StainProject

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```
run <- c(1,2,3,4,5,6,7,8,9,10,11,12)
Volume <- c(1,1,1,1,1,1,2,2,2,2,2,2)
BeforeSoak <- c(1,1,1,2,2,2,1,1,1,2,2,2)
OfSoak <- c(1,2,2,1,1,2,1,1,2,1,2,2)
Temperature <- c(1,2,2,1,2,1,1,2,1,2,1,2)
Detergent <- c(1,2,3,3,1,2,2,3,1,2,3,1)
Stain <- c(77.26189,73.60767,49.71833,61.47078,54.72022,78.31111,82.84678,56.76589,78.46422,45.68689,66
Variance_of_Stain <- c(52.34416958,117.2014775,113.6255434,82.79119963,1.49814625,
41.89106768,1.019014034,175.134884,66.03396014,35.62202186,79.32234409,19.4380829)
logVariance <- log(Variance_of_Stain)
data <- data.frame(run,Volume,BeforeSoak,OfSoak,Temperature,Detergent,Stain)
ka <- data -1
#data$run <- ka$run + 1
data
```

```
##    run Volume BeforeSoak OfSoak Temperature Detergent    Stain
## 1    1      1          1      1           1         1 77.26189
## 2    2      1          1      2           2         2 73.60767
## 3    3      1          1      2           2         3 49.71833
## 4    4      1          2      1           1         3 61.47078
## 5    5      1          2      1           2         1 54.72022
## 6    6      1          2      2           1         2 78.31111
## 7    7      2          1      1           1         2 82.84678
## 8    8      2          1      1           2         3 56.76589
## 9    9      2          1      2           1         1 78.46422
## 10  10      2          2      1           2         2 45.68689
## 11  11      2          2      2           1         3 66.21567
## 12  12      2          2      2           2         1 68.61644
```

```
cor(data, method = "kendall") #I think we use kendall estimation as it's based on rank
```

```
##                    run     Volume BeforeSoak    OfSoak Temperature  Detergent
## run         1.0000000 0.73854895  0.3692745 0.1641220   0.0410305  0.0000000
## Volume      0.7385489 1.00000000  0.0000000 0.0000000   0.0000000  0.0000000
## BeforeSoak  0.3692745 0.00000000  1.0000000 0.0000000   0.0000000  0.0000000
## OfSoak      0.1641220 0.00000000  0.0000000 1.0000000   0.0000000  0.0000000
## Temperature 0.0410305 0.00000000  0.0000000 0.0000000   1.0000000  0.0000000
## Detergent   0.0000000 0.00000000  0.0000000 0.0000000   0.0000000  1.0000000
## Stain       0.0000000 0.08206099 -0.2872135 0.2051525  -0.5744270 -0.2842676
##                     Stain
## run          0.00000000
## Volume       0.08206099
## BeforeSoak  -0.28721348
```

```
## OfSoak       0.20515248
## Temperature -0.57442696
## Detergent   -0.28426762
## Stain        1.00000000
```

```
#cor(data)
```

```
model2 <- lm(Stain ~ . - run, data = data)
summary(model2)
```

```
##
## Call:
## lm.default(formula = Stain ~ . - run, data = data)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -9.216 -3.616 -1.003  5.135  9.062
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 102.2165    15.7007   6.510 0.000626 ***
## Volume        0.5843     4.7887   0.122 0.906867
## BeforeSoak   -7.2739     4.7887  -1.519 0.179570
## OfSoak        6.0302     4.7887   1.259 0.254710
## Temperature -15.9092     4.7887  -3.322 0.015960 *
## Detergent    -5.6115     2.9325  -1.914 0.104188
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.294 on 6 degrees of freedom
## Multiple R-squared:  0.7562, Adjusted R-squared:  0.553
## F-statistic: 3.721 on 5 and 6 DF,  p-value: 0.07036
```

```
stepAIC(model2)
```

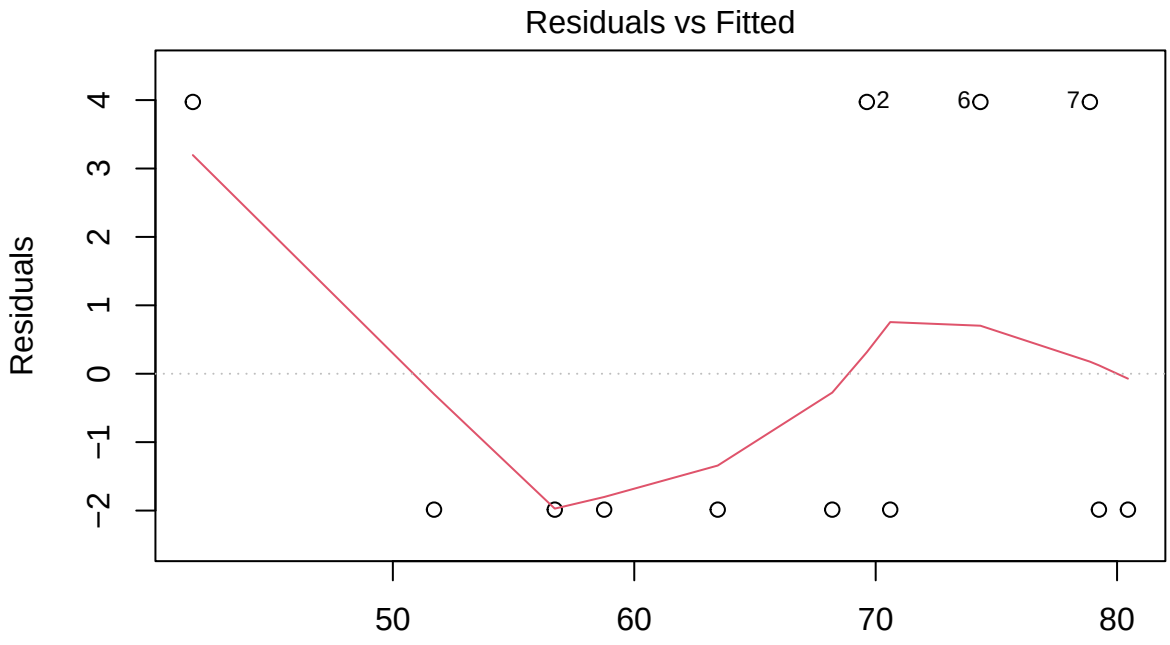
```
## Start:  AIC=54.46
## Stain ~ (run + Volume + BeforeSoak + OfSoak + Temperature + Detergent) -
##     run
##
##               Df Sum of Sq     RSS    AIC
## - Volume       1      1.02  413.79 52.485
## <none>                      412.77 54.456
## - OfSoak       1    109.09  521.86 55.270
## - BeforeSoak   1    158.73  571.50 56.360
## - Detergent    1    251.91  664.68 58.173
## - Temperature  1    759.30 1172.07 64.979
##
## Step:  AIC=52.49
## Stain ~ BeforeSoak + OfSoak + Temperature + Detergent
##
##               Df Sum of Sq     RSS    AIC
## <none>                      413.79 52.485
## - OfSoak       1    109.09  522.88 53.293
## - BeforeSoak   1    158.73  572.52 54.382
## - Detergent    1    251.91  665.70 56.191
## - Temperature  1    759.30 1173.10 62.990
```

```
##
## Call:
## lm.default(formula = Stain ~ BeforeSoak + OfSoak + Temperature +
##     Detergent, data = data)
##
## Coefficients:
## (Intercept)   BeforeSoak       OfSoak  Temperature    Detergent
##     103.093       -7.274        6.030      -15.909       -5.612
```

```
model <- lm(data$Stain ~ (. - run - Volume)^2, data = data)
summary(model)
```

```
##
## Call:
## lm.default(formula = data$Stain ~ (. - run - Volume)^2, data = data)
##
## Residuals:
##      1      2      3      4      5      6      7      8      9     10     11
## -1.986  3.973 -1.986 -1.986 -1.986  3.973  3.973 -1.986 -1.986  3.973 -1.986
##     12
## -1.986
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)               60.7126    80.7332   0.752    0.590
## BeforeSoak                -6.0625    56.3216  -0.108    0.932
## OfSoak                    -7.1413    32.9991  -0.216    0.864
## Temperature               36.4067    56.3216   0.646    0.635
## Detergent                 18.5945    31.7188   0.586    0.662
## BeforeSoak:OfSoak         12.2432    13.7616   0.890    0.537
## BeforeSoak:Temperature   -16.9872    23.8357  -0.713    0.606
## BeforeSoak:Detergent      -1.4122    13.7616  -0.103    0.935
## OfSoak:Temperature         0.4507    13.7616   0.033    0.979
## OfSoak:Detergent          -4.3503     6.8808  -0.632    0.641
## Temperature:Detergent    -13.2061    13.7616  -0.960    0.513
##
## Residual standard error: 9.731 on 1 degrees of freedom
## Multiple R-squared:  0.9441, Adjusted R-squared:  0.3847
## F-statistic: 1.688 on 10 and 1 DF,  p-value: 0.5408
```

```
plot(model, which = 1)
```

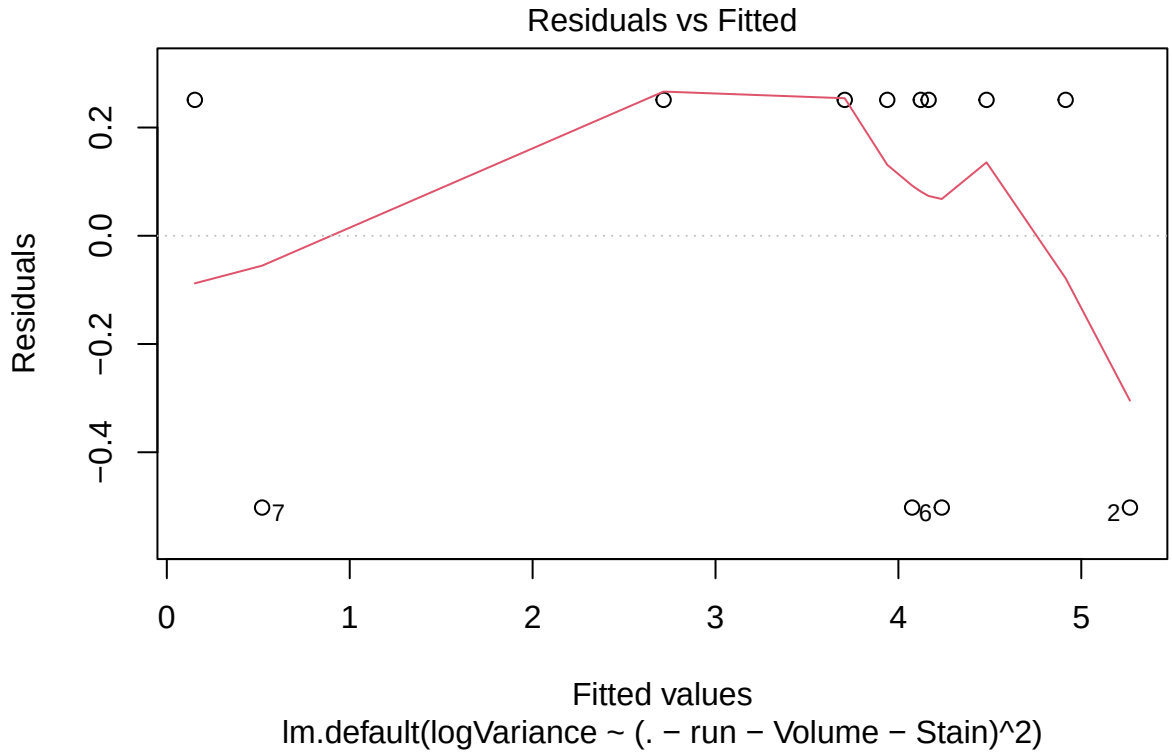



```
dispersion <- lm(logVariance ~ (. - run - Volume - Stain)^2, data = data)
summary(dispersion)
```

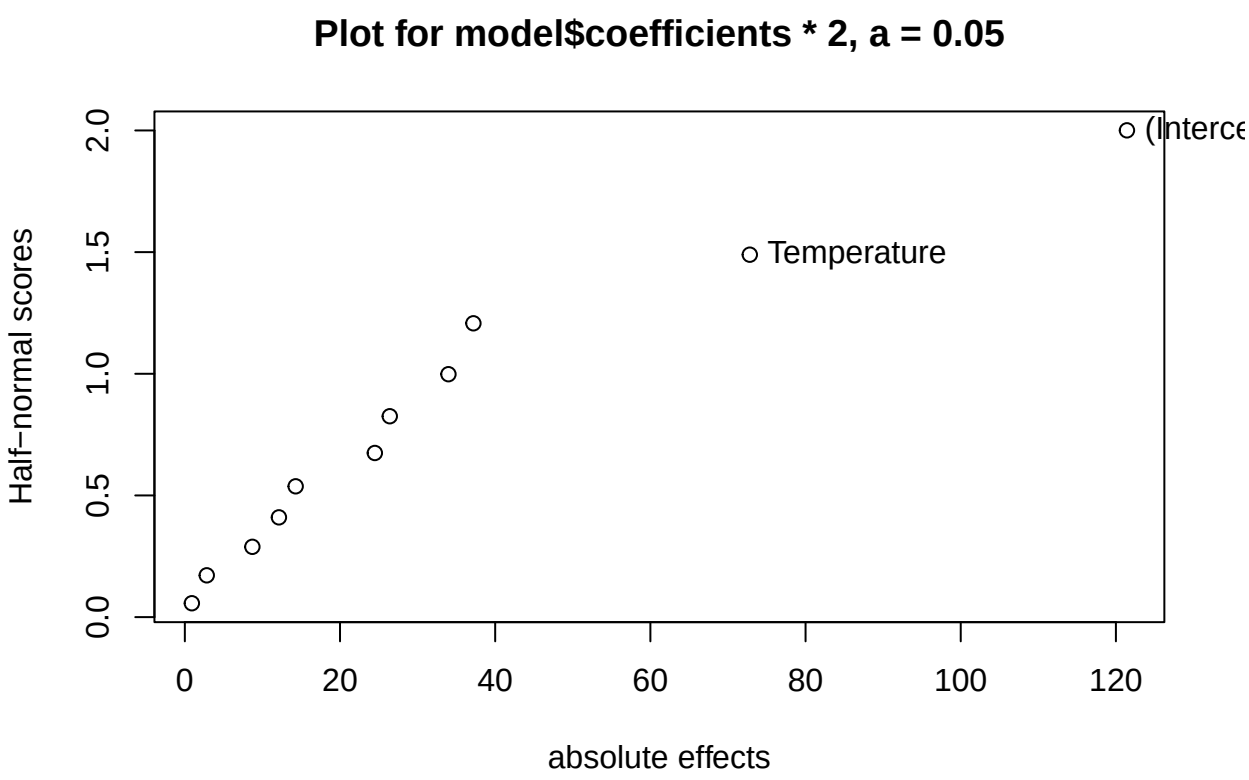
```
##
## Call:
## lm.default(formula = logVariance ~ (. - run - Volume - Stain)^2,
##     data = data)
##
## Residuals:
##       1       2       3       4       5       6       7       8       9      10
##  0.2511 -0.5022  0.2511  0.2511  0.2511 -0.5022 -0.5022  0.2511  0.2511 -0.5022
##      11      12
##  0.2511  0.2511
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)              11.3400    10.2056   1.111    0.467
## BeforeSoak               -2.4489     7.1197  -0.344    0.789
## OfSoak                   -1.2807     4.1715  -0.307    0.810
## Temperature               0.6985     7.1197   0.098    0.938
## Detergent                -9.4758     4.0096  -2.363    0.255
## BeforeSoak:OfSoak         1.3603     1.7396   0.782    0.578
## BeforeSoak:Temperature   -3.7472     3.0131  -1.244    0.431
## BeforeSoak:Detergent      3.8886     1.7396   2.235    0.268
## OfSoak:Temperature        0.9704     1.7396   0.558    0.676
## OfSoak:Detergent         -0.8177     0.8698  -0.940    0.520
```

```
## Temperature:Detergent    3.2192     1.7396   1.850    0.315
##
## Residual standard error: 1.23 on 1 degrees of freedom
## Multiple R-squared:  0.9499, Adjusted R-squared:  0.4492
## F-statistic: 1.897 on 10 and 1 DF,  p-value: 0.5155
```

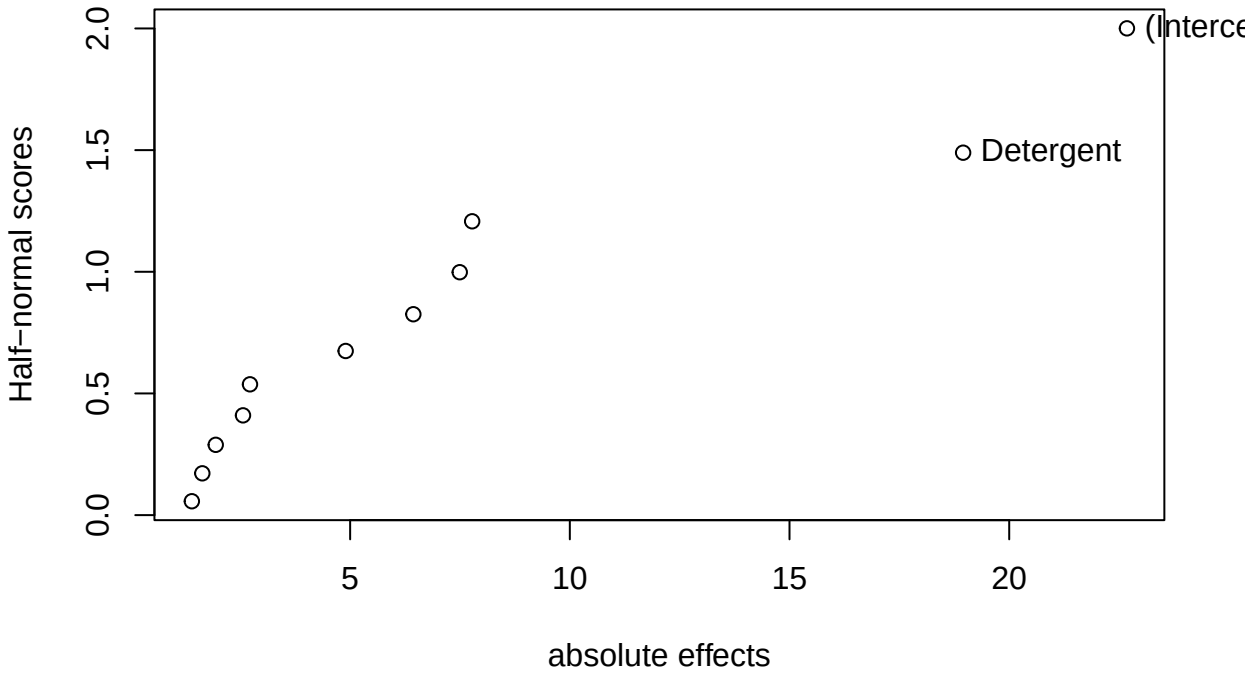
```
plot(dispersion, which = 1)
```




```
halfnormal(model$coefficients * 2)
```




```
halfnormal(dispersion$coefficients * 2)
```


Plot for dispersion$coefficients * 2, a = 0.05
Half−normal scores
0.0
0.5
1.0
1.5
2.0
5
10
15
20
absolute effects
(Interce
Detergent