

M3396: September 25th, 2024.

Logistic Regression w/ 2 categories in the Response.

We can represent one category by 0
and the other by 1.

$$P[Y=1 \mid X=x] = \cancel{X} \frac{e^{\beta_0 + \beta_1 x_1 + \dots + \beta_p x_p}}{1 + e^{\beta_0 + \beta_1 x_1 + \dots + \beta_p x_p}}$$

$$P[Y=0 \mid X=x] = \frac{\textcircled{1}}{1 + e^{\beta_0 + \beta_1 x_1 + \dots + \beta_p x_p}} \quad \text{"0"}$$

Logistic Regression w/ K categories in the Response.

In the book:

$$P[Y=K \mid X=x] = \frac{1}{1 + \sum_{k=1}^{K-1} e^{\beta_{0k} + \beta_{1k} x_1 + \dots + \beta_{pk} x_p}}$$

For other categories $l \in \{1, \dots, K-1\}$

$$P[Y=\textcircled{l} \mid X=x] = \frac{e^{\beta_{0l} + \beta_{1l} x_1 + \dots + \beta_{pl} x_p}}{1 + \sum_{k=1}^{K-1} e^{\beta_{0k} + \beta_{1k} x_1 + \dots + \beta_{pk} x_p}}$$