Problem Set 8

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1 Problem 5

The true values of β are:

$$\beta = \begin{bmatrix} 1.5 & -1 & -0.25 & 0.75 & 3.5 & -2 & 0.5 & 1 & 1.25 & 2 \end{bmatrix}'$$

The estimated values are:

$$\hat{\beta} = \begin{bmatrix} 1.4990 & -0.9978 & -0.2493 & 0.7486 & 3.5009 & -1.9997 & 0.5006 & 0.9994 & 1.2514 & 1.9997 \end{bmatrix}$$

rounded to four decimal places. The estimates re all very close to their corresponding values. They're all less than 0.01 away from the true value.

2 Problem 7

The results from the three methods (gradient descent, L-BFGS, and Nelder-Mead) are very similar as shown below (rounded to four decimal places:

$$\hat{\beta}_{GD} = \begin{bmatrix} 1.5003 & -0.9978 & -0.2493 & 0.7486 & 3.5009 & -1.9997 & 0.5006 & 0.9994 & 1.2514 & 1.9997 \end{bmatrix}$$

$$\hat{\beta}_{L-BFGS} = \begin{bmatrix} 1.5003 & -0.9978 & -0.2493 & 0.7486 & 3.5009 & -1.9997 & 0.5006 & 0.9994 & 1.2514 & 1.9997 \end{bmatrix}$$

$$\hat{\beta}_{NM} = \begin{bmatrix} 1.5003 & -0.9978 & -0.2496 & 0.7491 & 3.5013 & -1.9997 & 0.5006 & 0.9992 & 1.2516 & 1.9996 \end{bmatrix}$$

3 Problem 9

The model summary of the basic lm regression method are below:

They are incredibly close to the "true" values that we set, showing that we have a good estimation here.

	Model 1
X1	1.500
	(0.001)
X2	−0.998
	(0.001)
X3	−0.249
	(0.001)
X4	0.749
	(0.001)
X5	3.501
	(0.001)
X6	−2.000
	(0.001)
X7	0.501
	(0.001)
X8	0.999
	(0.001)
X9	1.251
	(0.001)
X10	2.000
	(0.001)
Num.Obs.	100 000
R2	0.998
R2 Adj.	0.998
AIC	6363.8
BIC	6468.4
Log.Lik.	−3170.897
F	4 322 726.616
RMSE	0.25