

R Material for Chapter 08

```
> attach(concent.data)
> concent.data
  time concent
1     6  0.0290
2     6  0.0350
3     6  0.0220
4     8  0.0790
5     8  0.0650
6     8  0.0880
7    10  0.1810
8    10  0.1620
9    10  0.2040
10   12  0.4250
11   12  0.3820
12   12  0.4720
13   14  1.1630
14   14  1.0810
15   14  1.2450
16   16  2.8420
17   16  2.4680
18   16  3.0997

> mtime <- mean(time)
> mtime
[1] 11
> ctime <- time - mtime      ## centering the variable time at its mean
> ctime
 [1] -5 -5 -5 -3 -3 -3 -1 -1 -1  1  1  1  3  3  3  5  5  5
> sqctime <- ctime*ctime
> cuctime <- ctime*sqctime
> fcctime <- sqctime*sqctime
> reg1 <- lm(concent ~ time)      ## simple linear model of time alone
> summary(reg1)

Call:
lm(formula = concent ~ time)

Residuals:
    Min       1Q   Median       3Q      Max
-0.6463 -0.3679 -0.1251  0.4738  1.0786

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -1.95002    0.42739  -4.563 0.000319 ***
time         0.24820    0.03711   6.689 5.2e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.5377 on 16 degrees of freedom
Multiple R-squared:  0.7366,    Adjusted R-squared:  0.7201
F-statistic: 44.74 on 1 and 16 DF,  p-value: 5.203e-06

> reg2 <- lm(concent ~ ctime + sqctime)      ## model using centered time and square of
                                             ## centered time
> summary(reg2)
Call:
lm(formula = concent ~ ctime + sqctime)

Residuals:
    Min       1Q   Median       3Q      Max
-0.31893 -0.14562 -0.08059  0.16476  0.45448
```

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.234082	0.078355	2.987	0.0092 **
ctime	0.248198	0.014910	16.646	4.42e-11 ***
sqctime	0.046806	0.005104	9.170	1.54e-07 ***

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

Residual standard error: 0.2161 on 15 degrees of freedom
Multiple R-squared: 0.9601, Adjusted R-squared: 0.9548
F-statistic: 180.6 on 2 and 15 DF, p-value: 3.199e-11

```
> reg3 <- lm(concent ~ ctime + sqctime + cuctime) ## cubic fit  
> reg4 <- lm(concent ~ ctime + sqctime + cuctime + fctime) ## quartic fit
```

```
> attach(class.data)  
> reg <- lm(wt~ht + gender) ## include categorical variable "gender" in the model  
> summary(reg)
```

Call:
lm(formula = wt ~ ht + gender)

Residuals:

Min	1Q	Median	3Q	Max
-40.700	-13.458	-2.981	13.567	39.021

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	-210.879	165.282	-1.276	0.2192
ht	5.279	2.521	2.094	0.0516 .
genderM	1.765	16.563	0.107	0.9164

coefficient of indicator of male

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

Residual standard error: 20.25 on 17 degrees of freedom
Multiple R-squared: 0.4841, Adjusted R-squared: 0.4234
F-statistic: 7.975 on 2 and 17 DF, p-value: 0.003607

```
> anova(reg)  
Analysis of Variance Table
```

Response: wt

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
ht	1	6536.1	6536.1	15.9382	0.0009429 ***
gender	1	4.7	4.7	0.0114	0.9163796
Residuals	17	6971.5	410.1		

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

```
> reg2<- lm(wt~ gender + ht) ## entered the two variables in reverse order  
> summary(reg2)
```

Call:
lm(formula = wt ~ gender + ht)

Residuals:

Min	1Q	Median	3Q	Max
-40.700	-13.458	-2.981	13.567	39.021

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	-210.879	165.282	-1.276	0.2192
genderM	1.765	16.563	0.107	0.9164
ht	5.279	2.521	2.094	0.0516

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

Residual standard error: 20.25 on 17 degrees of freedom

Multiple R-squared: 0.4841, Adjusted R-squared: 0.4234

F-statistic: 7.975 on 2 and 17 DF, p-value: 0.003607

```
> reg3<- lm(wt~ht + gender + gender*ht)
```

```
> summary(reg3)
```

```
> attach(pol.data)
```

```
> pol.data
```

	income	party	sqft	
1	3220	2	1160	## political part variable in this data
2	2750	1	1080	## 1=Dem 2=Rep 3=(Not Dem or Rep)
3	3620	2	1720	
4	3940	1	1840	
5	4510	3	2240	
6	3990	2	2190	
7	2430	1	830	
8	3070	1	1150	
9	3750	2	1570	
10	4790	2	2660	
11	2490	1	900	
12	3600	3	1680	
13	5370	1	2550	
14	3180	2	1770	
15	5910	2	2960	
16	3320	2	1190	
17	5920	3	3130	
18	3520	2	1560	
19	3720	1	1510	
20	4840	1	2190	

```
> fparty <- factor(party)
```

```
> reg <- lm(income~fparty + sqft)
```

```
> model.matrix(reg)
```

	(Intercept)	fparty2	fparty3	sqft
1	1	1	0	1160
2	1	0	0	1080
3	1	1	0	1720
4	1	0	0	1840
5	1	0	1	2240
6	1	1	0	2190
7	1	0	0	830
8	1	0	0	1150
9	1	1	0	1570
10	1	1	0	2660
11	1	0	0	900
12	1	0	1	1680
13	1	0	0	2550
14	1	1	0	1770
15	1	1	0	2960
16	1	1	0	1190
17	1	0	1	3130
18	1	1	0	1560
19	1	0	0	1510
20	1	0	0	2190

```
> summary(reg)
```

```
Call:
```

```
lm(formula = income ~ fparty + sqft)
```

```
Residuals:
```

```
    Min       1Q   Median       3Q      Max
-598.44 -149.08   18.45  209.28  424.54
```

```
Coefficients:
```

```
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 1283.1691   196.8490   6.519 7.08e-06 ***
fparty2     -199.3349   147.9635  -1.347   0.197
fparty3     -184.0893   219.5683  -0.838   0.414
sqft         1.5224     0.1111  13.704 2.94e-10 ***
```

```
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```

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

```
Residual standard error: 293.3 on 16 degrees of freedom
```

```
Multiple R-squared:  0.9318,    Adjusted R-squared:  0.919
```

```
F-statistic: 72.88 on 3 and 16 DF,  p-value: 1.512e-09
```