# Exam 1 Review

BIOE 498/598, Spring 2020

1. Hypothesis testing: interpretation of the $t$-test
2. Linear Modeling
    - Coefficients and residuals
    - Intercepts
    - Structure of the design matrix
    - Significance testing of effects
3. Experiment Design Terminology
4. Completely Random Designs
    - One Hot encoding
    - Eliminating degeneracy by dropping levels
    - Designing contrasts
    - Testing all contrasts and Tukey's HSD
5. Logistic regression — how it differs from linear regression
6. Factorial Designs
    - Advantages over one-at-a-time
    - Differences in interpretation of effects from one-at-a-time
    - Rank and power
    - Interaction plots
7. ANOVA
    - Meaning of $SS_{\text{total}}$, $SS_{\text{explained}}$, and $SS_{\text{residual}}$.
    - Calculating degrees of freedom for each $SS$.
    - $F$-statistic: meaning and calculation
    - ANOVA as $F$-statistic on models with single variables.
8. Power Analysis
    - Standard deviation vs. standard error
    - Calculating $n$ to resolve an effect size

9. Fractional Factorial Designs
    - Effect Sparsity Principle
    - Hierarchical Ordering Principle
    - Base designs and intentional confounding
    - Generators and defining relations
    - Confounding or alias structure
    - Resolution and minimum confounding
    - Full factorial designs embedded in fractional designs
    - Half-normal plots to interpret effects
    - Clearing effects by foldover or mirror image designs
10. Alternative to Fractional Designs
    - Plackett-Burman Designs: creating, complex aliasing, and hidden projection
    - Regression by subset selection
    - Orthogonal Arrays for multilevel factorials