50.007 Machine Learning HW 3 Victoria Yong 1004455

Q1.1

a) T
b) F
c) T
d) T (for range of 0 to 1)

Q1.2

2 and 3.

Since $P(y|x) = \begin{cases} h(x) & \text{for } y = +1 \\ 1 - h(x) & \text{for } y = -1 \end{cases}$

$P(y=1 \mid x, \theta) = h(x) = 0.28$

$P(y=0 \mid x, \theta) = 1 - h(x) = 0.72$

Q1.3

given $\theta = [3 \ -3 \ 0]^T$

$h_\theta(x) = g(\theta_0 + x_1\theta_1 + x_2\theta_2)$

$= g(3 - 3x_1)$

$\therefore$ Decision Boundary:
$y = 3 - 3x$.

$y = 1$ if $(3 - 3x_1) \geq 0$

$y = 0$ if $(3 - 3x_1) < 0$

Q1.4

given $\theta = [-64 \quad 0 \quad 0 \quad 1 \quad 1]^T$

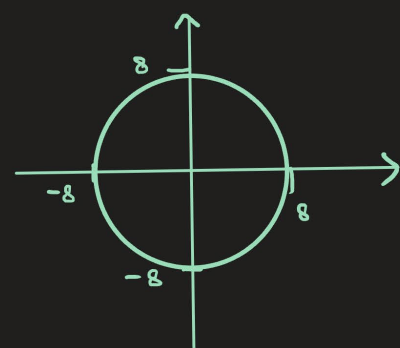
$$h_\theta(x) = g(\theta_0 + x_1\theta_1 + x_2\theta_2 + x_1^2\theta_3 + x_2^2\theta_4)$$

$$= g(x_1^2 + x_2^2 - 64)$$

$\therefore$ Decision boundary: $y = x_1^2 + x_2^2 - 8^2$

$y = 1$ if $(x_1^2 + x_2^2 - 64) \geq 0$

$y = 0$ if $(x_1^2 + x_2^2 - 64) < 0$



Q1.5

The likelihood of a logistic regression is multiplicative. Under a log transformation, the likelihood becomes additive, as seen in the given formula. This makes the numbers used in calculations smaller, which is easier for computers, and allows better precision (avoiding floating point arithmetic issues).