Statistical Methods II MATH 536 EVALUATION FINAL [100 pts] -- SPRING 2021 -- KSR

You may use MINITAB, SAS, R, Web Applets, etc. ...
please provide the output to support and justify your answers; when appropriate.

Please make the write-up: organized, presentable, etc.

PROBLEMS or QUESTIONS: SEE THE INSTRUCTOR IMMEDIATELY.

You may use textbooks, notes from this class, computer packages,
BUT you are not to consult other individuals, except the instructor.

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Whenever possible data-sets should be analyzed using descriptive techniques:
(both graphical and numerical).

All analyses (testing, confidence intervals, etc.) should have
conclusions/interpretations worded in terms of the problem.

Reject H_0 or (1.2, 5.3) is not a sufficient what do these things mean;
answer the question of interest, etc.

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1) [10 PTS]

The following design has been proposed as a BIBD ...
for 6 trts in 10 blks of size 3.

Do you agree or disagree - justify your answer. [Examine Closely ;-)]

BLK 1   A C E
BLK 2   A B F
BLK 3   A B D
BLK 4   A C F
BLK 5   A D E
BLK 6   B C D
BLK 7   B D E
BLK 8   B C F
BLK 9   C E F
BLK 10   D E F

2) [10 PTS]

The Food Science Department compared nine methods of preparing powdered eggs
using the following experiment: Powdered eggs prepared by one method were served
to a panel of judges. After tasting a small portion of the eggs, each judge gave
a flavor rating using a nine-point hedonic scale (1=very poor to 9=excellent).
The mean of the scores was the response analyzed. Because the sense of taste
becomes dulled by prolonged tasting, the optimum number of tests per session is
four. For this reason, a balanced incomplete block design requiring 18 sessions
was used.

Based on the results DATASET = eggs.txt,
perform a complete and appropriate analysis ...

3) [10 PTS]

page 571 # 10.90 DATASET = ex10-90.txt

4) [10 PTS]

page 553 # 10.33 DATASET = ex10-33.txt

5) [10 PTS]

pages 996-997 # 15.12 note: that it is *60* experimental units ...

6) [10 PTS]

An experiment was conducted to compare the accuracy of two mass spectrometers in
measuring the ratio of 14N to 15N. Two soil samples were taken from each of three
plots of land. Two subsamples (2 reps) of each sample were analyzed on each of
the two machines. The resulting design has machines crossed with plots and
samples. However, the samples are nested within plots. DATASET = nitrogen.txt

Give the population structure ...

Write a linear model for the experiment assuming machines are fixed
effects; plots and samples are random effects, explain the terms ...

Compute the ANOVA table include the E(MS) ...

Test Ho: no difference b/w the means for the two machines.

7) [10 PTS]

Soy Protein Isolates (SPI) are widely used in the food industry. Their applications are based upon their functional properties related to solubility, emulsification, and viscosity control. SPI are usually stored in dry powder form to enhance shelf life and make them easier to distribute.

The drying method of choice in industrial plants is spray-drying while the usual method used in bench-scale isolate production for research purposes is freeze-drying. A study was conducted to determine how the functional properties of SPI are affected by the method used to dry them and to compare the functional properties of dried SPI to fresh (undried) or frozen-thawed SPI.

Another factor that may affect the functional properties of SPI is the temperature used in the extraction process to create SPI. Thus a two-factor experiment was conducted.

The two factors and their levels are listed below.

A=Temperature (temp):
25, 40, 60, 80 degrees Fahrenheit

B=Method (meth):
1=fresh, 2=frozen and then thawed, 3=freeze dried, 4=spray dried

For each temperature, three SPI were created independently.
Each SPI was split into four parts. The four methods were assigned to the four parts of each SPI in a completely randomized manner.

Many response variables were measured for each part of each SPI.

We will consider an analysis of y = emulsion capacity
(grams of oil emulsified by 1 gram of product).

Identify the different sizes of experimental units.

Write out a model to describe the data from this experiment
and write out the analysis of variance table include E(MS).

8) [10 PTS]

A study was conducted on human subjects to measure the effects of three foods on serum glucose levels. Each of the three foods were randomly assigned to four subjects. The serum glucose was measured for each of the subjects at 15, 30, 45 minutes after the food was ingested. DATASET = glucose.txt

Display the profile plot for these data showing mean serum glucose
by time for each value of food ...

Provide a model for this design ...

Construct an ANOVA table include E(MS) ... reach appropriate conclusions ...

9) [10 PTS]

An experiment was conducted to study the effects of different types of background
music on the productivity of bank tellers. The treatments were defined as 5
different combinations of tempo and style [A,B,C,D,E].

The experimental unit in this study is a working day for the crew of bank
tellers; the productivity data pertain to the performance of the entire crew.
Because of concern about day-to-day variation and week-to-week variation - a
Latin-Square design was utilized.

DATASET = bank.txt

Does there appear to be a difference in productivity among the different types of
background music ... if so use a line diagram to aid in the interpretation of the
results.

10) [10 PTS]

In an experiment testing the effect of a toxic substance, 1500 experimental
insects were divided at random into six groups of 250 each. The insects in each
group were exposed to a fixed dose of the toxic substance. A day later, each
insect was observed.

DATASET = toxicity.txt
contains the X dose level, R number of deaths, N number of insects 250

Logistic modelling is believed to be appropriate ...

Find the maximum likelihood estimates of Beta0 and Beta1.
State the fitted response function.

What is the estimated probability ...
... that insect dies when the dose level is X = 3.5?
... that insect dies when the dose level is X = 5.5?

What is the estimated median lethal dose - that is, the dose
for which 50 percent of the experimental insects are expected to die?

Does adding a quadratic term [dose level squared] to the model -
significantly increase the predictive capabilities of the model?