Activity 1.1: Design Blueprints

Turkeys in Pens

0. Download software (JMP or R).

You may use either for this class, but I recommend having JMP installed/downloaded.

Scenario

We are interested in examining the effect of dietary protein on growth in Standard Bronze farm-raised turkeys. There are 24 turkeys available for the study.

The turkeys are housed 3 to a pen, and each pen has a single feed trough, meaning all turkeys within a pen receive the same diet.

Two diets are studied:

- Low-protein diet: 15% protein
- High-protein diet: 30% protein

Diets are assigned at random to pens, with 4 pens receiving each diet (8 pens total).

The turkeys are fed their assigned diet for 6 weeks. The primary outcome measured on each turkey is average daily weight gain (ADG), in lbs/day.

1. Sketch a blueprint for this study.

2. Describe the study structure

- **Treatment structure:**

- **Design structure:**

3. Pen-Level Data

a. Open the file `turkey_pen_data.csv`.

b. What does each row in this data file represent?

c. How many observations are there per diet? Why?

d. Create a plot of pen-level ADG on the y-axis and Diet on the x-axis (Hint: each diet should have 4 dots).

e. Create a summary table showing the mean and standard deviation of pen-level ADG for each diet.

Diet	Mean pen ADG	SD pen ADG
Low (15%)		
High (30%)		

4. Animal-Level Data

f. Open the file `turkey_animal_data.csv`.

g. What does each row in this data file represent? How many rows are there? Why?

h. Create a plot of animal-level ADG on the y-axis and Diet on the x-axis.

i. How many measurement/sampling units are there per diet in this plot?

j. Create a summary table showing the mean and standard deviation of ADG for each diet.

Diet	Mean ADG	SD ADG
Low (15%)		
High (30%)		

k. Compare the animal-level means and standard deviations to the pen-level results. What do you notice?

5. Comparing Analyses

Now consider a two-sample t-test comparing the low-protein and high-protein diets.

Pen-level analysis

l. Using `turkey_pen_data.csv`, conduct a two-sample independent t-test (assume unequal variances).

Report:

- Difference in mean ADG
- Standard error
- t-statistic, degrees of freedom, and p-value

Animal-level analysis

m. Using `turkey_animal_data.csv`, conduct the same two-sample independent t-test (assume unequal variances).

Report:

- Difference in mean ADG
- Standard error
- t-statistic, degrees of freedom, and p-value

6. Interpretation

n. Which analysis is *correct* for answering the research question? Explain.

Your explanation should address:

- What the experimental unit is
- Why one analysis artificially inflates the sample size
- Why this matters for statistical inference

7. Submit on Gradescope

When you are finished, submit your work to **Gradescope**:

1. Make sure your submission includes:
    - Your study blueprint sketch
    - Your written answers for parts (b)–(n)
    - Any requested tables/values from JMP or R
2. Combine everything into **one PDF**.
    - If you wrote on paper: take clear photos and save/print to PDF.
    - If you typed responses: export to PDF.
3. Go to **Canvas > Gradescope > Activity 1.1: Design Blueprints** and upload your PDF.
4. If Gradescope asks you to assign pages to questions, do so before submitting.