Brief Review of Logistic Regression – Interactive!

- Please go to the Ed Forum and click on
  "Review Session – Logistic Regression Midterm Practice"

- No notes, no AI

- **First,** please comment one-two sentences on the motivation for altering linear regression into logistic regression (you can make your comment anonymous)

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- **Range changes of the functions we use to do the work:**
  - Started with y going from –inf to +inf over the $\mathbb{R}$
  - Then p going from [0, 1] over the $\mathbb{R}$
  - Now, we have *log odds* going from –inf to +inf over the $\mathbb{R}$

- Please answer the first poll question

Probability/Odds/Log Odds

If we give you one, you should be able to find the other two.

$$\mathrm{P}(Y = 1) = \frac{1}{1 + e^{-\beta_0 - \beta_1 X}}$$

$$\ln\left(\frac{P(Y = 1)}{1 - P(Y = 1)}\right) = \beta_0 + \beta_1 X$$

odds

Please answer poll questions 2, 3, and 4

Please answer poll questions 5 and 6

Multiple Logistic Regression
- **Purpose**: Used for **binary classification** with **multiple predictors.**

Multinomial Logistic Regression
- **Purpose**: Used for **multi-class classification** problems where the response variable has more than two categories (K>2).

Please answer poll questions 7

Simple Logistic Regression (SLR)

1. Multi-class classification (more than two outcomes).

8. Predicting the type of amaryllis flower varieties (Red Pearl, Gervase, Christmas Gift)

6. Predicting whether an email is spam (yes/no)

2. A single probability for one class (e.g., $P(Y=1)$)

Multinomial Logistic Regression (MLR)

5. Binary classification (two outcomes: 0 or 1)

7. A probability distribution over K classes.

3. Classifies by selecting the class with the highest probability.

4. Uses a decision threshold (e.g., ≥ 0.5)

Scavenger hunt (On Ed)! Coefficient Interpretation

Example from lecture 🧡 Heart Disease

- $\log(P / (1 - P)) = \beta_0 + \beta_1 * age + \beta_2 * (female) + \beta_3 * (female * age)$

- For males: $\beta_0 + \beta_1 * age$

- For females: $(\beta_0 + \beta_2) + (\beta_1 + \beta_3) * age$

Please "heart" 😉 the Poll Ed post when you have found it.