observation i $\quad (x_{i1}, x_{i2}, \cdots, x_{ik}, y_i)$.

$$z_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_k x_{ik}$$

$$f(y \mid \vec{x}, \beta) = \underline{G(z_i)^{y_i} \cdot \cancel{G}\left[1 - G(z_i)\right]^{1-y_i}}$$

$$l_i(\beta) = y_i \log\left[G(z_i)\right] + (1-y_i) \cdot \log\left[1 - G(z_i)\right]$$

$$L(\beta) = \sum_{i=1}^{n} l_i(\beta)$$

$$= \sum_{i=1}^{n} \left\{ y_i \log\left[G(z_i)\right] + (1-y_i) \cdot \log\left[1 - G(z_i)\right] \right\}$$

$$\max_{\hat\beta_0, \hat\beta_1, \cdots \hat\beta_k} L(\beta)$$

$$\begin{bmatrix} \boxed{\begin{matrix} y_1 = 1 \\ y_2 = 0 \\ y_3 = 1 \\ \vdots \\ \\ \end{matrix}} & \begin{matrix} x_{11}, x_{12}, x_{13} \cdots \\ \\ \\ \\ \\ \end{matrix} \end{bmatrix}$$

$$\frac{\partial P(y=1 \mid \vec{x})}{\partial x_j} = \frac{d G(z)}{dz} \cdot \frac{\partial z}{\partial x_j} = \underline{g(z)} \cdot \beta_j$$

$$G(z) = G(\underline{\beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k})$$