment is designed using generators ABC and $BCDE$. It is known that factors A, B, and C do not interact with one another and factors C, D, and E do not interact with one another.

1. Which effects can be estimated ignoring three-factor and higher interactions?
2. Is it possible to have an improved resolution 2^{5-2} design for this situation. Explain your answer.

Problem IV. (12 points) In a Resolution VIII 2^{n-p} design

1. Main Effects are **NOT** confounded with which effects?
2. Two-Way Interaction Effects are **NOT** confounded with which effects?
3. Three-Way Interaction Effects are **NOT** confounded with which effects?
4. Four-Way Interaction Effects are **NOT** confounded with which effects?

Problem V. (10 points) Construct a Resolution IV design that is a $\frac{1}{8}$ fraction of a 2^8 factorial. Make sure to provide your design generators and display a list of the treatments to be used in the experiment.

Problem VI. (24 points) The manufacturer of instant soup products wanted to produce dry soup mix packages with minimum weight variation among packages. Five factors were identified that might influence variation in the filling process. A 2^{5-1} design was constructed using the defining equation $I = -ABCDE$ ($E = -ABCD$) to evaluate the effects of the factors and their interactions. The 16 treatments were selected as given in the following table. Between 125 and 150 packages of soup mix were sampled over an 8-hour production run for each treatment. The standard deviation of the weights of the 125 to 150 packages was computed as a measure of variation in the filling process, S_{ijklm}.

Run	A	B	C	D	E	S_{ijklm}
1	-1	-1	-1	1	1	0.78
2	1	-1	1	1	1	1.10
3	1	1	-1	-1	-1	1.70
4	1	-1	1	-1	-1	1.28
5	-1	1	-1	-1	1	0.97
6	-1	-1	1	-1	1	1.47
7	-1	1	-1	1	-1	1.85
8	1	1	1	1	-1	2.10
9	-1	1	1	1	1	0.76
10	1	1	-1	1	1	0.62
11	-1	-1	1	1	-1	1.09
12	-1	-1	-1	-1	-1	1.13
13	1	-1	-1	-1	1	1.25
14	1	1	1	-1	1	0.98
15	1	-1	-1	1	-1	1.36
16	-1	1	1	-1	-1	1.18

The SAS program: ASSIGN9-PROBVI-SP22 may be used in answering some of the following questions.

1. What is the resolution of the design? Justify your answer.
2. Show how the + and - signs for the levels of Factor E were determined for this design.
3. Show the alias structure for this design.
4. What assumptions must be made to estimate main effects and two-factor interactions free of any other effects?
5. Estimate the main effects and two-factor interactions and their standard errors.
6. Construct a quarter fraction design from the above design.