

Problem Set 7

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Table 1: Regression Result

	(1)
X1	1.501 (0.002)
X2	-0.996 (0.002)
X3	-0.249 (0.002)
X4	0.747 (0.002)
X5	3.502 (0.002)
X6	-1.999 (0.002)
X7	0.501 (0.002)
X8	0.999 (0.002)
X9	1.253 (0.002)
X10	1.999 (0.002)
Num.Obs.	100 000
R2	0.991
R2 Adj.	0.991
AIC	144 993.2
BIC	145 097.9
Log.Lik.	-72 485.615
RMSE	0.50

Table 1 shows the result from simple OLS regression in Question 9.

Q5.

- Compared the Column 1 and 2 in Table 2, we can see the difference between β and $\hat{\beta}$ resulted from the closed-form solution. One would say the closed-form solution result is equal to the true value.

Q7.

- Compared the Column 4 and 5 in Table 2, we can see the difference between the results from L-BFGS and from Nelder-Mead. They are almost the same but show a little difference.

Table 2: Comparison of the results

	TRUE	OLS	Gradient_Descent	L_BFGS	Nelder_Mead	MLE	Easy_way
Constant	1.50	1.5006	1.5006	1.5006	1.5003	1.5006	1.5006
β_1	-1.00	-0.9956	-0.9956	-0.9956	-0.9957	-0.9956	-0.9956
β_2	-0.25	-0.2486	-0.2486	-0.2486	-0.2483	-0.2486	-0.2486
β_3	0.75	0.7472	0.7472	0.7472	0.7471	0.7472	0.7472
β_4	3.50	3.5018	3.5018	3.5018	3.5016	3.5018	3.5018
β_5	-2.00	-1.9994	-1.9994	-1.9994	-1.9997	-1.9994	-1.9994
β_6	0.50	0.5011	0.5011	0.5011	0.5013	0.5011	0.5011
β_7	1.00	0.9987	0.9987	0.9987	0.9989	0.9987	0.9987
β_8	1.25	1.2528	1.2528	1.2528	1.2527	1.2528	1.2528
β_9	2.00	1.9994	1.9994	1.9994	1.9989	1.9994	1.9994
$Var(\beta - \hat{\beta})(e-5)$	0.00	0.43953	0.43954	0.43953	0.44349	0.43953	0.43953

Q9.

- To compare the results of different methods, I have constructed Table 2. The bottom row displays the variance $Var(\beta - \hat{\beta})$, indicating the extent to which the estimates deviate from the true value β . These values are so small that they appear to be consistent with the true value.