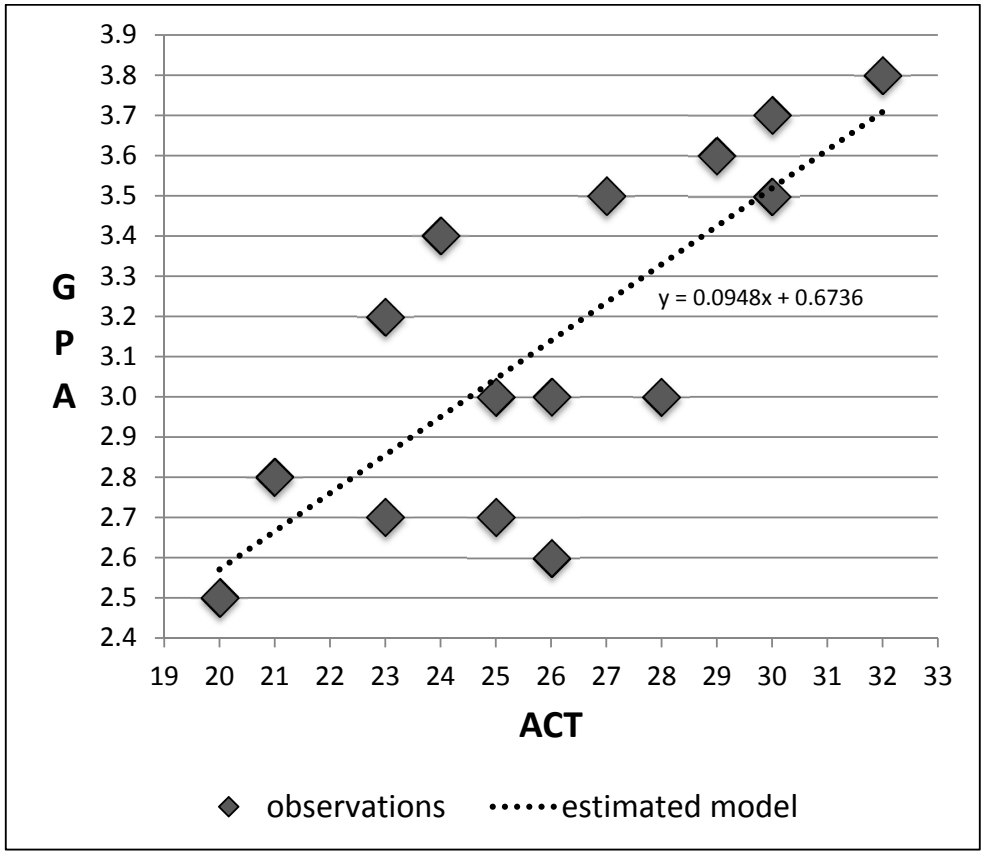
student	GPA (y)	ACT (x)	y-avg(y)	x-avg(x)	(y-avg(y))*(x-avg(x))	(x-avg(x))^2	estimated y	residual
1	2.8	21	-0.33	-4.93	1.64	24.34	2.67	0.13
2	3.4	24	0.27	-1.93	-0.52	3.74	2.95	0.45
3	3.0	26	-0.13	0.07	-0.01	0.00	3.14	-0.14
4	3.5	27	0.37	1.07	0.39	1.14	3.23	0.27
5	3.6	29	0.47	3.07	1.43	9.40	3.42	0.18
6	3.0	25	-0.13	-0.93	0.12	0.87	3.04	-0.04
7	2.7	25	-0.43	-0.93	0.40	0.87	3.04	-0.34
8	3.7	30	0.57	4.07	2.30	16.54	3.52	0.18
9	3.2	23	0.07	-2.93	-0.20	8.60	2.86	0.34
10	3.0	28	-0.13	2.07	-0.28	4.27	3.33	-0.33
11	3.5	30	0.37	4.07	1.49	16.54	3.52	-0.02
12	2.5	20	-0.63	-5.93	3.76	35.20	2.57	-0.07
13	3.8	32	0.67	6.07	4.04	36.80	3.71	0.09
14	2.6	26	-0.53	0.07	-0.04	0.00	3.14	-0.54
15	2.7	23	-0.43	-2.93	1.27	8.60	2.86	-0.16

n	sum(y)	sum(x)
15	47	389
	avg(y)	avg(x)
	3.13	25.93

	sum	sum
	15.83	166.93

	estimated
beta_0	0.67
beta_1	0.09


3.9
3.8
3.7
3.6
3.5
3.4
3.3
3.2
3.1
3.0
2.9
2.8
2.7
2.6
2.5
2.4
GPA
y = 0.0948x + 0.6736
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
ACT
observations
estimated model

student	GPA (y)	ACT (x)
1	2.8	21
2	3.4	24
3	3.0	26
4	3.5	27
5	3.6	29
6	3.0	25
7	2.7	25
8	3.7	30
9	3.2	23
10	3.0	28
11	3.5	30
12	2.5	20
13	3.8	32
14	2.6	26
15	2.7	23

vector y
2.8
3.4
3.0
3.5
3.6
3.0
2.7
3.7
3.2
3.0
3.5
2.5
3.8
2.6
2.7

matrix X	
1	21
1	24
1	26
1	27
1	29
1	25
1	25
1	30
1	23
1	28
1	30
1	20
1	32
1	26
1	23

X'								
1	1	1	1	1	1	1	1	1
21	24	26	27	29	25	25	30	23

X'X	
15	389
389	10255

Hint for Windows: Expand to the size of the matrix & Press F2, the
Hint for Mac: Expand to the size of the matrix & press CONTROL+U

(X'X)^(-1)	
4.10	-0.16
-0.16	0.01

Hint for Windows: Expand to the size of the matrix & Press F2, the
Hint for Mac: Expand to the size of the matrix & press CONTROL+U

X'y
47
1235

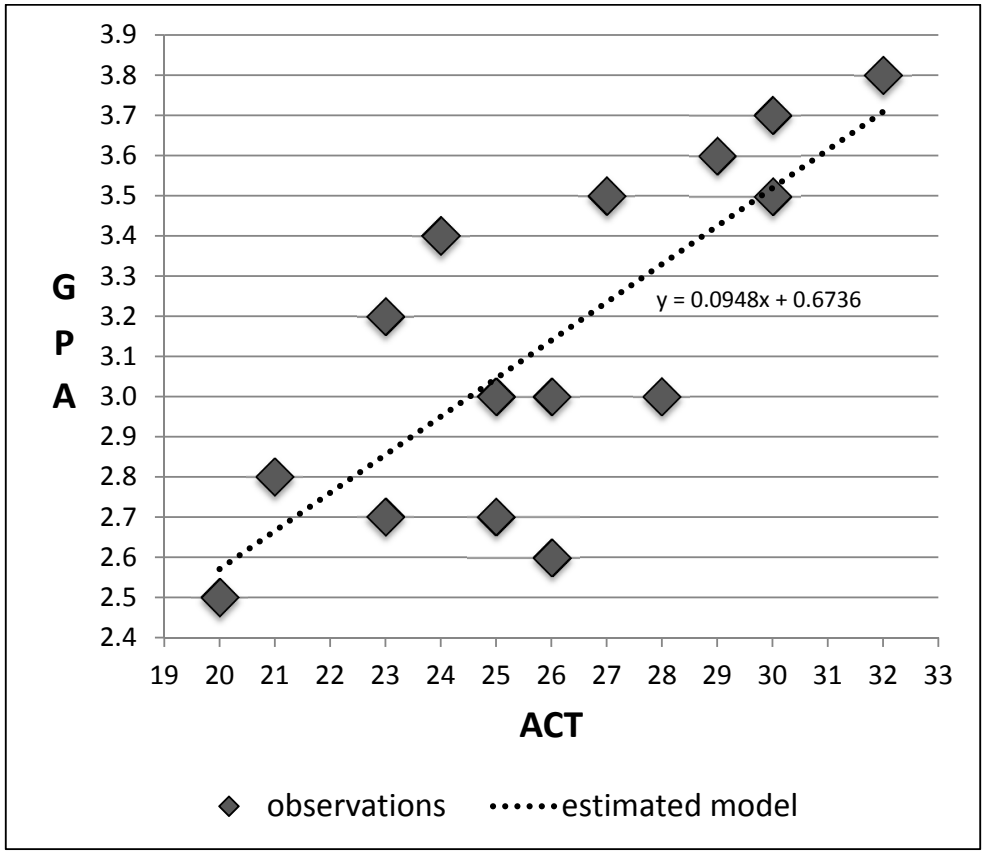
	estim.
beta_0	0.67
beta_1	0.09

1	1	1	1	1	1
28	30	20	32	26	23

n Ctrl+Shift+Enter (use "MMULT")
J, and then press ⌘+RETURN

n Ctrl+Shift+Enter (use "MINVERSE")
J, and then press ⌘+RETURN

estimated y	residual
2.67	0.13
2.95	0.45
3.14	-0.14
3.23	0.27
3.42	0.18
3.04	-0.04
3.04	-0.34
3.52	0.18
2.86	0.34
3.33	-0.33
3.52	-0.02
2.57	-0.07
3.71	0.09
3.14	-0.54
2.86	-0.16


3.9
3.8
3.7
3.6
3.5
3.4
3.3
3.2
3.1
3.0
2.9
2.8
2.7
2.6
2.5
2.4
GPA
y = 0.0948x + 0.6736
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
ACT
observations
estimated model

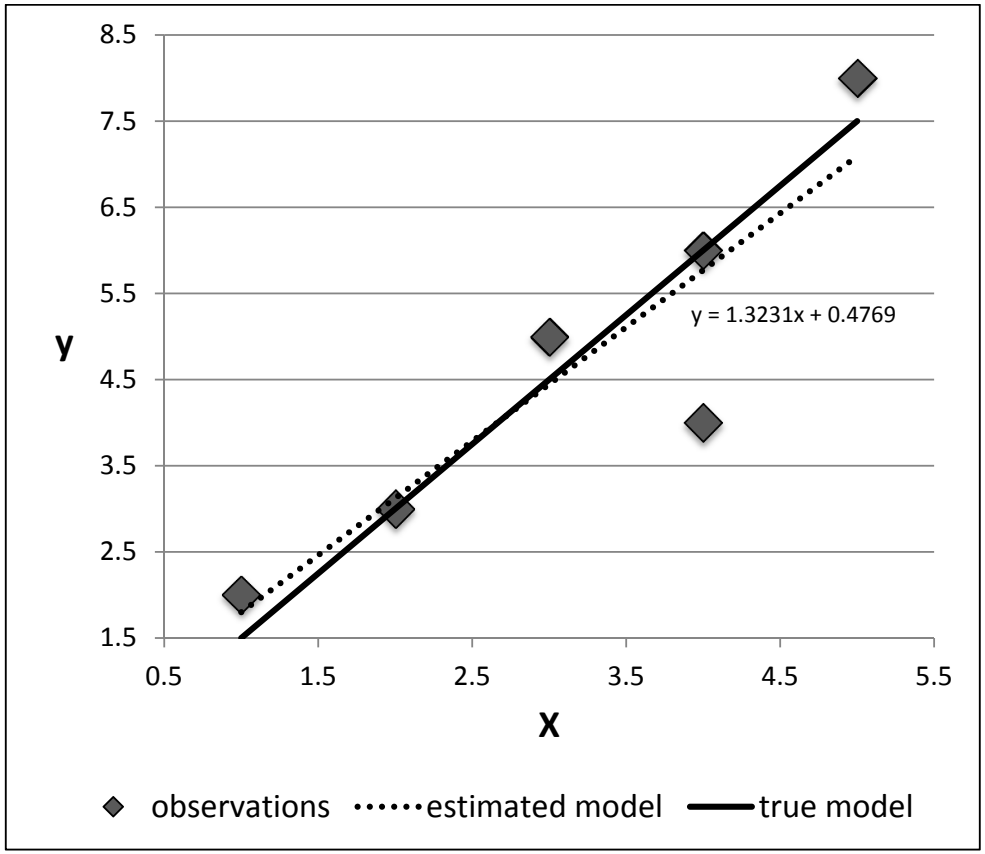
y	x
2	1
6	4
3	2
8	5
5	3
4	4
sum(y)	sum(x)
28	19
avg(y)	avg(x)
4.67	3.17

y-avg(y)	x-avg(x)	(y-avg(y))*(x-avg(x))	(x-avg(x))^2
-2.67	-2.17	5.78	4.69
1.33	0.83	1.11	0.69
-1.67	-1.17	1.94	1.36
3.33	1.83	6.11	3.36
0.33	-0.17	-0.06	0.03
-0.67	0.83	-0.56	0.69
		sum	sum
		14.33	10.83

	estimated	true
beta_0	0.48	0
beta_1	1.32	1.5

estimated y	true model y
1.80	1.5
5.77	6.0
3.12	3.0
7.09	7.5
4.45	4.5
5.77	6.0

residual	disturbance
0.20	0.5
0.23	0.0
-0.12	0.0
0.91	0.5
0.55	0.5
-1.77	-2.0


8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
y
0.5
1.5
2.5
3.5
4.5
5.5
X
y = 1.3231x + 0.4769
observations
estimated model
true model

y	x
2	1
6	4
3	2
8	5
5	3
4	4

vector y
2
6
3
8
5
4

matrix X	
1	1
1	4
1	2
1	5
1	3
1	4

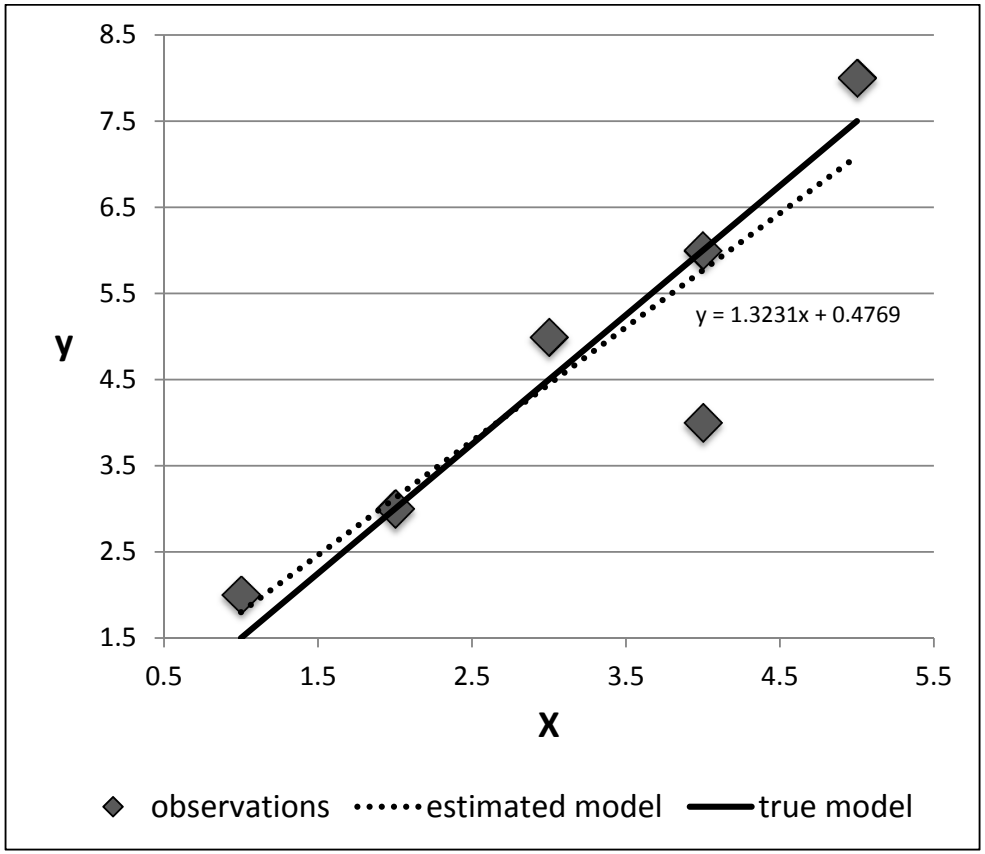
X'					
1	1	1	1	1	1
1	4	2	5	3	4

X'X	
6	19
19	71

(X'X)^(-1)	
1.09	-0.29
-0.29	0.09

estimated y	true model y
1.80	1.5
5.77	6.0
3.12	3.0
7.09	7.5
4.45	4.5
5.77	6.0

X'y
28.0
103.0

	estim.	true
beta_0	0.48	0
beta_1	1.32	1.5

residual	disturbance
0.20	0.5
0.23	0.0
-0.12	0.0
0.91	0.5
0.55	0.5
-1.77	-2.0