# Logistic Regression

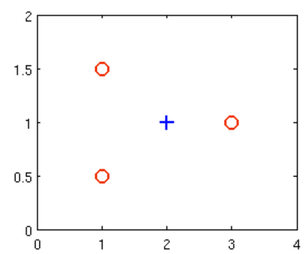
TOTAL POINTS 5

**1. Suppose that you have trained a logistic regression classifier, and it outputs on a new example $x$ a prediction $h_\theta(x)$ = 0.7. This means (check all that apply):** 1 point

- [x] Our estimate for $P(y=0|x;\theta)$ is 0.3.
- [ ] Our estimate for $P(y=1|x;\theta)$ is 0.3.
- [x] Our estimate for $P(y=1|x;\theta)$ is 0.7.
- [ ] Our estimate for $P(y=0|x;\theta)$ is 0.7.

**2. Suppose you have the following training set, and fit a logistic regression classifier $h_\theta(x) = g(\theta_0 + \theta_1 x_1 + \theta_2 x_2)$.** 1 point

| $x_1$ | $x_2$ | $y$ |
|---|---|---|
| 1 | 0.5 | 0 |
| 1 | 1.5 | 0 |
| 2 | 1 | 1 |
| 3 | 1 | 0 |




**Which of the following are true? Check all that apply.**

- [ ] $J(\theta)$ will be a convex function, so gradient descent should converge to the global minimum.
- [x] Adding polynomial features (e.g., instead using $h_\theta(x) = g(\theta_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_1^2 + \theta_4 x_1 x_2 + \theta_5 x_2^2)$ ) could increase how well we can fit the training data.
- [x] The positive and negative examples cannot be separated using a straight line. So, gradient descent will fail to converge.
- [ ] Because the positive and negative examples cannot be separated using a straight line, linear regression will perform as well as logistic regression on this data.

**3. For logistic regression, the gradient is given by $\frac{\partial}{\partial\theta_j} J(\theta) = \frac{1}{m}\sum_{i=1}^m (h_\theta(x^{(i)}) - y^{(i)}) x_j^{(i)}$. Which of these is a correct gradient descent update for logistic regression with a learning rate of $\alpha$? Check all that apply.** 1 point

- [ ] $\theta_j := \theta_j - \alpha\frac{1}{m}\sum_{i=1}^m (h_\theta(x^{(i)}) - y^{(i)}) x^{(i)}$ (simultaneously update for all $j$).
- [x] $\theta_j := \theta_j - \alpha\frac{1}{m}\sum_{i=1}^m (h_\theta(x^{(i)}) - y^{(i)}) x_j^{(i)}$ (simultaneously update for all $j$).
- [x] $\theta_j := \theta_j - \alpha\frac{1}{m}\sum_{i=1}^m \left(\frac{1}{1+e^{-\theta^T x^{(i)}}} - y^{(i)}\right) x_j^{(i)}$ (simultaneously update for all $j$).
- [ ] $\theta := \theta - \alpha\frac{1}{m}\sum_{i=1}^m \left(\theta^T x - y^{(i)}\right) x^{(i)}$.

**4. Which of the following statements are true? Check all that apply.**

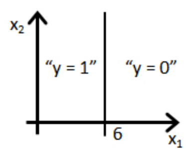
1 point

- [ ] For logistic regression, sometimes gradient descent will converge to a local minimum (and fail to find the global minimum). This is the reason we prefer more advanced optimization algorithms such as fminunc (conjugate gradient/BFGS/L-BFGS/etc).
- [x] The cost function $J(\theta)$ for logistic regression trained with $m \geq 1$ examples is always greater than or equal to zero.
- [x] The sigmoid function $g(z) = \frac{1}{1+e^{-z}}$ is never greater than one ($> 1$).
- [ ] Linear regression always works well for classification if you classify by using a threshold on the prediction made by linear regression.

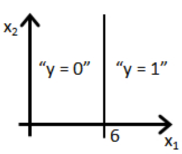
**5. Suppose you train a logistic classifier $h_\theta(x) = g(\theta_0 + \theta_1 x_1 + \theta_2 x_2)$. Suppose $\theta_0 = 6, \theta_1 = -1, \theta_2 = 0$. Which of the following figures represents the decision boundary found by your classifier?**

1 point

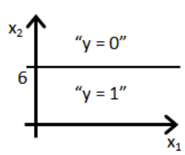
- ( ) Figure:



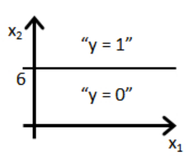

- (•) Figure:




- ( ) Figure:




- ( ) Figure:

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