Linear Regression with Multiple Variables

TOTAL POINTS 5

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: 1 point

midterm exam	(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 (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 = 72, final = 74 is training example 2.) Please round off your answer to two decimal places and enter in the text box below.

-0.37

$$\text{mid} = \frac{7921 + 5184 + 8836 + 4761}{4} = 6675.5$$

$$\text{range} = 8836 - 4761 = 4075$$

$$\text{normalized} = \frac{5184 - 6675.5}{4075} \approx -0.37$$

2. You run gradient descent for 15 iterations

1 point

with $\alpha = 0.3$ and compute $J(\theta)$ after each

iteration. You find that the value of $J(\theta)$ **increases** over

time. Based on this, which of the following conclusions seems

most plausible?

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

3. Suppose you have $m = 14$ training examples with $n = 3$ 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?

1 point

- (•) X is 14×4, y is 14×1, θ is 4×1
- ( ) X is 14×3, y is 14×1, θ is 3×3
- ( ) X is 14×4, y is 14×4, θ is 4×4
- ( ) X is 14×3, y is 14×1, θ is 3×1

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?

1 point

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

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

1 point

- [ ] It prevents the matrix $X^T X$ (used in the normal equation) from being non-invertable (singular/degenerate).
- [x] It speeds up gradient descent by making it require fewer iterations to get to a good solution.
- [ ] It is necessary to prevent the normal equation from getting stuck in local optima.
- [ ] It speeds up gradient descent by making each iteration of gradient descent less expensive to compute.