For each of the problems, save a pdf of your answers, programs, and output in sub-directories Problem 1 and Problem 2 on the provided Flash Drive.

1. Description of the study: Researchers from the Panhandle Research and Extension Center in Scottsbluff came to the SC3L desk with data for a trial that they conducted. They said that the study was performed in order to evaluate three wheat varieties grown under five different levels of irrigation (coded 0, 1, 2, 3, and 4). A zero irrigation level was included to enable the researchers to evaluate drought-tolerance. They had nine fields available each with one moving-line irrigator. These irrigators could be set to up to three different levels per line irrigator. Seven fields (field 1, 2, 3, 5, 6, 7 and 8) had three irrigation levels. However, the line irrigators in fields 4 and 9 were only able to do two irrigation levels.

   After asking them further questions, you find out that the three wheat varieties were planted in strips perpendicular to the moving line irrigator. They also measured "moisture holding capacity" (MHC) as a % of theoretical maximum on each field × irrigation level combination (but not separately for each variety level). At the end of the season, the dry matter yield was measured.

   The following figure shows the layout of a representative block

shades of gray ⇒ irrigation level (applied by column down entire field) (white = no irrigation)
hatching (vertical, horizontal or none) ⇒ variety (applied by entire row across field)

   (a) 1. How would you explain the experimental design used to the researchers?
   (b) Sketch out the ANOVA that you would use to explain the experiment to the researchers. Include an explanation of the assumptions that you need to test for the model.
   (c) Analyze the data using the analysis that you sketched for the researchers. The data are located in *QE_May2023_Irrigation.sas* (SAS program), *QE_May2023_Irrigation.csv* (CSV text), and *QE_May2023_Irrigation.txt* (tab delimited).
   (d) Write a summary report for the researchers. (No more than 2 pages (not including the appendix). While you may include figures generated by SAS/R, you should not include other SAS/R output! Include your SAS/R program in an appendix)

2. In your previous class you covered analyzing count using a Poisson distribution with a log link function. For your next class you will introduce analyzing overdispersed count data. In preparing for the class you will need an example data set and a couple of alternative approaches the students could use for analyzing this type of data.

   (a) Simulate a set of overdispersed count data, where the design is a CRD.

   (b) Analyze the simulated data using a Poisson distribution with a log link function. What from the analysis indicates that the data are overdispersed?

   (c) Propose two alternative models for this data set which would be reasonable alternatives given the data are overdispersed.