

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 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

1. 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.