1. Let $y_i = \beta_0 + \beta_1 x_i + \varepsilon_i$ where $E(\varepsilon_i) = 0$ for $i = 1, ..., n$. Fix x_i and y_i and allow β_0 and β_1 to vary. Then the least squares estimator is $\min_{\beta_0,\beta_1} \sum_{i=1}^{n} (y_i - \beta_0 - \beta_1 x_i)^2$.

   True

   False

2. Under the definitions and assumptions given in "Lesson: Introduction to least squares estimation", the least squares estimator is the orthogonal projection of the vector $\mathbf{Y}$ onto the row space of X.

   True

   False

3. The equation $X^T X \beta = X^T \mathbf{Y}$ always has a unique solution.

   True

   False

4. In order to use least squares in the linear regression context, we must assume that:

   The error terms are normally distributed.

   The error term has zero mean.

   The relationship between the expected value of the response and the predictors is linear.

   The variance is constant across error terms.

   The relationship between the expected value of the response and the parameters is linear (or can be transformed to linearity).

5. The Gauss-Markov theorem states that the least squares estimator has the lowest variance among all esimators of $\boldsymbol{\beta}$ (given that the least squares assumptions are met). 3 / 3 points

   True

   False

6. In the context of linear regression, for any error distribution, the least squares estimator is equivalent to the maximum likelihood estimator. 3 / 3 points

   True

   False

7. The fitted values of a regression model are defined as $\hat{\mathbf{y}} = X\beta$. 3 / 3 points

   True

   False

8. Let H be the hat matrix, as defined in "Lesson: Deriving the least squares solution". Then $H\mathbf{Y} = \widehat{\mathbf{Y}}$. 3 / 3 points

   True

   False

9. Let H be the hat matrix, as defined in "Lesson: Deriving the least squares solution". Then $H\widehat{\mathbf{Y}} = ...$ 3 / 3 points

   $X\beta$

   $\widehat{\mathbf{Y}}$

   $\mathbf{Y}$

   $X\widehat{\beta}$