Linear Regression with Multiple Variables

5 questions

1. Suppose m=4 students have taken some class, and the class had a midterm exam and a final exam. You have collected a dataset of their scores on the two exams, which is as follows:

midterm exam	$(\text{midterm exam})^2$	final exam
89	7921	96
72	5184	74
94	8836	87
69	4761	78

You'd like to use polynomial regression to predict a student's final exam score from their midterm exam score. Concretely, suppose you want to fit a model of the form $h_\theta(x) = \theta_0 + \theta_1 x_1 + \theta_2 x_2$, where x_1 is the midterm score and x_2 is $(\text{midterm score})^2$. Further, you plan to use both feature scaling (dividing by the "max-min", or range, of a feature) and mean normalization.

What is the normalized feature $x_2^{(2)}$? (Hint: midterm = 89, final = 96 is training example 1.) Please round off your answer to two decimal places and enter in the text box below.

-0.37

2. You run gradient descent for 15 iterations

with $\alpha = 0.3$ and compute

$J(\theta)$ after each iteration. You find that the

value of $J(\theta)$ **decreases slowly** and is still

decreasing after 15 iterations. Based on this, which of the

following conclusions seems most plausible?

- Rather than use the current value of α, it'd be more promising to try a smaller value of α (say $\alpha = 0.1$).
- $\alpha = 0.3$ is an effective choice of learning rate.
- Rather than use the current value of α, it'd be more promising to try a larger value of α (say $\alpha = 1.0$).

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3. Suppose you have $m = 28$ training examples with $n = 4$ features (excluding the additional all-ones feature for the intercept term, which you should add). The normal equation is $\theta = (X^T X)^{-1} X^T y$. For the given values of m and n, what are the dimensions of θ, X, and y in this equation?

- X is 28×5, y is 28×5, θ is 5×5
- X is 28×4, y is 28×1, θ is 4×4
- X is 28×5, y is 28×1, θ is 5×1
- X is 28×4, y is 28×1, θ is4×1

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4. Suppose you have a dataset with $m = 50$ examples and $n = 200000$ features for each example. You want to use multivariate linear regression to fit the parameters θ to our data. Should you prefer gradient descent or the normal equation?

- ○ Gradient descent, since it will always converge to the optimal θ.
- ○ The normal equation, since it provides an efficient way to directly find the solution.
- ○ Gradient descent, since $(X^T X)^{-1}$ will be very slow to compute in the normal equation.
- ○ The normal equation, since gradient descent might be unable to find the optimal θ.

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5. Which of the following are reasons for using feature scaling?

- ☐ It prevents the matrix $X^T X$ (used in the normal equation) from being non-invertable (singular/degenerate).
- ☐ It speeds up gradient descent by making it require fewer iterations to get to a good solution.
- ☐ It speeds up solving for θ using the normal equation.
- ☐ It is necessary to prevent gradient descent from getting stuck in local optima.

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