1.

The ratio of leaf area to dry weight was determined for three conditions of shading in three species of pine trees. Download the **tree.csv** dataset and use it to determine which factors (or combination of factors) affect ratio. What can you say about interaction? Use α = 0.05.

2.

New apple varieties are being introduced; we need to figure out which varieties store better, i.e., maintain apple flavor and crispness longer. Four randomly selected commercial apple growers agreed to participate in our experiment to evaluate three new apple varieties. At each grower’s orchard, three adjacent 0.5 hectare plots are cleared and then each is randomly assigned to one of the three new varieties. After three years, each 0.5 hectare plot yields at least twelve bushels of apples. Twelve bushels are randomly selected from each variety, then divided into three groups which are randomized to one of the three storage methods. The bushels are held in storage for six months, then two apples per bushel are randomly selected to be evaluated for their flavor/crispness. There are 288 measurements of freshness.

Draw the Hasse diagram for this experiment.

3.

Avocado oil may be extracted from avocado paste using the following steps:

1. Dilute the paste with water
2. Adjust the pH of the paste
3. Heat the paste at 90oC for 5 minutes
4. Let the paste settle
5. Centrifuge the paste

The following factors may be varied:

1. Dilution rate (3:1 water or 5:1 water)
2. pH (4.0 or 5.5)
3. Settling (9 days at 23oC or 4 days at 37oC)
4. Centrifugation (6000g or 12000g)

You are assigned to design a study to investigate how the four factors affect the extraction efficiency. Briefly describe the experimental design that you would recommend for each of the following scenarios. You may assume that the avocado paste (prior to any of the five steps mentioned) may be used any time up to a week after its preparation. You may also assume that the primary cost is processing; the cost of the paste is trivial.

1. The researcher wants to study the effect of the four factors mentioned above on the extraction efficiency. Avocado paste is rather uniform, and we have enough money for 48 experimental units.
2. The researcher wants to study the effects of the four factors mentioned on the extraction efficiency. Avocado paste is not uniform but varies from individual fruit to fruit. Each fruit produces enough paste for about 20 experimental units, and we have enough money for 48 experimental units.

4.

A sensory experiment was conducted to determine if consumers have a preference between regular and reduced-fat cream cheese. Twenty-four judges will rate both types of cream cheese; twelve judges will rate the cream cheese in the following order, regular -> reduced-fat cream cheese, whereas the other twelve judges will have the order reversed, reduced-fat -> regular. We anticipate judge to judge differences and possible differences between the first and second cream cheese tasted. The response is rated on a liking scale, 0 – 100 with higher scores indicating greater liking. Download the **creamcheese.csv** dataset use it to determine if there is a difference in liking between the two kinds of cream cheese. Use α = 0.05.

5.

A nickel-titanium alloy is used to make components for jet turbine aircraft engines. Cracking is a potentially serious problem in the final part because it can lead to nonrecoverable failure. A test is run at the part producer plant to determine the effect of four factors on cracks. The four factors are:

1. A= Pouring temperature
2. B=titanium content
3. C= treatment method
4. D = the amount of grain refiner used.

The response is the length of an induced crack (in *mm* x 10-2). Download the **crack.csv** dataset and use it to determine which factors (or combination of factors) affect crack length. Use α = 0.05.