

Error	48	10117	210.77223
Corrected Total	49	12781	

Root MSE	14.51800	R-Square	0.2084
Dependent Mean	101.50000	Adj R-Sq	0.1919
Coeff Var	14.30345		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	61.13913	11.53808	5.30	<.0001
height	height	1	0.76878	0.21627	3.55	0.0009

Output Statistics

Obs	Dependent Variable	Predicted Value	Std Error Mean	Std Error Predict Residual	Std Error Residual	Student Residual	-2	-1	0	1	2	Cook's D
1	105.0000	88.8152	4.1169	16.1848	13.922	1.163			**			0.059
2	90.0000	89.5839	3.9309	0.4161	13.976	0.0298						0.000
3	82.0000	90.3527	3.7482	-8.3527	14.026	-0.596		*				0.013
4	96.0000	90.3527	3.7482	5.6473	14.026	0.403						0.006
5	82.0000	91.1215	3.5692	-9.1215	14.072	-0.648		*				0.014
6	74.0000	91.1215	3.5692	-17.1215	14.072	-1.217		**				0.048
7	104.0000	91.8903	3.3946	12.1097	14.116	0.858			*			0.021
8	100.0000	91.8903	3.3946	8.1097	14.116	0.575			*			0.010
9	80.0000	92.6590	3.2250	-12.6590	14.155	-0.894		*				0.021
10	98.0000	93.4278	3.0614	4.5722	14.192	0.322						0.002
11	96.0000	94.1966	2.9046	1.8034	14.224	0.127						0.000
12	86.0000	94.9654	2.7558	-8.9654	14.254	-0.629		*				0.007
13	88.0000	94.9654	2.7558	-6.9654	14.254	-0.489						0.004
14	128.0000	94.9654	2.7558	33.0346	14.254	2.318			****			0.100
15	118.0000	95.7342	2.6165	22.2658	14.280	1.559			***			0.041
16	90.0000	96.5029	2.4883	-6.5029	14.303	-0.455						0.003
17	108.0000	98.0405	2.2721	9.9595	14.339	0.695			*			0.006
18	120.0000	98.0405	2.2721	21.9595	14.339	1.531			***			0.029
19	114.0000	98.8093	2.1882	15.1907	14.352	1.058			**			0.013
20	78.0000	98.8093	2.1882	-20.8093	14.352	-1.450		**				0.024
21	116.0000	99.5781	2.1231	16.4219	14.362	1.143			**			0.014
22	74.0000	99.5781	2.1231	-25.5781	14.362	-1.781		***				0.035
23	80.0000	100.3468	2.0786	-20.3468	14.368	-1.416		**				0.021
24	98.0000	101.1156	2.0560	-3.1156	14.372	-0.217						0.000
25	90.0000	101.8844	2.0560	-11.8844	14.372	-0.827		*				0.007
26	92.0000	102.6532	2.0786	-10.6532	14.368	-0.741		*				0.006
27	80.0000	102.6532	2.0786	-22.6532	14.368	-1.577		***				0.026
28	88.0000	102.6532	2.0786	-14.6532	14.368	-1.020		**				0.011
29	104.0000	103.4219	2.1231	0.5781	14.362	0.0402						0.000
30	100.0000	104.1907	2.1882	-4.1907	14.352	-0.292						0.001
31	126.0000	104.9595	2.2721	21.0405	14.339	1.467			**			0.027
32	108.0000	105.7283	2.3728	2.2717	14.323	0.159						0.000
33	106.0000	106.4971	2.4883	-0.4971	14.303	-0.0348						0.000
34	98.0000	106.4971	2.4883	-8.4971	14.303	-0.594		*				0.005
35	94.0000	106.4971	2.4883	-12.4971	14.303	-0.874		*				0.012
36	88.0000	107.2658	2.6165	-19.2658	14.280	-1.349		**				0.031
37	110.0000	107.2658	2.6165	2.7342	14.280	0.191						0.001
38	124.0000	107.2658	2.6165	16.7342	14.280	1.172			**			0.023

39	86.0000	108.0346	2.7558	-22.0346	14.254	-1.546	***		0.045
40	120.0000	108.0346	2.7558	11.9654	14.254	0.839	*		0.013
41	112.0000	108.8034	2.9046	3.1966	14.224	0.225			0.001
42	100.0000	109.5722	3.0614	-9.5722	14.192	-0.674	*		0.011
43	122.0000	110.3410	3.2250	11.6590	14.155	0.824	*		0.018
44	122.0000	110.3410	3.2250	11.6590	14.155	0.824	*		0.018

Output Statistics

Obs	RStudent	Hat Diag	Cov		-----DFBETAS-----	
		H	Ratio	DFFITS	Intercept	height
1	1.1669	0.0804	1.0712	0.3451	0.3249	-0.2991
2	0.0295	0.0733	1.1255	0.0083	0.0077	-0.0071
3	-0.5915	0.0667	1.1010	-0.1581	-0.1455	0.1322
4	0.3991	0.0667	1.1100	0.1067	0.0982	-0.0892
5	-0.6442	0.0604	1.0908	-0.1634	-0.1482	0.1337
6	-1.2229	0.0604	1.0427	-0.3102	-0.2814	0.2537
7	0.8555	0.0547	1.0698	0.2057	0.1834	-0.1638
8	0.5705	0.0547	1.0882	0.1372	0.1223	-0.1093
9	-0.8924	0.0493	1.0609	-0.2033	-0.1773	0.1568
10	0.3191	0.0445	1.0868	0.0688	0.0585	-0.0511
11	0.1255	0.0400	1.0858	0.0256	0.0211	-0.0181
12	-0.6250	0.0360	1.0642	-0.1208	-0.0953	0.0806
13	-0.4848	0.0360	1.0713	-0.0937	-0.0739	0.0625
14	2.4335	0.0360	0.8534	0.4705	0.3712	-0.3138
15	1.5835	0.0325	0.9716	0.2901	0.2175	-0.1799
16	-0.4509	0.0294	1.0653	-0.0784	-0.0551	0.0443
17	0.6908	0.0245	1.0478	0.1095	0.0637	-0.0469
18	1.5538	0.0245	0.9673	0.2462	0.1434	-0.1055
19	1.0598	0.0227	1.0180	0.1616	0.0820	-0.0559
20	-1.4672	0.0227	0.9758	-0.2237	-0.1135	0.0774
21	1.1472	0.0214	1.0085	0.1696	0.0717	-0.0432
22	-1.8236	0.0214	0.9296	-0.2696	-0.1139	0.0687
23	-1.4315	0.0205	0.9777	-0.2071	-0.0682	0.0323
24	-0.2146	0.0201	1.0623	-0.0307	-0.0070	0.0016
25	-0.8242	0.0201	1.0342	-0.1179	-0.0148	-0.0062
26	-0.7379	0.0205	1.0406	-0.1067	-0.0024	-0.0167
27	-1.6021	0.0205	0.9574	-0.2318	-0.0051	-0.0362
28	-1.0203	0.0205	1.0192	-0.1476	-0.0033	-0.0230
29	0.0398	0.0214	1.0657	0.0059	-0.0005	0.0015
30	-0.2892	0.0227	1.0635	-0.0441	0.0076	-0.0153
31	1.4857	0.0245	0.9754	0.2354	-0.0614	0.1008
32	0.1570	0.0267	1.0705	0.0260	-0.0088	0.0130
33	-0.0344	0.0294	1.0745	-0.0060	0.0024	-0.0034
34	-0.5900	0.0294	1.0588	-0.1026	0.0420	-0.0580
35	-0.8715	0.0294	1.0407	-0.1516	0.0620	-0.0857
36	-1.3611	0.0325	0.9978	-0.2494	0.1173	-0.1546
37	0.1895	0.0325	1.0764	0.0347	-0.0163	0.0215
38	1.1765	0.0325	1.0172	0.2156	-0.1014	0.1336
39	-1.5692	0.0360	0.9769	-0.3034	0.1589	-0.2024
40	0.8368	0.0360	1.0505	0.1618	-0.0847	0.1079
41	0.2225	0.0400	1.0842	0.0454	-0.0259	0.0321
42	-0.6706	0.0445	1.0709	-0.1447	0.0883	-0.1073
43	0.8209	0.0493	1.0664	0.1870	-0.1207	0.1442
44	0.8209	0.0493	1.0664	0.1870	-0.1207	0.1442

Output Statistics

Obs	Dependent Variable	Predicted Value	Std Error Mean	Std Error Predict	Std Error Residual	Std Error Residual	Student Residual	-2	-1	0	1	2	Cook's D
45	110.0000	111.1097	3.3946	-1.1097	14.116	-0.0786							0.000
46	124.0000	111.1097	3.3946	12.8903	14.116	0.913			*				0.024
47	122.0000	111.8785	3.5692	10.1215	14.072	0.719			*				0.017
48	94.0000	112.6473	3.7482	-18.6473	14.026	-1.329		**					0.063
49	110.0000	112.6473	3.7482	-2.6473	14.026	-0.189							0.001
50	140.0000	114.1848	4.1169	25.8152	13.922	1.854			***				0.150

Output Statistics

Obs	RStudent	Hat Diag H	Cov Ratio	DFFITS	Intercept	height
45	-0.0778	0.0547	1.1030	-0.0187	0.0126	-0.0149
46	0.9116	0.0547	1.0653	0.2192	-0.1482	0.1746
47	0.7156	0.0604	1.0863	0.1815	-0.1275	0.1485
48	-1.3405	0.0667	1.0367	-0.3582	0.2600	-0.2997
49	-0.1868	0.0667	1.1158	-0.0499	0.0362	-0.0418
50	1.9043	0.0804	0.9775	0.5631	-0.4303	0.4881

Sum of Residuals 0
 Sum of Squared Residuals 10117
 Predicted Residual SS (PRESS) 10942

Program Notes 13.2 - 95% Confidence and Prediction Intervals

PROC REG also produces the 95% confidence and prediction intervals as is shown below. The option **CLI** prints the 95% prediction intervals and **CLM** prints the 95% confidence interval for the mean of Y for each value of X. If we choose not to print the statistics from **PROC REG**, and focus only on the plot of the intervals, we can also use the **NOPRINT** option of the **MODEL** statement.

SAS commands:

```
PROC REG DATA=BP;
    MODEL SBP = HEIGHT / P CLI CLM;
RUN;
QUIT;
```

SAS output:

The SAS System
 Model: MODEL1
 Dependent Variable: sbp sbp

Number of Observations Read 50
 Number of Observations Used 50

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	2663.43287	2663.43287	12.64	0.0009
Error	48	10117	210.77223		
Corrected Total	49	12781			

Root MSE 14.51800 R-Square 0.2084
 Dependent Mean 101.50000 Adj R-Sq 0.1919
 Coeff Var 14.30345

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	61.13913	11.53808	5.30	<.0001
height	height	1	0.76878	0.21627	3.55	0.0009

Output Statistics

Obs	Dependent Variable	Predicted Value	Std Error Mean Predict	95% CL Mean	95% CL Predict	Residual
1	105.0000	88.8152	4.1169	80.5376 97.0927	58.4738 119.1565	16.1848
2	90.0000	89.5839	3.9309	81.6803 97.4876	59.3425 119.8254	0.4161
3	82.0000	90.3527	3.7482	82.8165 97.8890	60.2052 120.5002	-8.3527
4	96.0000	90.3527	3.7482	82.8165 97.8890	60.2052 120.5002	5.6473
5	82.0000	91.1215	3.5692	83.9451 98.2979	61.0619 121.1811	-9.1215
6	74.0000	91.1215	3.5692	83.9451 98.2979	61.0619 121.1811	-17.1215
7	104.0000	91.8903	3.3946	85.0650 98.7156	61.9125 121.8680	12.1097
8	100.0000	91.8903	3.3946	85.0650 98.7156	61.9125 121.8680	8.1097
9	80.0000	92.6590	3.2250	86.1747 99.1434	62.7571 122.5610	-12.6590
10	98.0000	93.4278	3.0614	87.2726 99.5831	63.5955 123.2601	4.5722
11	96.0000	94.1966	2.9046	88.3566 100.0366	64.4278 123.9655	1.8034
12	86.0000	94.9654	2.7558	89.4244 100.5064	65.2537 124.6770	-8.9654
13	88.0000	94.9654	2.7558	89.4244 100.5064	65.2537 124.6770	-6.9654
14	128.0000	94.9654	2.7558	89.4244 100.5064	65.2537 124.6770	33.0346
15	118.0000	95.7342	2.6165	90.4732 100.9951	66.0735 125.3948	22.2658
16	90.0000	96.5029	2.4883	91.4999 101.5060	66.8869 126.1190	-6.5029
17	108.0000	98.0405	2.2721	93.4721 102.6089	68.4948 127.5862	9.9595
18	120.0000	98.0405	2.2721	93.4721 102.6089	68.4948 127.5862	21.9595
19	114.0000	98.8093	2.1882	94.4095 103.2090	69.2892 128.3294	15.1907
20	78.0000	98.8093	2.1882	94.4095 103.2090	69.2892 128.3294	-20.8093
21	116.0000	99.5781	2.1231	95.3092 103.8469	70.0772 129.0789	16.4219
22	74.0000	99.5781	2.1231	95.3092 103.8469	70.0772 129.0789	-25.5781
23	80.0000	100.3468	2.0786	96.1675 104.5262	70.8588 129.8349	-20.3468
24	98.0000	101.1156	2.0560	96.9817 105.2495	71.6340 130.5973	-3.1156
25	90.0000	101.8844	2.0560	97.7505 106.0183	72.4027 131.3660	-11.8844
26	92.0000	102.6532	2.0786	98.4738 106.8325	73.1651 132.1412	-10.6532
27	80.0000	102.6532	2.0786	98.4738 106.8325	73.1651 132.1412	-22.6532
28	88.0000	102.6532	2.0786	98.4738 106.8325	73.1651 132.1412	-14.6532

29	104.0000	103.4219	2.1231	99.1531	107.6908	73.9211	132.9228	0.5781
30	100.0000	104.1907	2.1882	99.7910	108.5905	74.6706	133.7108	-4.1907
31	126.0000	104.9595	2.2721	100.3911	109.5279	75.4138	134.5052	21.0405
32	108.0000	105.7283	2.3728	100.9574	110.4991	76.1506	135.3060	2.2717
33	106.0000	106.4971	2.4883	101.4940	111.5001	76.8810	136.1131	-0.4971
34	98.0000	106.4971	2.4883	101.4940	111.5001	76.8810	136.1131	-8.4971
35	94.0000	106.4971	2.4883	101.4940	111.5001	76.8810	136.1131	-12.4971
36	88.0000	107.2658	2.6165	102.0049	112.5268	77.6052	136.9265	-19.2658
37	110.0000	107.2658	2.6165	102.0049	112.5268	77.6052	136.9265	2.7342
38	124.0000	107.2658	2.6165	102.0049	112.5268	77.6052	136.9265	16.7342
39	86.0000	108.0346	2.7558	102.4936	113.5756	78.3230	137.7463	-22.0346
40	120.0000	108.0346	2.7558	102.4936	113.5756	78.3230	137.7463	11.9654
41	112.0000	108.8034	2.9046	102.9634	114.6434	79.0345	138.5722	3.1966
42	100.0000	109.5722	3.0614	103.4169	115.7274	79.7399	139.4045	-9.5722
43	122.0000	110.3410	3.2250	103.8566	116.8253	80.4390	140.2429	11.6590
44	122.0000	110.3410	3.2250	103.8566	116.8253	80.4390	140.2429	11.6590
45	110.0000	111.1097	3.3946	104.2844	117.9350	81.1320	141.0875	-1.1097
46	124.0000	111.1097	3.3946	104.2844	117.9350	81.1320	141.0875	12.8903
47	122.0000	111.8785	3.5692	104.7021	119.0549	81.8189	141.9381	10.1215
48	94.0000	112.6473	3.7482	105.1110	120.1835	82.4998	142.7948	-18.6473
49	110.0000	112.6473	3.7482	105.1110	120.1835	82.4998	142.7948	-2.6473
50	140.0000	114.1848	4.1169	105.9073	122.4624	83.8435	144.5262	25.8152
							Sum of Residuals	0
							Sum of Squared Residuals	10117
							Predicted Residual SS (PRESS)	10942

The SAS commands can be used to create several diagnostic plots. Notice here that we use the **NOPRINT** option.

SAS commands:

```
GOPTIONS DEVICE= GIF VPOS= 24 HPOS= 75 VSIZE= 5 HSIZE= 6 FTEXT=COMPLEX;
ODS HTML;
ODS GRAPHICS ON;
ODS NOPTITLE;

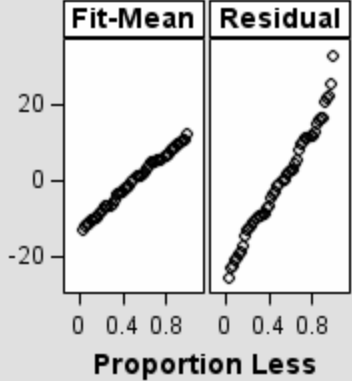
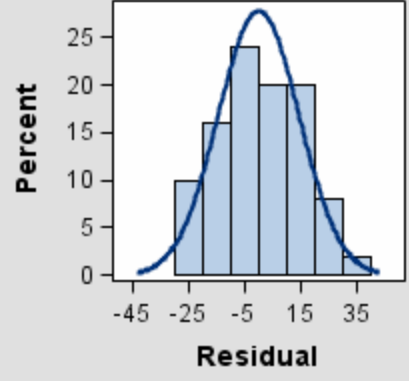
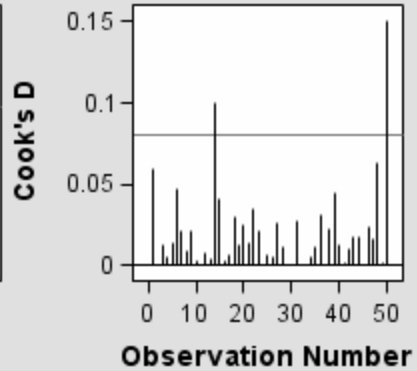
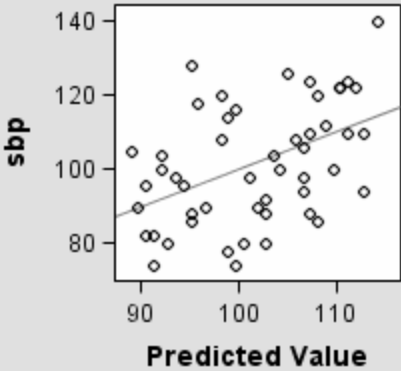
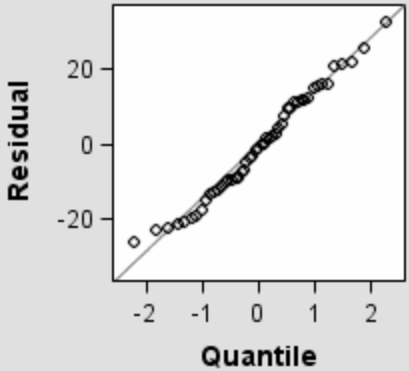
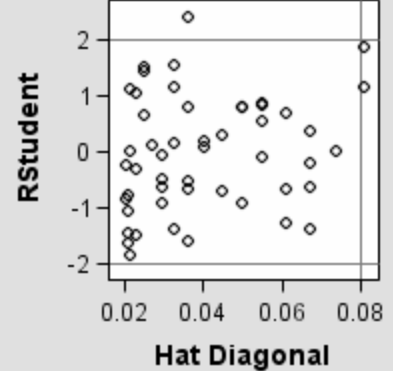
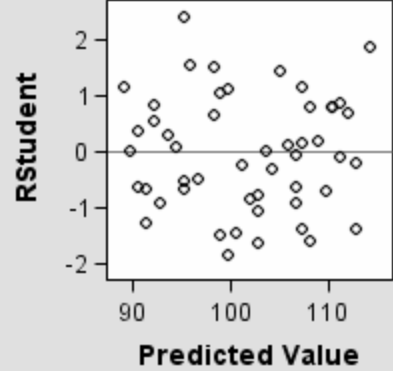
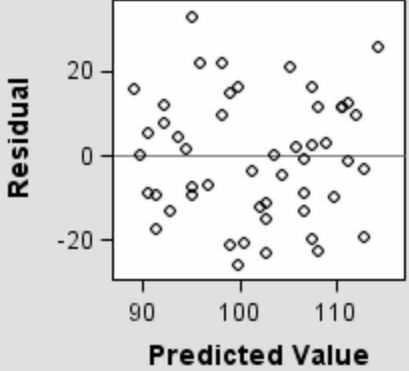
PROC REG DATA=BP NOPRINT;
  MODEL SBP = HEIGHT;
RUN;
QUIT;

ODS GRAPHICS OFF;
ODS HTML CLOSE;
```

SAS output:

MODEL1

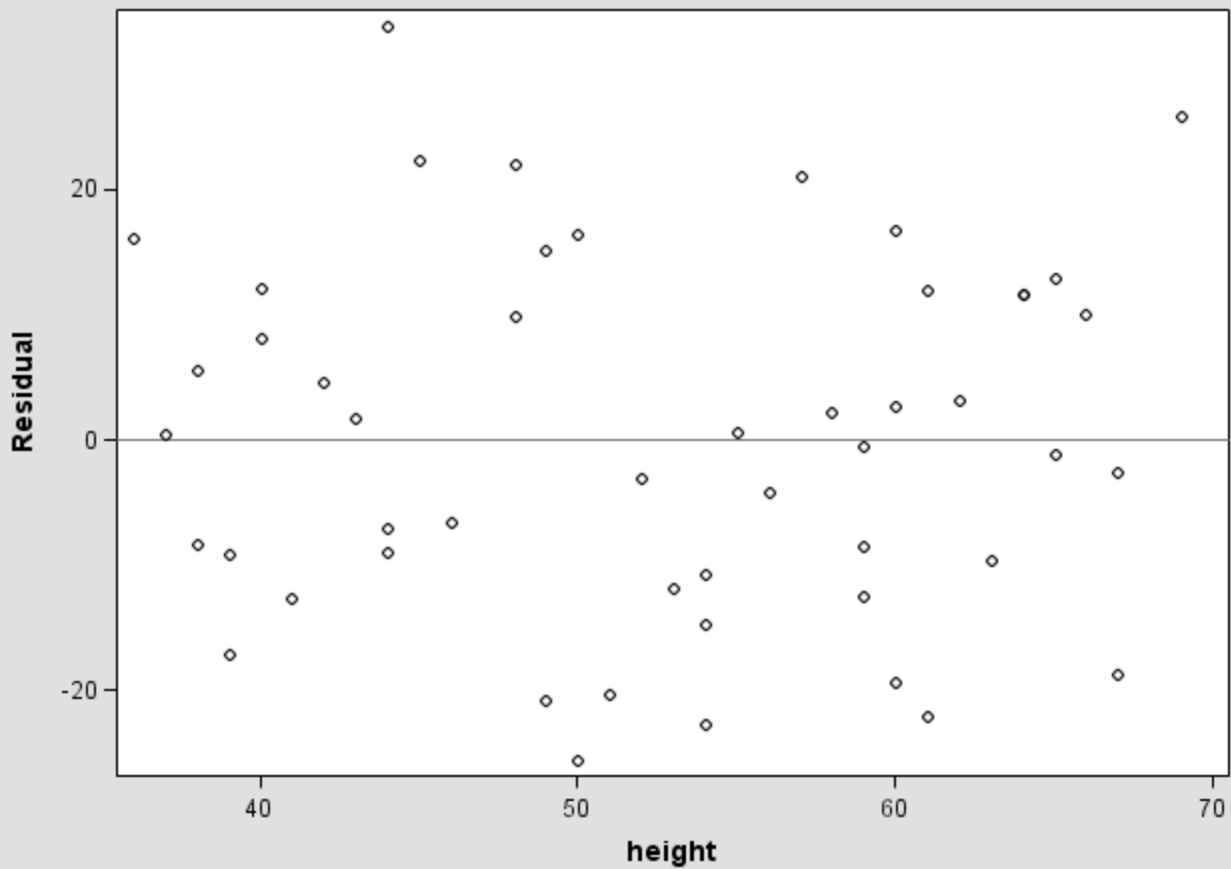
Fit Diagnostics for sbp

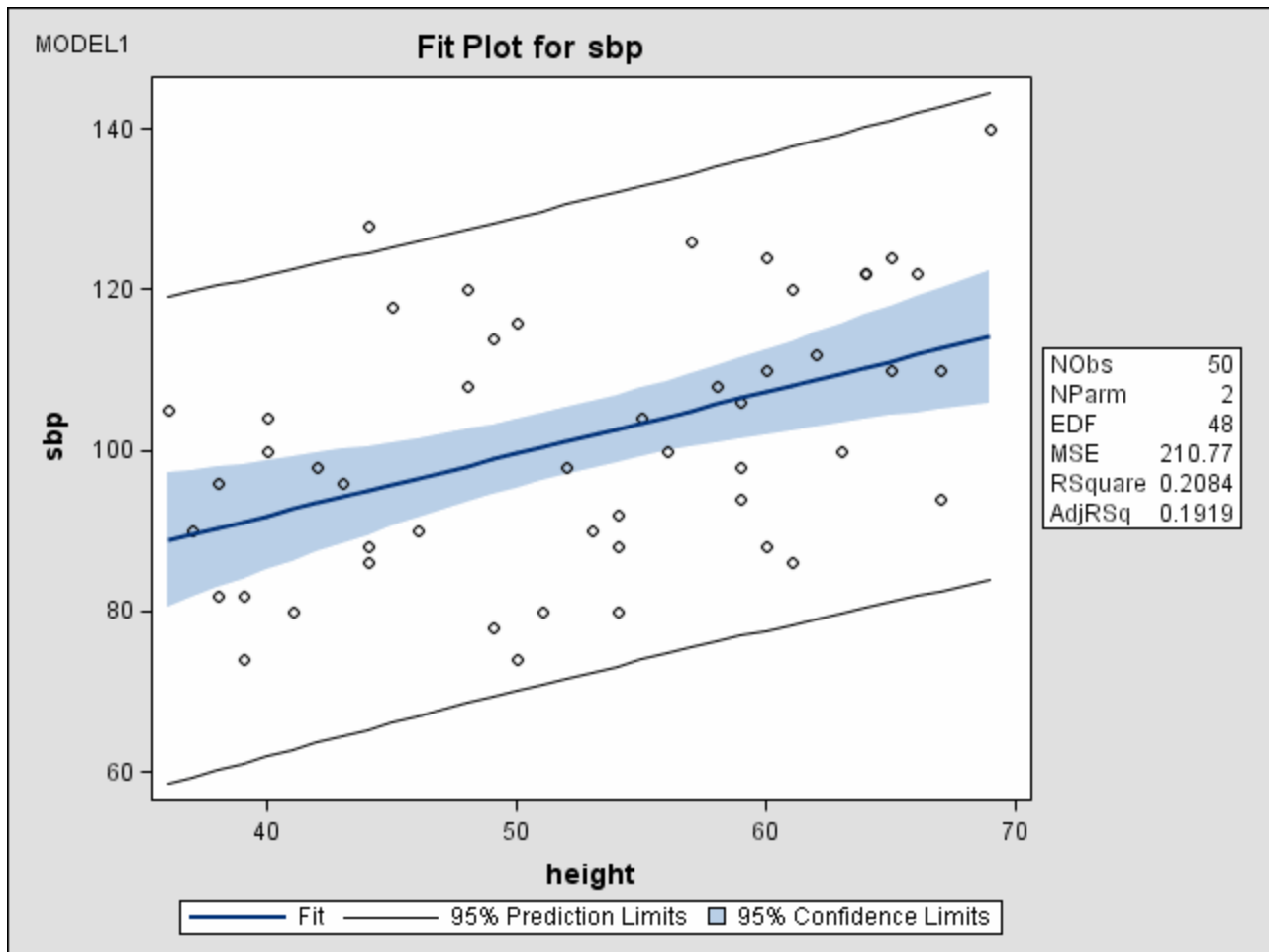


NObs	50
NParm	2
EDF	48
MSE	210.77
RSquare	0.2084
AdjRSq	0.1919

MODEL1

Residual by Regressors for sbp





Notice the first block of SAS code beginning with **PROC REG**. In the **OUTPUT** statement, **OUT** names the dataset containing output from **PROC REG**. **U95** and **L95** are keywords in SAS that refer to the upper and lower 95% prediction interval values. **P** or **PREDICTED** is another SAS keyword that refers to the predicted value of the dependent variable and **U95M** and **L95M** are keywords that refer to the upper and lower 95% confidence interval values for the mean of Y at each value of the independent variable. Other keywords that provide output statistics that can be requested are **RESIDUAL** or **R**, **STDP**, **STDR**, **STUDENT**, **COOKD**, **H**, **PRESS**, **RSTUDENT**, **DFFITs**, **COVRATIO**.

In the second block of SAS code below, we are using the dataset **STATs** created in the first block of SAS code which contains the six variables mentioned above: **P**, **L95**, **U95**, **L95M**, **U95M**, **SBP** that are to be plotted versus **HEIGHT**, the independent variable. The **OVERLAY** option means that all three of these plots are shown in a single figure. To improve the quality of the plot, we are using **ODS** commands along with **PROC GPLOT**. This could be done with some of the other plots that are built in some of the other procedures as well.

SAS commands:

```
PROC REG DATA=BP;
```

```

MODEL SBP = HEIGHT / P CLI CLM;
OUTPUT OUT=STATS
      P=PRED
      L95=LOW95PI
      U95=UP95PI
      L95M=LOW95CI
      U95M=UP95CI;
RUN;
PROC PRINT DATA=STATS;
RUN;

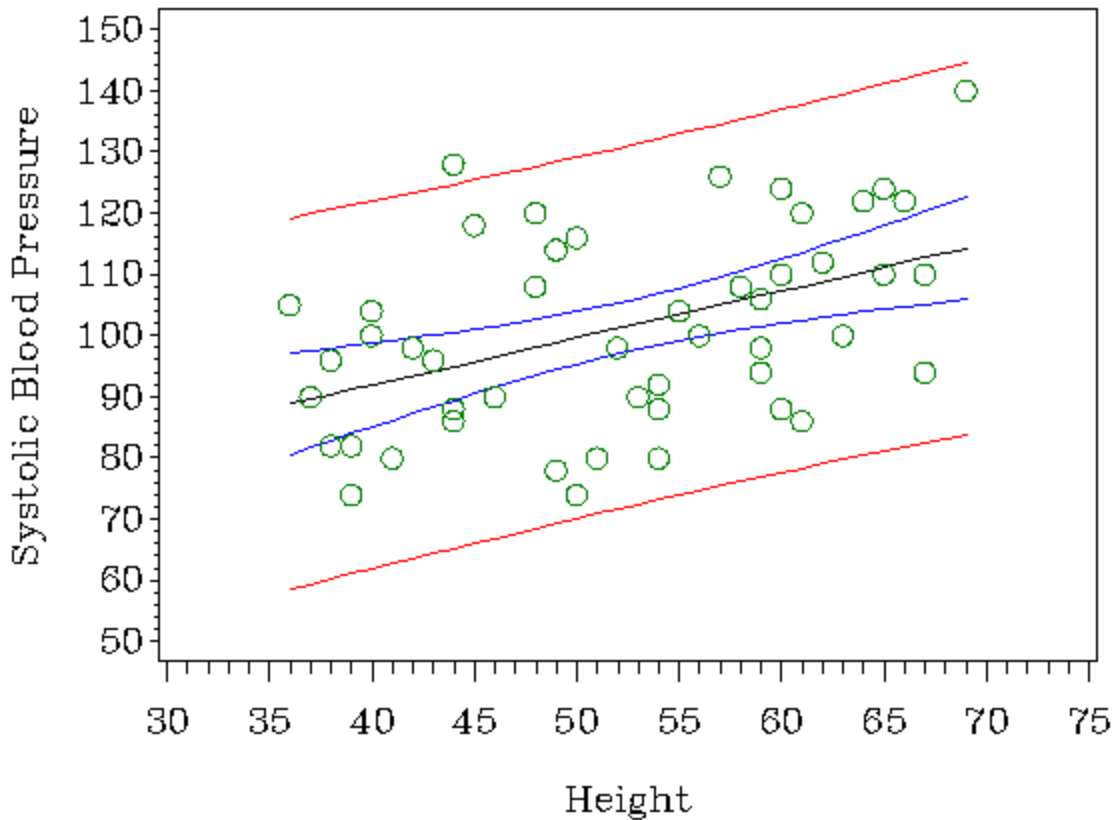
GOPTIONS DEVICE= GIF VPOS= 24 HPOS= 75 VSIZE= 5 HSIZE= 6 FTEXT=COMPLEX;
ODS HTML;
ODS GRAPHICS ON;
ODS NOPTITLE;
SYMBOL1 V=NONE I=JOIN C=RED;
SYMBOL2 V=NONE I=JOIN C=BLACK;
SYMBOL3 V=NONE I=JOIN C=BLUE;
SYMBOL4 V=CIRCLE C=GREEN;

PROC GGPLOT DATA=STATS;
  PLOT (UP95PI LOW95PI)*HEIGHT=1
       PRED*HEIGHT=2
       (UP95CI LOW95CI)*HEIGHT=3
       SBP*HEIGHT=4/ OVERLAY HAXIS=AXIS1 VAXIS=AXIS2;
  AXIS1 ORDER= (30 TO 75 BY 5) LABEL=('Height');
  AXIS2 LABEL=(A=90 R=0 'Systolic Blood Pressure');
RUN;
QUIT;

ODS GRAPHICS OFF;
ODS HTML CLOSE;

```

SAS output:



Note 13.3- Multiple Regression Analysis, Variable Selection Procedures, and Residual Plots

1. Multiple Regression Analysis

PROC REG can also be used to perform the multiple regression analysis. The SAS commands for analyzing the data in Table 13.6 are the following.

SAS commands:

```

PROC IMPORT FILE='C:\TABLE13-6.XLS' OUT=TABLE13_6 REPLACE;
RUN;

DATA MULTIPLE;
  SET TABLE13_6;
PROC REG;
  MODEL SBP=HEIGHT AGE WEIGHT;
  MODEL SBP=WEIGHT;
RUN;

```

SAS output:

The SAS System
 Model: MODEL1
 Dependent Variable: SBP SBP

Number of Observations Read 50
 Number of Observations Used 50

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	5266.46864	1755.48955	9.27	<.0001
Error	46	8714.41136	189.44373		
Corrected Total	49	13981			

Root MSE 13.76386 R-Square 0.3767
 Dependent Mean 121.32000 Adj R-Sq 0.3360
 Coeff Var 11.34508

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	53.96258	41.54436	1.30	0.2004
Height	Height	1	0.38447	0.67246	0.57	0.5703
Age	Age	1	0.43808	0.13192	3.32	0.0018
Weight	Weight	1	0.15435	0.05969	2.59	0.0129

The SAS System

Model: MODEL2

Dependent Variable: SBP SBP

Number of Observations Read 50
 Number of Observations Used 50

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	3021.92511	3021.92511	13.24	0.0007
Error	48	10959	228.31156		
Corrected Total	49	13981			

Root MSE 15.10998 R-Square 0.2161
 Dependent Mean 121.32000 Adj R-Sq 0.1998
 Coeff Var 12.45465

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
----------	-------	----	--------------------	----------------	---------	---------

Intercept	Intercept	1	92.49948	8.20495	11.27	<.0001
Weight	Weight	1	0.17666	0.04856	3.64	0.0007

2. Variable Selection Procedures

PROC REG can also be used to perform stepwise and all possible regressions in the multiple regression setting. The data to be analyzed are those shown in Table 13.6. The **CORR** option of **PROC REG** requests that the correlation matrix of all the variables listed in the **MODEL** statement be printed. It is printed as a square matrix with 1's - the correlation of a variable with itself - printed down the diagonal. The **SELECTION** option tells SAS what method of analysis should be used. The selection of **STEPWISE** tells SAS to use a forward stepwise regression method, which allows for a variable to be entered or deleted at each step. SAS prints the F test statistic - the square of the t value. When **SELECTION** is **ADJRSQ**, SAS performs all possible regressions using the adjusted r-square measure as the criterion of best. By including **CP**, we have requested that its values also be printed as part of the output.

SAS commands:

```
PROC IMPORT FILE='C:\TABLE13-6.XLS' OUT=TABLE13_6 REPLACE;
RUN;

DATA MULTIPLE;
  SET TABLE13_6;
PROC REG CORR;
  MODEL SBP=HEIGHT AGE WEIGHT/ SELECTION=STEPWISE;
  MODEL SBP=HEIGHT AGE WEIGHT/ SELECTION=ADJRSQ CP;
RUN;
QUIT;
```

SAS output:

The SAS System

Number of Observations Read	50
Number of Observations Used	50

Correlation

Variable	Label	Height	Age	Weight	SBP
Height	Height	1.0000	-0.3265	0.6360	0.2143
Age	Age	-0.3265	1.0000	-0.0040	0.3932
Weight	Weight	0.6360	-0.0040	1.0000	0.4649
SBP	SBP	0.2143	0.3932	0.4649	1.0000

The SAS System

Model: MODEL1

Dependent Variable: SBP SBP

Number of Observations Read	50
-----------------------------	----

Number of Observations Used 50

Stepwise Selection: Step 1

Variable Weight Entered: R-Square = 0.2161 and C(p) = 11.8481

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	3021.92511	3021.92511	13.24	0.0007
Error	48	10959	228.31156		
Corrected Total	49	13981			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	92.49948	8.20495	29017	127.09	<.0001
Weight	0.17666	0.04856	3021.92511	13.24	0.0007

Bounds on condition number: 1, 1

Stepwise Selection: Step 2

Variable Age Entered: R-Square = 0.3723 and C(p) = 2.3269

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	5204.54272	2602.27136	13.94	<.0001
Error	47	8776.33728	186.73058		
Corrected Total	49	13981			

The SAS System

Model: MODEL1

Dependent Variable: SBP SBP

Stepwise Selection: Step 2

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	77.18464	8.66755	14808	79.30	<.0001
Age	0.40642	0.11887	2182.61761	11.69	0.0013
Weight	0.17727	0.04391	3042.60042	16.29	0.0002

Bounds on condition number: 1, 4.0001

All variables left in the model are significant at the 0.1500 level.

No other variable met the 0.1500 significance level for entry into the model.

Summary of Stepwise Selection

Variable	Variable	Number	Partial	Model
----------	----------	--------	---------	-------

Step	Entered	Removed	Label	Vars In	R-Square	R-Square	C(p)	F Value	Pr > F
1	Weight		Weight	1	0.2161	0.2161	11.8481	13.24	0.0007
2	Age		Age	2	0.1561	0.3723	2.3269	11.69	0.0013

The SAS System

Model: MODEL2

Dependent Variable: SBP

Adjusted R-Square Selection Method

Number of Observations Read 50
Number of Observations Used 50

Number in Model	Adjusted R-Square	R-Square	C(p)	Variables in Model
2	0.3455	0.3723	2.3269	Age Weight
3	0.3360	0.3767	4.0000	Height Age Weight
2	0.2557	0.2861	8.6871	Height Age
1	0.1998	0.2161	11.8481	Weight
2	0.1944	0.2273	13.0272	Height Weight
1	0.1370	0.1546	16.3876	Age
1	0.0260	0.0459	24.4113	Height

3. Residual Plots

Residual plots provide useful ways to check model assumptions.

SAS commands:

```
PROC IMPORT FILE='C:\TABLE13-6.XLS' OUT=TABLE13_6 REPLACE;
RUN;
```

```
GOPTIONS DEVICE= GIF VPOS= 24 HPOS= 75 VSIZE= 5 HSIZE= 6 FTEXT=COMPLEX;
ODS HTML;
ODS GRAPHICS ON;
ODS NOPTITLE;
```

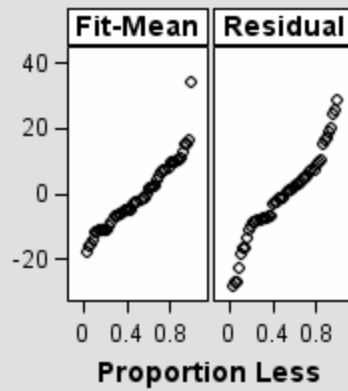
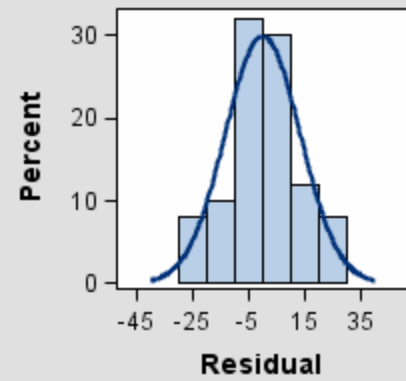
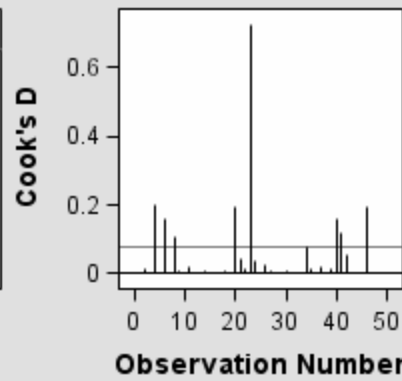
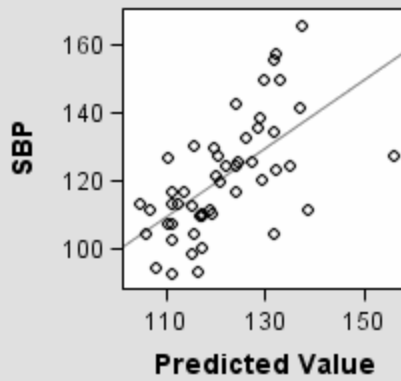
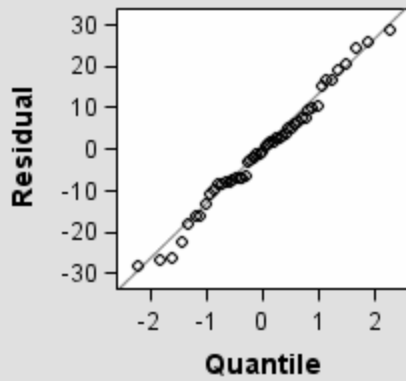
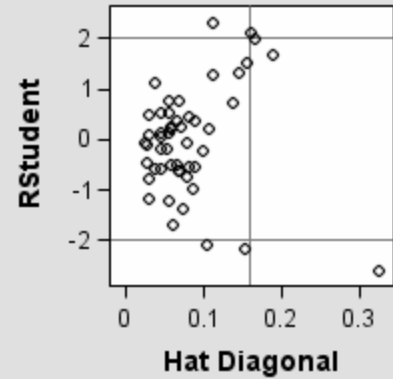
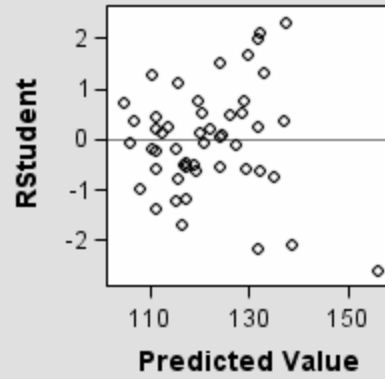
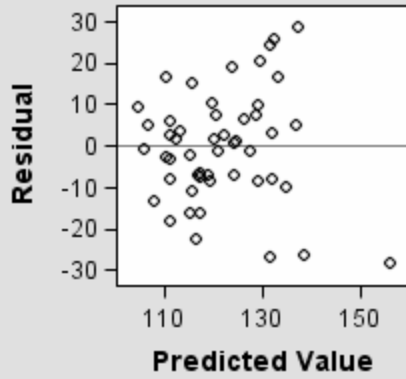
```
DATA MULTIPLE;
  SET TABLE13_6;
PROC REG NOPRINT;
  MODEL SBP=HEIGHT AGE WEIGHT;
RUN;
QUIT;
```

```
ODS GRAPHICS OFF;
ODS HTML CLOSE;
```

SAS output:

MODEL1

Fit Diagnostics for SBP



NObs	50
NParm	4
EDF	46
MSE	189.44
RSquare	0.3767
AdjRSq	0.336

MODEL1

Residual by Regressors for SBP

