Feedback — VI. Logistic Regression

Help

You submitted this quiz on **Mon 11 Nov 2013 2:34 PM PST**. You got a score of **5.00** out of **5.00**.

Question 1

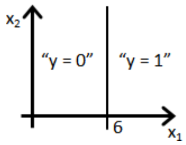
Suppose that you have trained a logistic regression classifier, and it outputs on a new example x a prediction $h_\theta(x)$ = 0.2. This means (check all that apply):

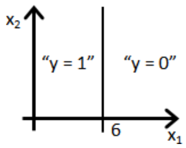
Your Answer		Score	Explanation
☑ Our estimate for $P(y=0\|x;\theta)$ is 0.8.	✔	0.25	Since we must have $P(y=0\|x;\theta) = 1 - P(y=1\|x;\theta)$, the former is 1 - 0.2 = 0.8.
☑ Our estimate for $P(y=1\|x;\theta)$ is 0.2.	✔	0.25	$h_\theta(x)$ is precisely $P(y=1\|x;\theta)$, so each is 0.2.
☐ Our estimate for $P(y=0\|x;\theta)$ is 0.2.	✔	0.25	$h_\theta(x)$ is $P(y=1\|x;\theta)$, not $P(y=0\|x;\theta)$.
☐ Our estimate for $P(y=1\|x;\theta)$ is 0.8.	✔	0.25	$h_\theta(x)$ gives $P(y=1\|x;\theta)$, not $1 - P(y=1\|x;\theta)$.
Total		1.00 / 1.00	

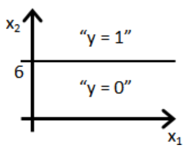
Question 2

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

Your Answer	Score	Explanation

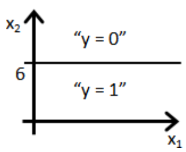






1.00

In this figure, we transition from negative to positive when x_2 goes from below 6 to above 6 which is true for the given values of θ.

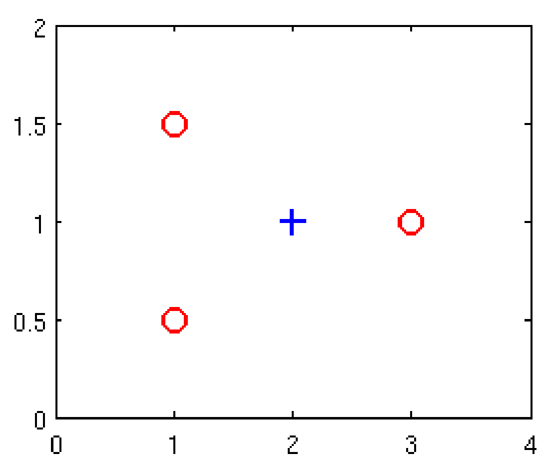


Total 1.00 / 1.00

Question 3

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

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.

Your Answer		Score	Explanation
☐ If we train gradient descent for enough iterations, for some examples $x^{(i)}$ in the training set it is possible to obtain $h_\theta(x^{(i)}) > 1$.	✔	0.25	The function $g(z)$ in the hypothesis $h_\theta(x)$ is the sigmoid function $\frac{1}{1+e^{-z}}$ which always lies between 0 and 1.
☑ 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.	✔	0.25	Adding new features can only improve the fit on the training set: since setting $\theta_3 = \theta_4 = \theta_5 = 0$ makes the hypothesis the same as the original one, gradient descent will use those features (by making the corresponding θ_j non-zero) only if doing so improves the training set fit.
☐ The positive and negative examples cannot be separated using a straight line. So, gradient descent will fail to converge.	✔	0.25	While it is true they cannot be separated, gradient descent will still converge to the optimal fit. Some examples will remain misclassified at the optimum.
☑ $J(\theta)$ will be a convex function, so gradient descent should converge to the global minimum.	✔	0.25	The cost function $J(\theta)$ is guaranteed to be convex for logistic regression.
Total		1.00 / 1.00	

Question 4

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

Your Answer		Score	Explanation
☐ $\theta := \theta - \alpha \frac{1}{m} \sum_{i=1}^{m} \left(\theta^T x - y^{(i)}\right) x^{(i)}$.	✔	0.25	This vectorized version uses the linear regression hypothesis $\theta^T x$ instead of that for logistic regression.
☑ $\theta := \theta - \alpha \frac{1}{m} \sum_{i=1}^{m} \left(\frac{1}{1+e^{-\theta^T x^{(i)}}} - y^{(i)}\right) x^{(i)}$.	✔	0.25	This is a vectorized version of gradient descent that substitues in the exact form of $h_\theta(x^{(i)})$ used by logistic regression.
☐ $\theta_j := \theta_j - \alpha \frac{1}{m} \sum_{i=1}^{m} \left(\theta^T x - y^{(i)}\right) x_j^{(i)}$ (simultaneously update for all j).	✔	0.25	This uses the linear regression hypothesis $\theta^T x$ instead of that for logistic regression.
☑ $\theta_j := \theta_j - \alpha \frac{1}{m} \sum_{i=1}^{m} (h_\theta(x^{(i)}) - y^{(i)}) x_j^{(i)}$ (simultaneously update for all j).	✔	0.25	This is a direct substitution of $\frac{\partial}{\partial\theta_j} J(\theta)$ into the gradient descent update.
Total		1.00 / 1.00	

Question 5

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

Your Answer	Score	Explanation

☐ Since we train one classifier when there are two classes, we train two classifiers when there are three classes (and we do one-vs-all classification).	✔	0.25	We need to train three classifiers if there are three classes; each one treats one of the three classes as the $y = 1$ examples and the rest as the $y = 0$ examples.
☑ The cost function $J(\theta)$ for logistic regression trained with $m \geq 1$ examples is always greater than or equal to zero.	✔	0.25	The cost for any example $x^{(i)}$ is always ≥ 0 since it is the negative log of a quantity less than one. The cost function $J(\theta)$ is a summation over the cost for each eample, so the cost function itself must be greater than or equal to zero.
☐ 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).	✔	0.25	The cost function for logistic regression is convex, so gradient descent will always converge to the global minimum. We still might use a more advanded optimization algorithm since they can be faster and don't require you to select a learning rate.
☑ The sigmoid function $g(z) = \frac{1}{1+e^{-z}}$ is never greater than one (> 1).	✔	0.25	The denomiator ranges from ∞ to 1 as z grows, so the result is always in $(0, 1)$.
Total		1.00 / 1.00	