

Toluca Company Example (Problem from Neter, Kutner, Nachtsheim & Wasserman 1996,1.21)
A particular part needed for refrigeration equipment replacement parts are produced periodically.
Production requires a setup plus the time needed to produce the part. The company wants to study costs by examining 25 production runs over 3 years.

```

1      dm'log;clear;output;clear';
2      ****;
3      *** EXST7034 Example 1 using PC-SAS - Toluca Company Example      ***;
4      *** Problem from Neter, Kutner, Nachtsheim & Wasserman 1996,1.21  ***;
5      ****;
6      *** A particular part needed for refrigeration equipment replacement ***;
7      *** parts are produced periodically. Production requires a setup ***;
8      *** plus the time needed to produce the part. The company wants to ***;
9      *** study costs by examining 25 production runs over 3 years.      ***;
10     ****;
11
12     ODS HTML style=minimal rs=none
13     body='C:\Geaghan\EXST\EXST7034New\Fall2002\SAS\03b-Toluca-Bootstrap.html' ;
NOTE: Writing HTML Body file: C:\Geaghan\EXST\EXST7034New\Fall2002\SAS\03b-Toluca-
Bootstrap.html
14
15     OPTIONS LS=155 PS=256 NOCENTER NODATE NONUMBER nlabel;
16     DATA ONE; INFILE CARDS MISSEVER;
17     TITLE1 'EXST7034 - Chapter 3 examples : Toluca example';
18     LABEL X = 'Lot size'
19     Y = 'work hours';
20     INPUT X Y;
21     CARDS;
NOTE: The data set WORK.ONE has 25 observations and 2 variables.
NOTE: DATA statement used (Total process time):
      real time          0.01 seconds
      cpu time           0.02 seconds
47     ;
48     PROC SORT DATA=ONE; BY X Y; run;
NOTE: There were 25 observations read from the data set WORK.ONE.
NOTE: The data set WORK.ONE has 25 observations and 2 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time          0.02 seconds
      cpu time           0.02 seconds
49     proc print DATA=ONE; run;
NOTE: There were 25 observations read from the data set WORK.ONE.
NOTE: The PROCEDURE PRINT printed page 1.
NOTE: PROCEDURE PRINT used (Total process time):
      real time          0.10 seconds
      cpu time           0.02 seconds

```

EXST7034 - Chapter 3 examples : Toluca example

Obs	X	Y			
1	20	113	13	70	361
2	30	121	14	80	342
3	30	212	15	80	352
4	30	273	16	80	399
5	40	160	17	90	376
6	40	244	18	90	377
7	50	157	19	90	389
8	50	221	20	90	468
9	50	268	21	100	353
10	60	224	22	100	420
11	70	252	23	110	421
12	70	323	24	110	435
			25	120	546

```

51      DATA BOOTS;
52          DO Run = 1 TO 100 BY 1;
53          DO rep = 1 TO 25 BY 1;
54              get = INT(RANUNI(7882271)*25+1);
55          SET ONE POINT=get NOBS=subjects; OUTPUT;
56      END;
57  END;
58  stop;
59  RUN;
NOTE: The data set WORK.BOOTS has 2500 observations and 4 variables.
NOTE: DATA statement used (Total process time):
      real time          0.00 seconds
      cpu time           0.01 seconds
60      proc print data=boots; run;
NOTE: There were 2500 observations read from the data set WORK.BOOTS.
NOTE: The PROCEDURE PRINT printed pages 2-11.
NOTE: PROCEDURE PRINT used (Total process time):
      real time          0.70 seconds
      cpu time           0.55 seconds
61
62      PROC SORT DATA=BOOTS; BY run rep; run;
NOTE: There were 2500 observations read from the data set WORK.BOOTS.
NOTE: The data set WORK.BOOTS has 2500 observations and 4 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time          0.00 seconds
      cpu time           0.01 seconds

```

EXST7034 - Chapter 3 examples : Toluca example

Obs	Run	rep	X	Y	43	2	18	30	121	2458	99	8	110	435
1	1	1	30	212	44	2	19	90	376	2459	99	9	50	268
2	1	2	30	273	45	2	20	30	212	2460	99	10	50	268
3	1	3	80	342	46	2	21	70	252	2461	99	11	30	212
4	1	4	70	252	47	2	22	50	221	2462	99	12	110	435
5	1	5	50	157	48	2	23	70	252	2463	99	13	30	273
6	1	6	90	389	49	2	24	30	273	2464	99	14	90	389
7	1	7	120	546	50	2	25	90	468	2465	99	15	40	244
8	1	8	50	157	51	3	1	70	361	2466	99	16	50	221
9	1	9	20	113	52	3	2	110	421	2467	99	17	90	377
10	1	10	80	352	53	3	3	70	252	2468	99	18	40	160
11	1	11	20	113	54	3	4	30	273	2469	99	19	90	389
12	1	12	70	252	55	3	5	70	361	2470	99	20	80	342
13	1	13	40	244	56	3	6	110	435	2471	99	21	40	160
14	1	14	30	121	57	3	7	60	224	2472	99	22	70	252
15	1	15	60	224	58	3	8	110	421	2473	99	23	100	420
16	1	16	60	224	59	3	9	120	546	2474	99	24	20	113
17	1	17	120	546	60	3	10	70	323	2475	99	25	50	157
18	1	18	50	268	61	3	11	100	353	2476	100	1	50	221
19	1	19	50	268	62	3	12	70	252	2477	100	2	40	160
20	1	20	90	376	63	3	13	90	376	2478	100	3	80	399
21	1	21	20	113	64	3	14	70	252	2479	100	4	40	244
22	1	22	90	376	65	3	15	30	273	2480	100	5	100	420
23	1	23	110	421	66	3	16	50	157	2481	100	6	80	352
24	1	24	30	212	67	3	17	100	353	2482	100	7	40	160
25	1	25	50	157	68	3	18	80	399	2483	100	8	70	252
26	2	1	50	268	69	3	19	90	389	2484	100	9	50	221
27	2	2	30	121	70	3	20	80	352	2485	100	10	80	399
28	2	3	50	221	71	3	21	110	421	2486	100	11	110	421
29	2	4	70	323	72	3	22	90	377	2487	100	12	30	212
30	2	5	80	342	73	3	23	40	244	2488	100	13	90	376
31	2	6	40	244	74	3	24	80	399	2489	100	14	80	342
32	2	7	50	221	75	3	25	80	342	2490	100	15	20	113
33	2	8	110	421						2491	100	16	80	342
34	2	9	20	113						2492	100	17	70	361
35	2	10	80	352	. . .					2493	100	18	80	342
36	2	11	20	113	2451	99	1	120	546	2494	100	19	40	160
37	2	12	70	252	2452	99	2	70	323	2495	100	20	80	399
38	2	13	90	468	2453	99	3	80	342	2496	100	21	90	468
39	2	14	30	212	2454	99	4	50	268	2497	100	22	70	323
40	2	15	110	435	2455	99	5	90	376	2498	100	23	90	376
41	2	16	100	420	2456	99	6	100	353	2499	100	24	30	273
42	2	17	90	468	2457	99	7	40	244	2500	100	25	40	160

```
63
64     PROC REG DATA=one; TITLE2 'Ordinary Regression';
65     MODEL Y = X / clb;
66     RUN;
NOTE: The PROCEDURE REG printed page 12.
NOTE: PROCEDURE REG used (Total process time):
      real time          0.08 seconds
      cpu time           0.04 seconds
```

EXST7034 - Chapter 3 examples : Toluca example
Ordinary Regression

The REG Procedure
Model: MODEL1
Dependent Variable: Y

Number of Observations Read 25
Number of Observations Used 25

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	252378	252378	105.88	<.0001
Error	23	54825	2383.71562		
Corrected Total	24	307203			

Root MSE	48.82331	R-Square	0.8215
Dependent Mean	312.28000	Adj R-Sq	0.8138
Coeff Var	15.63447		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	95% Confidence Limits	
Intercept	1	62.36586	26.17743	2.38	0.0259	8.21371	116.51801
X	1	3.57020	0.34697	10.29	<.0001	2.85244	4.28797

```
68     PROC REG DATA=boots outest=BVALUES NOPRINT; by run;
69     TITLE2 'Bootstrap regression';
70     MODEL Y = X;
71     RUN;
NOTE: Interactivity disabled with BY processing.
NOTE: PROCEDURE REG used (Total process time):
      real time          0.11 seconds
      cpu time           0.05 seconds
NOTE: The data set WORK.BVALUES has 100 observations and 8 variables.
72     proc sort data=BVALUES; by x; run;
NOTE: There were 100 observations read from the data set WORK.BVALUES.
NOTE: The data set WORK.BVALUES has 100 observations and 8 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time          0.01 seconds
      cpu time           0.02 seconds
73     proc print data=BVALUES; run;
NOTE: There were 100 observations read from the data set WORK.BVALUES.
NOTE: The PROCEDURE PRINT printed page 13.
NOTE: PROCEDURE PRINT used (Total process time):
      real time          0.11 seconds
      cpu time           0.05 seconds
```

EXST7034 - Chapter 3 examples : Toluca example

Bootstrap regression

Obs	Run	MODEL	TYPE	DEPVAR	RMSE	Intercept	X	Y
1	82	MODEL1	PARMS	Y	41.7407	134.861	2.59126	-1
2	3	MODEL1	PARMS	Y	51.0319	123.107	2.76683	-1
3	54	MODEL1	PARMS	Y	39.3332	125.587	2.84464	-1
4	44	MODEL1	PARMS	Y	47.3047	126.205	2.86971	-1
5	81	MODEL1	PARMS	Y	46.0099	111.316	2.89946	-1
6	87	MODEL1	PARMS	Y	36.8329	127.251	3.01487	-1
7	61	MODEL1	PARMS	Y	51.5811	105.398	3.06390	-1
8	66	MODEL1	PARMS	Y	35.6824	118.647	3.07327	-1
9	93	MODEL1	PARMS	Y	43.8319	86.728	3.11646	-1
10	50	MODEL1	PARMS	Y	46.4621	77.388	3.13966	-1
11	91	MODEL1	PARMS	Y	57.6174	107.618	3.15769	-1
12	56	MODEL1	PARMS	Y	45.1223	89.526	3.16615	-1
13	28	MODEL1	PARMS	Y	49.8072	86.372	3.19468	-1
14	74	MODEL1	PARMS	Y	52.6577	100.545	3.20706	-1
15	58	MODEL1	PARMS	Y	50.2002	104.539	3.23363	-1
16	51	MODEL1	PARMS	Y	55.9802	75.899	3.26440	-1
17	97	MODEL1	PARMS	Y	53.9004	80.331	3.26458	-1
18	31	MODEL1	PARMS	Y	61.1783	86.347	3.27282	-1
19	59	MODEL1	PARMS	Y	35.6158	86.789	3.27422	-1
20	17	MODEL1	PARMS	Y	48.3680	94.280	3.28623	-1
21	4	MODEL1	PARMS	Y	40.6223	78.452	3.28868	-1
22	19	MODEL1	PARMS	Y	42.1425	100.777	3.30166	-1
23	99	MODEL1	PARMS	Y	42.0460	78.027	3.32327	-1
24	60	MODEL1	PARMS	Y	50.9507	79.746	3.33247	-1
25	5	MODEL1	PARMS	Y	45.1451	67.012	3.34079	-1
26	41	MODEL1	PARMS	Y	52.2004	86.563	3.35101	-1
27	95	MODEL1	PARMS	Y	50.5651	63.960	3.37000	-1
28	55	MODEL1	PARMS	Y	47.2783	64.983	3.37726	-1
29	16	MODEL1	PARMS	Y	50.6517	76.315	3.38628	-1
30	26	MODEL1	PARMS	Y	50.2494	75.524	3.39325	-1
31	77	MODEL1	PARMS	Y	47.2725	72.145	3.41474	-1
32	24	MODEL1	PARMS	Y	47.7363	57.078	3.46630	-1
33	84	MODEL1	PARMS	Y	49.1344	78.067	3.47463	-1
34	33	MODEL1	PARMS	Y	44.6301	57.034	3.47726	-1
35	86	MODEL1	PARMS	Y	44.1553	72.706	3.48058	-1
36	67	MODEL1	PARMS	Y	49.3499	58.230	3.49190	-1
37	70	MODEL1	PARMS	Y	44.7920	56.959	3.52095	-1
38	62	MODEL1	PARMS	Y	46.6345	66.090	3.56140	-1
39	15	MODEL1	PARMS	Y	48.1735	65.534	3.56317	-1
40	10	MODEL1	PARMS	Y	43.7481	69.196	3.56597	-1
41	94	MODEL1	PARMS	Y	46.3670	55.207	3.56618	-1
42	57	MODEL1	PARMS	Y	53.7411	54.199	3.57488	-1
43	22	MODEL1	PARMS	Y	58.9418	53.660	3.58529	-1
44	80	MODEL1	PARMS	Y	51.9914	66.959	3.58902	-1
45	8	MODEL1	PARMS	Y	43.1577	51.909	3.59609	-1
46	85	MODEL1	PARMS	Y	50.8817	62.486	3.60796	-1
47	64	MODEL1	PARMS	Y	49.0121	70.945	3.61678	-1
48	47	MODEL1	PARMS	Y	61.0700	74.328	3.62710	-1
49	92	MODEL1	PARMS	Y	53.7405	88.329	3.62894	-1
50	2	MODEL1	PARMS	Y	49.7982	61.518	3.63293	-1
51	25	MODEL1	PARMS	Y	41.1842	67.116	3.64571	-1
52	76	MODEL1	PARMS	Y	44.8527	38.849	3.65425	-1
53	32	MODEL1	PARMS	Y	48.0592	61.337	3.66146	-1
54	65	MODEL1	PARMS	Y	56.7756	59.318	3.66776	-1
55	37	MODEL1	PARMS	Y	51.9299	55.332	3.67272	-1
56	20	MODEL1	PARMS	Y	46.6238	42.661	3.68402	-1
57	36	MODEL1	PARMS	Y	42.6244	50.392	3.68566	-1
58	45	MODEL1	PARMS	Y	45.1329	28.461	3.68574	-1
59	90	MODEL1	PARMS	Y	46.2043	72.259	3.68765	-1
60	1	MODEL1	PARMS	Y	50.8986	44.809	3.70051	-1
61	100	MODEL1	PARMS	Y	44.2195	57.228	3.72105	-1
62	83	MODEL1	PARMS	Y	30.6351	37.138	3.72459	-1
63	6	MODEL1	PARMS	Y	55.2445	50.137	3.73138	-1

Obs	Run	MODEL	TYPE	DEPVAR	RMSE	Intercept	X	Y
64	71	MODEL1	PARMS	Y	52.9861	64.641	3.74627	-1
65	12	MODEL1	PARMS	Y	52.0756	52.540	3.75250	-1
66	78	MODEL1	PARMS	Y	39.7721	35.190	3.75333	-1
67	52	MODEL1	PARMS	Y	39.8334	34.718	3.75411	-1
68	79	MODEL1	PARMS	Y	50.7358	28.809	3.77544	-1
69	18	MODEL1	PARMS	Y	49.6111	40.078	3.77768	-1
70	88	MODEL1	PARMS	Y	39.3903	42.824	3.78577	-1
71	34	MODEL1	PARMS	Y	45.1711	47.006	3.80257	-1
72	73	MODEL1	PARMS	Y	57.4732	58.794	3.81783	-1
73	40	MODEL1	PARMS	Y	44.7595	51.760	3.83105	-1
74	89	MODEL1	PARMS	Y	53.4314	48.472	3.83600	-1
75	96	MODEL1	PARMS	Y	41.7803	50.463	3.83702	-1
76	13	MODEL1	PARMS	Y	36.6400	50.784	3.84161	-1
77	14	MODEL1	PARMS	Y	43.7076	47.239	3.85369	-1
78	98	MODEL1	PARMS	Y	46.0813	50.566	3.85610	-1
79	9	MODEL1	PARMS	Y	54.4719	43.174	3.87765	-1
80	7	MODEL1	PARMS	Y	49.7550	25.838	3.87831	-1
81	75	MODEL1	PARMS	Y	39.1623	52.110	3.89400	-1
82	11	MODEL1	PARMS	Y	53.4616	36.527	3.89721	-1
83	39	MODEL1	PARMS	Y	45.3303	41.056	3.90133	-1
84	27	MODEL1	PARMS	Y	46.9983	37.779	3.92472	-1
85	63	MODEL1	PARMS	Y	44.7901	26.095	3.93974	-1
86	69	MODEL1	PARMS	Y	47.4464	39.229	3.94862	-1
87	21	MODEL1	PARMS	Y	56.4481	54.047	3.95050	-1
88	68	MODEL1	PARMS	Y	40.6551	43.092	3.98335	-1
89	46	MODEL1	PARMS	Y	45.4350	40.683	3.99027	-1
90	23	MODEL1	PARMS	Y	43.6410	45.642	3.99178	-1
91	53	MODEL1	PARMS	Y	48.0742	39.460	3.99317	-1
92	35	MODEL1	PARMS	Y	44.8151	23.462	4.01033	-1
93	29	MODEL1	PARMS	Y	38.8309	22.751	4.02565	-1
94	49	MODEL1	PARMS	Y	45.2442	15.354	4.03757	-1
95	72	MODEL1	PARMS	Y	44.5693	20.846	4.12841	-1
96	42	MODEL1	PARMS	Y	37.5898	30.967	4.16054	-1
97	30	MODEL1	PARMS	Y	37.3580	15.018	4.19351	-1
98	38	MODEL1	PARMS	Y	42.8476	7.146	4.22384	-1
99	48	MODEL1	PARMS	Y	51.7880	13.824	4.30728	-1
100	43	MODEL1	PARMS	Y	47.9269	-0.065	4.48785	-1

74 proc univariate data=bvalues plot normal; var x; run;

NOTE: The PROCEDURE UNIVARIATE printed page 14.

NOTE: PROCEDURE UNIVARIATE used (Total process time):

real time 0.08 seconds
cpu time 0.03 seconds

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EXST7034 - Chapter 3 examples : Toluca example
Bootstrap regression

The UNIVARIATE Procedure
Variable: X

Moments

N	100	Sum Weights	100
Mean	3.59897381	Sum Observations	359.897381
Std Deviation	0.35111495	Variance	0.12328171
Skewness	-0.3399621	Kurtosis	0.17072476
Uncorrected SS	1307.46614	Corrected SS	12.2048894
Coeff Variation	9.75597412	Std Error Mean	0.0351115

Basic Statistical Measures

Location		Variability	
Mean	3.598974	Std Deviation	0.35111
Median	3.639319	Variance	0.12328
Mode	.	Range	1.89659
		Interquartile Range	0.49342

Tests for Location: Mu0=0

Test	-Statistic-	-----p Value-----
Student's t	t 102.5013	Pr > t <.0001
Sign	M 50	Pr >= M <.0001
Signed Rank	S 2525	Pr >= S <.0001

Tests for Normality

Test	--Statistic---	-----p Value-----
Shapiro-Wilk	W 0.988569	Pr < W 0.5511
Kolmogorov-Smirnov	D 0.087387	Pr > D 0.0596
Cramer-von Mises	W-Sq 0.085377	Pr > W-Sq 0.1806
Anderson-Darling	A-Sq 0.461043	Pr > A-Sq >0.2500

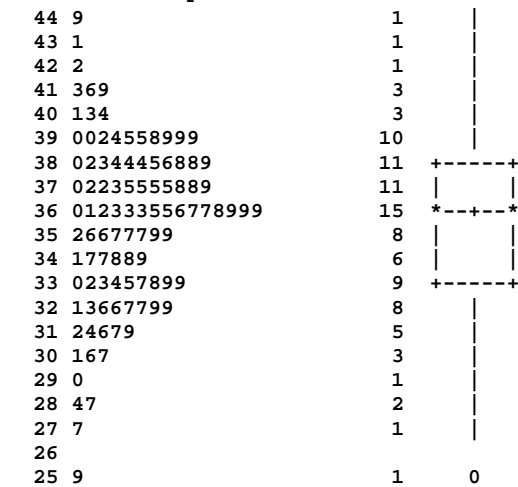
Quantiles (Definition 5)

Quantile	Estimate
100% Max	4.48785
99%	4.39756
95%	4.14448
90%	3.99247
75% Q3	3.83932
50% Median	3.63932
25% Q1	3.34590
10%	3.14867
5%	2.95717
1%	2.67904
0% Min	2.59126

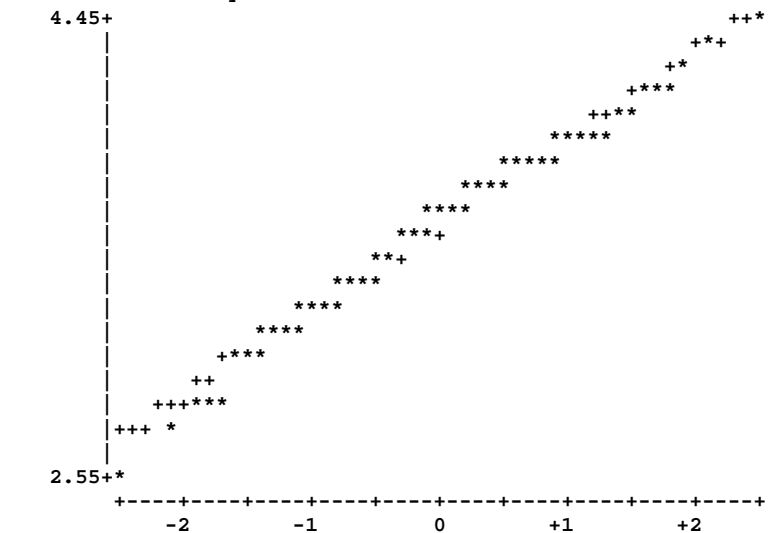
Extreme Observations

-----Lowest-----		-----Highest-----	
Value	Obs	Value	Obs
2.59126	1	4.16054	96
2.76683	2	4.19351	97
2.84464	3	4.22384	98
2.86971	4	4.30728	99
2.89946	5	4.48785	100

Stem Leaf Boxplot



Normal Probability Plot



Multiply Stem.Leaf by 10**-1

```

76      OPTIONS LS=111 PS=56 NOCENTER NODATE NONUMBER;
77      proc chart data=bvalues; vbar x / type=freq;
78      run;
NOTE: The PROCEDURE CHART printed page 15.
NOTE: PROCEDURE CHART used (Total process time):
      real time          0.06 seconds
      cpu time           0.01 seconds
79      ods html close;

```

EXST7034 - Chapter 3 examples : Toluca example
Bootstrap regression

Frequency

