1. The following output was obtained from a computer program that performed a two-factor ANOVA on a factorial experiment.

Table

Description automatically generated

a) Fill in the blanks in the ANOVA table.

b) How many levels were used for factor B?

c) How many replicates of the experiment were performed?

1. Brewer’s malt is produced from germinating barley, so brewers like to know under what conditions they should germinate their barley. The following is part of an experiment on barley germination. Barley seeds were divided into 30 lots of 100 seeds, and each lot of 100 seeds was germinated under one of ten conditions chosen at random. The conditions are the ten combinations of weeks after harvest (1, 3, 6, 9, or 12 weeks) and the amount of water used in germination (4 ml or 8 ml). The response is the number of seeds germinating. We are interested in whether the timing and/or amount of water affect germination. Analyze these data to determine how the germination rate depends on the treatments.

Table

Description automatically generated

1. Pine oleoresin is obtained by tapping the trunks of pine trees. Tapping is done by cutting a hole in the bark and collecting the resin that oozes out. This experiment compares four shapes for the holes and the efficacy of acid treating the holes. Twenty-four pine trees are randomly selected from a plantation, and the 24 are assigned randomly to the eight combinations of whole shape (circular, diagonal slash, check, rectangular) and acid treatment (yes or no). The response is the total grams of resin collected from the hole (data from Low and Bin Mohd. Ali 1985). Analyze these data to determine how the treatments affect resin yield. Include the Tukey HSD test in your analysis.

Table

Description automatically generated

1. Big sagebrush is often planted in range restoration projects. An experiment is performed to determine the effects of storage length and relative humidity on the viability of seeds. Sixty-three batches of 300 seeds each are randomly divided into 21 groups of three. These 21 groups each receive a different treatment, namely the combinations of storage length (0, 60, 120, 180, 240, 300, or 360 days) and storage relative humidity (0, 32, or 45%). After the storage time, the seeds are planted, and the response is the percentage of seeds that sprout. Use the data set HW3\_Q4.xlsx and analyze these data for the effects of the factors on viability.
2. A researcher is interested in comparing the effect of 3 new herbicides and 2 different doses of nitrogen on soybean yield. Design the appropriate experiment with 2 replicates (paste the result below indicating the method/r code used for that).
3. Create an interaction plot for the experiment measuring height in 2 cultivars of sorghum measured under 3 different fertilizers. Is there an interaction between the cultivar and fertilizer? The script below could be used to create the dataset in R:

data <-

data.frame(

Fertilizer = c(1, 2, 3, 1, 2, 3),

Cultivar = c("A", "A", "A", "B", "B", "B"),

height = c(1, 2, 3, 5, 4, 2)

)

Table

Description automatically generated

1. Answer question 3 of chapter 3.
2. The data set HW3\_Q8.csv contains information about a fish weight experiment conducted under 2 seasons and 3 densities (number of fishes/tank). Analyze this data and construct an interaction plot. Is there evidence of interaction?
3. What is the constraint used by R to solve the Normal equations and estimate the parameters of interest in ANOVA? Why is this a necessary step? Are there any other options for constraints?
4. Reanalyze the dataset HW3\_Q8.csv and obtain the type II and type III sums of squares.