Math 150, Spring 2023
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WU # 3
Tuesday, Jan 24, 2023

Your Name: ________________________________

Names of people you worked with: ________________________________

**Task**: Consider what we called "Model 2" last week:

$$y_i = \beta_0 + \beta_1 x_i + \epsilon_i \quad i = 1, 2, \ldots, n \tag{1}$$
$$\epsilon_i \sim N(0, \sigma^2), \text{ independently} \tag{2}$$
$$E[Y_i] = \beta_0 + \beta_1 x_i \tag{3}$$

Which part of "Model 2" (might be a full equation, might just be a word) demonstrates each of the following technical conditions:

- The average value for the response variable is a linear function of the explanatory variable.
- The error terms follow a normal distribution around the linear model.
- The error terms have a mean of zero.
- The error terms have a constant variance of $\sigma^2$.
- The error terms are independent.
- The error terms are identically distributed.

**Solution:** Which part of "Model 2" (might be a full equation, might just be a word) demonstrates each of the following technical conditions:

- The average value for the response variable is a linear function of the explanatory variable.

  **Solution:** (3) shows that the relationship is linear in the population,.

- The error terms follow a normal distribution around the linear model.

  **Solution:** We actually need both (1) and (2). The errors are normal, but they also need to be distributed around the line.

- The error terms have a mean of zero.

  **Solution:** the "zero" value in $N(0, \sigma^2)$ says that the errors are centered around zero.

- The error terms have a constant variance of $\sigma^2$.

  **Solution:** the $\sigma^2$ value in $N(0, \sigma^2)$ says that the errors have variance $\sigma^2$ (note that there is no "i" index on $\sigma^2$).

- The error terms are independent.

  **Solution:** the "independent" part is specifically stated in (2).

- The error terms are identically distributed.

  **Solution:** The "identical" part is that there is no "i" in $N(0, \sigma^2)$, therefore the model doesn't change for the different values of "i", i.e., the different observations in the population or in the sample.