Linear Regression:

$$\theta_j = \theta_j - \alpha\left(\frac{1}{m}\right) \sum_{i=1}^{m} \left(h(x^{(i)}) - y^{(i)}\right) x_j^{(i)}$$

$$\sum_{i=1}^{m} \Delta^{(i)} x_j^{(i)} \rightarrow \quad \delta_1 \quad \delta_2 = \delta$$

$$\theta_j = \theta_j - \frac{\alpha}{m} \delta^T$$

$$\begin{pmatrix} x_0^1 & x_1^1 \\ x_0^2 & x_1^2 \\ x_0^3 & x_1^3 \end{pmatrix} \begin{pmatrix} \theta_0 \\ \theta_1 \end{pmatrix} = \quad h(x^{(i)}) = X \cdot \theta \qquad m \times 1 \text{ vector}$$

$$\Delta = X \cdot \theta - y^{m \times 1} \qquad m \times 1 \text{ vector}$$

$$\delta = \Delta' \ (1 \times m \text{ vector}) \cdot X \ (2 \times m \text{ vector}) = [\delta_0 \ \delta_1]$$

"Normal Equations" method

$$X\theta = y$$

$$X^T X \theta = X^T y \qquad \text{(make square matrices)}$$

$$\theta = (X^T X)^{-1} X^T y \qquad \text{(solve for theta)}$$

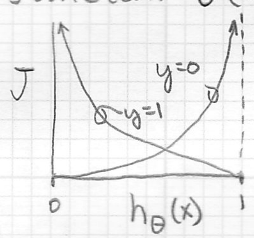
Logistic Regression:

$$h_\theta(x) = g(\theta^T x) \qquad g(z) = \frac{1}{1+e^{-z}} \qquad y \in \{0, 1\}$$

hypothesis

$$\boxed{h_\theta(x) = \frac{1}{1+e^{-\theta^T x}}}$$

cost function $J(h_\theta(x), y) = -y\log(h_\theta(x)) - (1-y)\log(1-h_\theta(x))$



$$= \begin{cases} -\log(1-h_\theta(x)) & y=0 \\ -\log(h_\theta(x)) & y=1 \end{cases}$$

Case $y=0$: $J = -\log(1-g(\theta^T x))$

$$= \log(1+e^{\theta^T x})$$

$$\frac{\partial J}{\partial \theta_j} = \frac{\partial}{\partial(\theta^T x)} \log(1+e^{\theta^T x}) \cdot \frac{\partial}{\partial \theta_j}(\theta^T x)$$

$$= \frac{1}{1+e^{-\theta^T x}} \cdot x_j$$

Case $y=1$: $J = -\log(g(\theta^T x))$

$$= \log(1+e^{-\theta^T x})$$

$$\frac{\partial J}{\partial \theta_j} = \frac{\partial}{\partial(\theta^T x)} \log(1+e^{-\theta^T x}) \cdot \frac{\partial}{\partial \theta_j}(\theta^T x)$$

$$= -\frac{1}{1+e^{\theta^T x}} \cdot x_j$$

$$\theta_j = \theta_j - \left(\frac{\alpha}{m}\right)\left(\frac{1}{1+e^{-\theta^T x}} - y\right)^T X_j = \theta_j - \left(\frac{\alpha}{m}\right)\left(h_\theta(x) - y\right)^T \mathbf{X}$$

$H_0: \quad X \sim N(355, 25)$

$H_1: \quad n = 100 \quad \bar{X} = 356.5 \qquad \bar{X} > 355$

$=$

$\alpha = 0.01$

$P(z > \alpha) = 0.01$

$1 - P(z \leq \alpha) = 0.99$

$z_c = 2.32$

$$z = \frac{\bar{X} - 355}{\frac{\sqrt{25}}{\sqrt{100}}}$$