Machine Learning: Assignment 1

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3. (a) $x_1 = 0.5 and x_2 = 0.9$
$a = g(z)$ where g is the sigmoid function

$$z_1^2 = .2 * 1 + .5 * .5 + .5 * .9 = 0.9$$

$$a_1^2 = \frac{1}{1+e^{-.09}} = 0.711$$

$$z_2^2 = .2 * 1 + .1 * .5 + .7 * .9 = 0.88$$

$$a_2^2 = \frac{1}{1+e^{-.88}} = 0.707$$

$$z_1^3 = .2 * 1 + 1 * .711 + 2 * .707 = 2.33$$

$$a_2^2 = \frac{1}{1+e^{-2.33}} = 0.911$$

(b) $\delta_1^3 = .911 - 1 = -0.089$ so:

$$\delta_1^2 = 1 * -.089 * .711 * (1 - 0.711) = -0.0183$$

$$\delta_2^2 = 2 * -.089 * .707 * (1 - 0.707) = -0.0369$$

Theta updates:

$\theta_0 1^1 = .2 + (-0.089 * 1) = 0.102$
$\theta_1 1^1 = 1 + (-0.089 * .711) = 0.937$
$\theta_2 1^1 = 2 + (-0.089 * .707) = 1.937$

$$\theta_0 2^1 = .2 + (-0.0183 * 1) = 0.182$$
$$\theta_1 2^1 = .5 + (-0.0183 * .5) = 0.491$$
$$\theta_2 2^1 = .5 + (-0.0183 * .9) = 0.484$$

$$\theta_0 2^1 = .2 + (-0.0369 * 1) = 0.163$$
$$\theta_0 2^1 = .1 + (-0.0369 * .5) = 0.082$$
$$\theta_0 2^1 = .7 + (-0.0369 * .9) = 0.667$$

4. (a) Line with those intercepts: $x_2 = 2x_1 + 2$

(b) See attached document (I wrote this question out because it would have been to hard to do in Latex)