

Models with quantitative and qualitative variables

R code

```
#Models with quantitative and qualitative variables
soap=read.table("C:/Users/Mihinda/Desktop/soap.txt", header=1)
#the data file
soap
fit <- lm(scrap ~ speed + line + speed:line, data=soap)
summary(fit)
anova(fit)
fit1 <- lm(scrap ~ speed, data=soap)
summary(fit1)
anova(fit1)
```

R output

```
> soap=read.table("C:/Users/Mihinda/Desktop/soap.txt", header=1)
#the data file
> soap
```

	Row	scrap	speed	line
1	1	218	100	1
2	2	248	125	1
3	3	360	220	1
4	4	351	205	1
5	5	470	300	1
6	6	394	255	1
7	7	332	225	1
8	8	321	175	1
9	9	410	270	1
10	10	260	170	1
11	11	241	155	1
12	12	331	190	1
13	13	275	140	1
14	14	425	290	1
15	15	367	265	1
16	16	140	105	0
17	17	277	215	0
18	18	384	270	0
19	19	341	255	0
20	20	215	175	0
21	21	180	135	0
22	22	260	200	0
23	23	361	275	0
24	24	252	155	0
25	25	422	320	0
26	26	273	190	0
27	27	410	295	0

```

> fit <- lm(scrap ~ speed + line + speed:line, data=soap)
> summary(fit)

Call:
lm(formula = scrap ~ speed + line + speed:line, data = soap)

Residuals:
    Min       1Q   Median       3Q      Max
-34.50 -11.06   2.78   14.82   39.51

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)   7.57446    20.86970   0.363  0.71996
speed         1.32205     0.09262  14.273 6.45e-13 ***
line        90.39086    28.34573   3.189  0.00409 **
speed:line   -0.17666     0.12884  -1.371  0.18355
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 20.75 on 23 degrees of freedom
Multiple R-squared:  0.9447,    Adjusted R-squared:  0.9375
F-statistic: 130.9 on 3 and 23 DF,  p-value: 1.341e-14

> anova(fit)
Analysis of Variance Table

Response: scrap
      Df Sum Sq Mean Sq  F value    Pr(>F)
speed   1 149661  149661  347.5548 2.224e-15 ***
line    1  18694   18694   43.4129 1.009e-06 ***
speed:line 1    810     810    1.8802  0.1835
Residuals 23  9904     431
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

> fit1 <- lm(scrap ~ speed, data=soap)
> summary(fit1)

Call:
lm(formula = scrap ~ speed, data = soap)

Residuals:
    Min       1Q   Median       3Q      Max
-58.389 -26.474  -3.038   33.555   47.611

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)   64.0357     23.2488   2.754   0.0108 *
speed          1.1963      0.1061  11.280 2.68e-11 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 34.3 on 25 degrees of freedom
Multiple R-squared:  0.8358,    Adjusted R-squared:  0.8292
F-statistic: 127.2 on 1 and 25 DF,  p-value: 2.676e-11

> anova(fit1)
Analysis of Variance Table

Response: scrap
      Df Sum Sq Mean Sq F value    Pr(>F)
speed   1 149661  149661  127.23 2.676e-11 ***
Residuals 25  29408    1176
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
>

```

1) Test whether the two regressions functions for the two lines are identical.

2) If they are not identical, do they have the same slope?