

WLSE/ Regression

Yes



WLSE: for non-constant variance situation

```
ch11ta01<-matrix(scan("CH11TA01.txt"),ncol=2, byrow=T) ;  
# x1 <- ch11ta01[,1];  
# y <- ch11ta01[,2];  
dum <- data.frame("Age"=ch11ta01[,1], "BP"=ch11ta01[,2])  
# regress BP on AGE #  
dum
```

	Age	BP
1	27	73
2	21	66
3	22	63
4	24	75
5	25	71
6	23	70

7	20	65
8	20	70
9	29	79
10	24	72
11	25	68
12	28	67
13	26	79
14	38	91
15	32	76
16	33	69
17	31	66
18	34	73
19	37	78
20	38	87
21	33	76
22	35	79
23	30	73
24	31	80
25	37	68
26	39	75
27	46	89
28	49	101
29	40	70
30	42	72
31	43	80
32	46	83
33	43	75
34	44	71
35	46	80
36	47	96
37	45	92
38	49	80
39	48	70
40	40	90
41	42	85
42	55	76
43	54	71
44	57	99
45	52	86
46	53	79
47	56	92
48	52	85
49	50	71

```
50  59  90
51  50  91
52  52 100
53  58  80
54  57 109
```

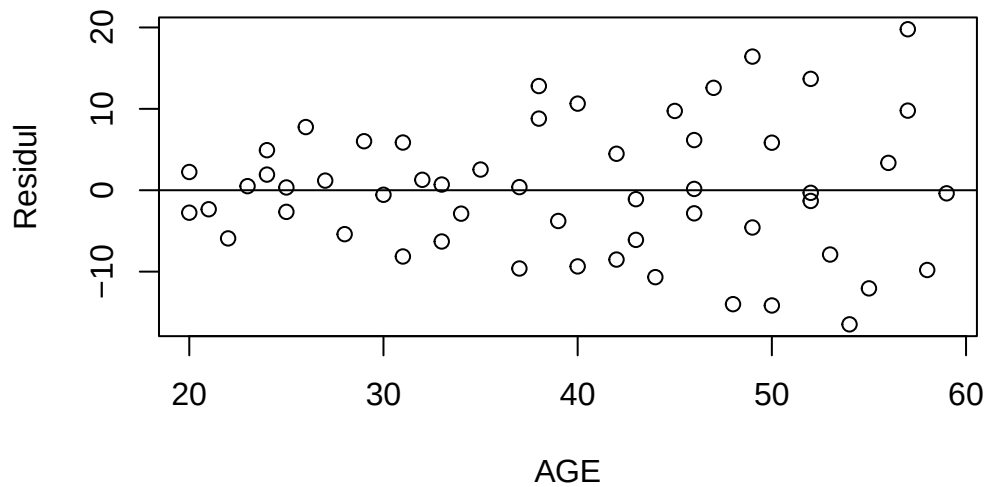
```
attach(dum)
fm <- lm(BP~Age, dum)

# To get Figure 11.1
plot(Age, BP, xlab="AGE", ylab="BLOOD PRESSURE", main="Scatter Plot")
abline(fm)
```



```
plot(Age,resid(fm), xlab="AGE", ylab="Residual", main="Residual plot against X");
abline(0,0);
```

Residual plot against X



```
# Note: the plot exhibits a megaphone shape => nonconstant var => try W.L.S.E. here
# To get the weights w_i's
# Since the plot exhibits a megaphone shape, apply rule 1 on p.425 to
#                               get estimates of the variances:
# => Regress absolute residuals on AGE #

dum1 <- data.frame("Age"=Age, "ABSei"=abs(resid(fm)))
dum1
```

	Age	ABSei
1	27	1.1822391
2	21	2.3375761
3	22	5.9176069
4	24	4.9223315
5	25	0.3423007
6	23	0.5023623
7	20	2.7575453
8	20	2.2424547
9	29	6.0221775
10	24	1.9223315
11	25	2.6576993
12	28	5.3977917
13	26	7.7622699

14	38	12.8019003
15	32	1.2820851
16	33	6.2979457
17	31	8.1378841
18	34	2.8779765
19	37	0.3819311
20	38	8.8019003
21	33	0.7020543
22	35	2.5419927
23	30	0.5578533
24	31	5.8621159
25	37	9.6180689
26	39	3.7781305
27	46	6.1616539
28	49	16.4215616
29	40	9.3581613
30	42	8.5182229
31	43	1.0982537
32	46	0.1616539
33	43	6.0982537
34	44	10.6782845
35	46	2.8383461
36	47	12.5816232
37	45	9.7416847
38	49	4.5784384
39	48	13.9984076
40	40	10.6418387
41	42	4.4817771
42	55	12.0586232
43	54	16.4785924
44	57	9.7813152
45	52	0.3185308
46	53	7.8985616
47	56	3.3613460
48	52	1.3185308
49	50	14.1584692
50	59	0.3787464
51	50	5.8415308
52	52	13.6814692
53	58	9.7987156
54	57	19.7813152

```
attach(dum1)
```

The following object is masked from dum:

Age

```
fm1 <- lm(ABSei~Age, dum1)
plot(Age,abs(resid(fm)), xlab="AGE", ylab="Absolute Residual", main="Absolute Residual plot against X",
abline(fm1);
```



```
# To get Table11.1 on p427 of the text #
ch11ta01<-data.frame("x1"=Age,"y"=BP,"e_i"=resid(fm),"ABS_ei"=abs(resid(fm)),"hat{s_i}"=fitted(fm),
ch11ta01;
```

	x1	y	e_i	ABS_ei	hat.s_i.	w_i
1	27	73	1.1822391	1.1822391	3.801175	0.069209280
2	21	66	-2.3375761	2.3375761	2.612141	0.146557083
3	22	63	-5.9176069	5.9176069	2.810313	0.126616574
4	24	75	4.9223315	4.9223315	3.206658	0.097251155
5	25	71	0.3423007	0.3423007	3.404830	0.086259931
6	23	70	0.5023623	0.5023623	3.008485	0.110485213

7	20	65	-2.7575453	2.7575453	2.413969	0.171607704
8	20	70	2.2424547	2.2424547	2.413969	0.171607704
9	29	79	6.0221775	6.0221775	4.197519	0.056756367
10	24	72	1.9223315	1.9223315	3.206658	0.097251155
11	25	68	-2.6576993	2.6576993	3.404830	0.086259931
12	28	67	-5.3977917	5.3977917	3.999347	0.062520410
13	26	79	7.7622699	7.7622699	3.603002	0.077031950
14	38	91	12.8019003	12.8019003	5.981070	0.027953887
15	32	76	1.2820851	1.2820851	4.792036	0.043547157
16	33	69	-6.2979457	6.2979457	4.990209	0.040157124
17	31	66	-8.1378841	8.1378841	4.593864	0.047385311
18	34	73	-2.8779765	2.8779765	5.188381	0.037148074
19	37	78	0.3819311	0.3819311	5.782898	0.029902601
20	38	87	8.8019003	8.8019003	5.981070	0.027953887
21	33	76	0.7020543	0.7020543	4.990209	0.040157124
22	35	79	2.5419927	2.5419927	5.386553	0.034464985
23	30	73	-0.5578533	0.5578533	4.395692	0.051754195
24	31	80	5.8621159	5.8621159	4.593864	0.047385311
25	37	68	-9.6180689	9.6180689	5.782898	0.029902601
26	39	75	-3.7781305	3.7781305	6.179242	0.026189640
27	46	89	6.1616539	6.1616539	7.566449	0.017466900
28	49	101	16.4215616	16.4215616	8.160966	0.015014709
29	40	70	-9.3581613	9.3581613	6.377415	0.024587291
30	42	72	-8.5182229	8.5182229	6.773759	0.021794177
31	43	80	-1.0982537	1.0982537	6.971932	0.020572817
32	46	83	0.1616539	0.1616539	7.566449	0.017466900
33	43	75	-6.0982537	6.0982537	6.971932	0.020572817
34	44	71	-10.6782845	10.6782845	7.170104	0.019451321
35	46	80	-2.8383461	2.8383461	7.566449	0.017466900
36	47	96	12.5816232	12.5816232	7.764621	0.016586681
37	45	92	9.7416847	9.7416847	7.368276	0.018419091
38	49	80	-4.5784384	4.5784384	8.160966	0.015014709
39	48	70	-13.9984076	13.9984076	7.962793	0.015771359
40	40	90	10.6418387	10.6418387	6.377415	0.024587291
41	42	85	4.4817771	4.4817771	6.773759	0.021794177
42	55	76	-12.0586232	12.0586232	9.349999	0.011438704
43	54	71	-16.4785924	16.4785924	9.151827	0.011939452
44	57	99	9.7813152	9.7813152	9.746344	0.010527289
45	52	86	-0.3185308	0.3185308	8.755482	0.013044872
46	53	79	-7.8985616	7.8985616	8.953655	0.012473815
47	56	92	3.3613460	3.3613460	9.548172	0.010968811
48	52	85	-1.3185308	1.3185308	8.755482	0.013044872
49	50	71	-14.1584692	14.1584692	8.359138	0.014311232

```

50 59 90 -0.3787464 0.3787464 10.142689 0.009720617
51 50 91 5.8415308 5.8415308 8.359138 0.014311232
52 52 100 13.6814692 13.6814692 8.755482 0.013044872
53 58 80 -9.7987156 9.7987156 9.944516 0.010111898
54 57 109 19.7813152 19.7813152 9.746344 0.010527289

```

```

# To get W.L.S.E. using R... regress regress BP on AGE, weighted by w_i#
fm2 <- lm(BP~Age, dum,weights=1/(fitted(fm1)^2))

# The equation (11.20) on p428 of the text #
fm2

```

Call:

```
lm(formula = BP ~ Age, data = dum, weights = 1/(fitted(fm1)^2))
```

Coefficients:

```

(Intercept)      Age
    55.5658      0.5963

```

```
summary(fm2)
```

Call:

```
lm(formula = BP ~ Age, data = dum, weights = 1/(fitted(fm1)^2))
```

Weighted Residuals:

```

      Min       1Q   Median       3Q      Max
-2.0230 -0.9939 -0.0327  0.9250  2.2008

```

Coefficients:

```

              Estimate Std. Error t value Pr(>|t|)
(Intercept)  55.56577      2.52092  22.042 < 2e-16 ***
Age           0.59634      0.07924   7.526 7.19e-10 ***
---

```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Residual standard error: 1.213 on 52 degrees of freedom

Multiple R-squared: 0.5214, Adjusted R-squared: 0.5122

F-statistic: 56.64 on 1 and 52 DF, p-value: 7.187e-10


```
# you can get the estimate of the standard deviation of b_w1 from this table...
```