Assignment 3 Exercise 3

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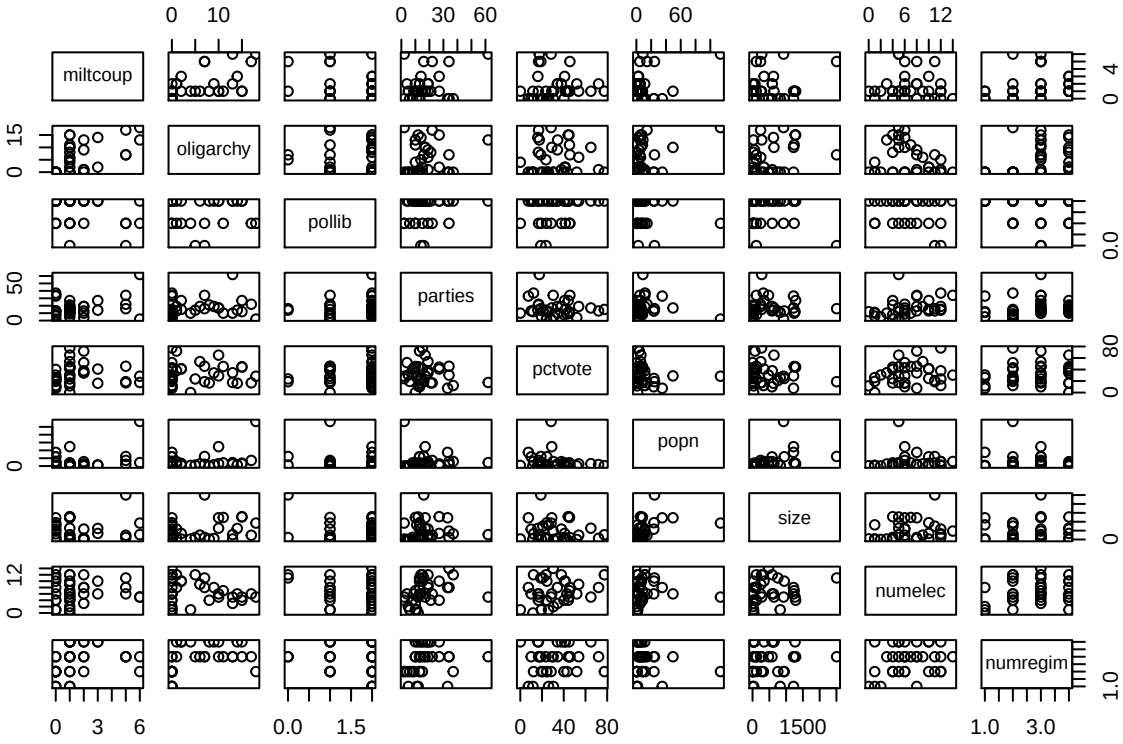
3/15/2020

Exercise 3

a) First we check if there are any linear correlated factors in the model:

```
africa = read.table("africa.txt", header = TRUE)
plot(africa)
```



We conclude that there are no linear correlations.

With the generalised linear regression model function we run the poisson regression with the following result:

```
africa$pollib = factor(africa$pollib)
africaglm=glm(miltcoup~oligarchy+pollib+parties+pctvote+popn+size+numelec+numregim, family=poisson,data=
summary(africaglm)
```

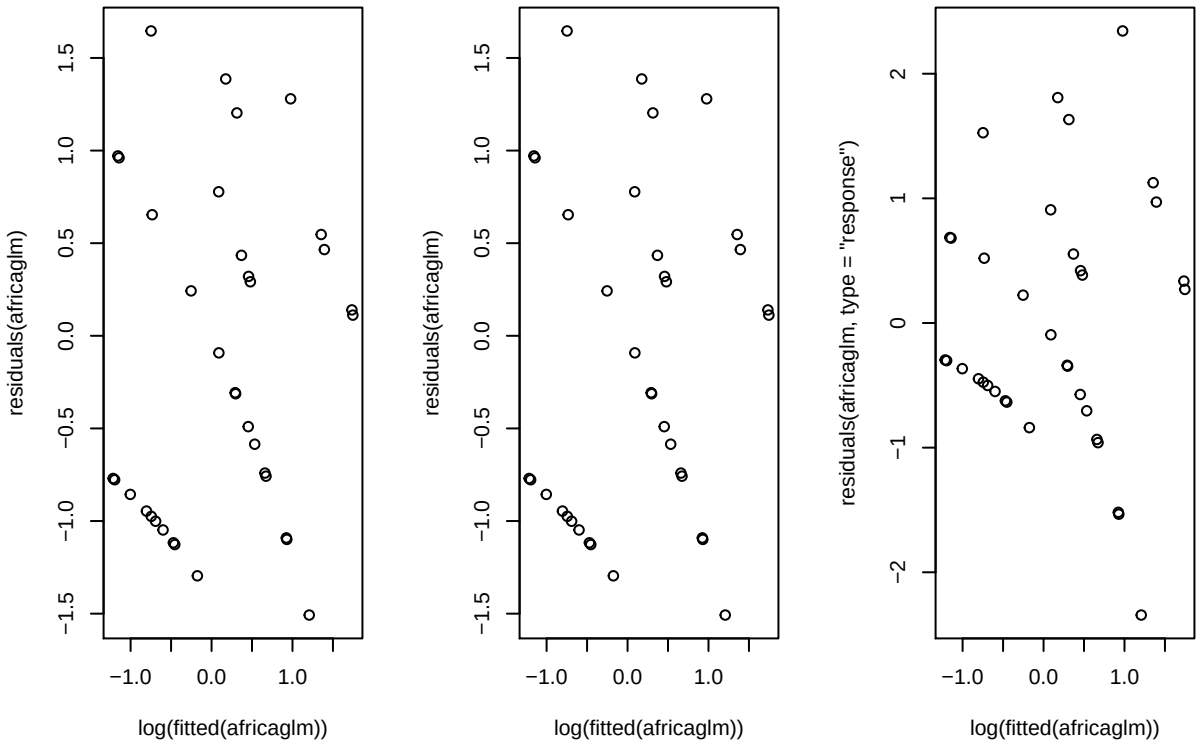
```
##
## Call:
## glm(formula = miltcoup ~ oligarchy + pollib + parties + pctvote +
##     popn + size + numelec + numregim, family = poisson, data = africa)
##
## Deviance Residuals:
```

```
##     Min       1Q   Median       3Q      Max
## -1.5075  -0.9533  -0.3100   0.4859   1.6459
##
## Coefficients:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.2334274  0.9976112  -0.234  0.81500
## oligarchy    0.0725658  0.0353457   2.053  0.04007 *
## pollib1     -1.1032439  0.6558114  -1.682  0.09252 .
## pollib2     -1.6903057  0.6766503  -2.498  0.01249 *
## parties      0.0312212  0.0111663   2.796  0.00517 **
## pctvote      0.0154413  0.0101027   1.528  0.12641
## popn         0.0109586  0.0071490   1.533  0.12531
## size        -0.0002651  0.0002690  -0.985  0.32444
## numelec     -0.0296185  0.0696248  -0.425  0.67054
## numregim     0.2109432  0.2339330   0.902  0.36720
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 65.945  on 35  degrees of freedom
## Residual deviance: 28.249  on 26  degrees of freedom
## AIC: 113.06
##
## Number of Fisher Scoring iterations: 5
```

We conclude that oligarchy, pollib and parties signifcantly estimate (or have a linear relation with) the amount of successful military coups. As we take pollib as a factor we find that categorie 2 (full civil rights) has significant less militairy coups (estimated 1.6903057 coups less) than pollib categorie 0.

Furthermore we performed the plotted residuals against the fitted values and we can't recognized any specific pattern. Data is scatterted. Then we applied logarithm to make x-values fitted by a linear function. The plot seems ok and also not specific structure. Finally we set residuals' type as response and from the plot we see that the response residuals decreased with the (logarithm) of the fitted values, as not expected under a poisson model.

```
par(mfrow=c(1,3))
plot(log(fitted(africaglm)),residuals(africaglm))
plot(log(fitted(africaglm)),residuals(africaglm))
plot(log(fitted(africaglm)),residuals(africaglm, type="response"))
```



b) In the step down method we have removed the following factors in the order: numelec > numregim > size > popn > pctvote. Our model now is miltcoup = 0.251377 + 0.092622*oligarchy* - *0.574103*pollib + 0.022059*parties + error. With this process we went from a R squared value of 0.5652689 to 0.5017707, but reduced the formula from eight factors to three. The fitted values against the residuals look the same as before. And we show some plots for our model. All of them follow the similar pattern as full model.

```
summary(glm(miltcoup~oligarchy+pollib+parties+pctvote+popn+size+numelec+numregim, family=poisson,data=a
```

```
##
## Call:
## glm(formula = miltcoup ~ oligarchy + pollib + parties + pctvote +
##     popn + size + numelec + numregim, family = poisson, data = africa)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.5075  -0.9533  -0.3100   0.4859   1.6459
##
## Coefficients:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.2334274  0.9976112  -0.234  0.81500
## oligarchy    0.0725658  0.0353457   2.053  0.04007 *
## pollib1     -1.1032439  0.6558114  -1.682  0.09252 .
## pollib2     -1.6903057  0.6766503  -2.498  0.01249 *
## parties      0.0312212  0.0111663   2.796  0.00517 **
## pctvote      0.0154413  0.0101027   1.528  0.12641
## popn         0.0109586  0.0071490   1.533  0.12531
## size        -0.0002651  0.0002690  -0.985  0.32444
## numelec     -0.0296185  0.0696248  -0.425  0.67054
## numregim     0.2109432  0.2339330   0.902  0.36720
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 65.945  on 35  degrees of freedom
## Residual deviance: 28.249  on 26  degrees of freedom
## AIC: 113.06
##
## Number of Fisher Scoring iterations: 5
```

```
summary(glm(miltcoup~oligarchy+pollib+parties+pctvote+popn+size+numregim, family=poisson,data=africa))
```

```
##
## Call:
## glm(formula = miltcoup ~ oligarchy + pollib + parties + pctvote +
##     popn + size + numregim, family = poisson, data = africa)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.5346  -0.9405  -0.3131   0.4241   1.6642
##
## Coefficients:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.4577458  0.8602345  -0.532  0.59464
## oligarchy    0.0812015  0.0288154   2.818  0.00483 **
## pollib1     -0.9642976  0.5620939  -1.716  0.08625 .
## pollib2     -1.5149509  0.5269441  -2.875  0.00404 **
## parties      0.0293409  0.0103101   2.846  0.00443 **
## pctvote      0.0139115  0.0094654   1.470  0.14164
## popn         0.0099592  0.0067249   1.481  0.13862
## size        -0.0002688  0.0002687  -1.000  0.31710
## numregim     0.1804415  0.2241166   0.805  0.42075
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 65.945  on 35  degrees of freedom
## Residual deviance: 28.430  on 27  degrees of freedom
## AIC: 111.24
##
## Number of Fisher Scoring iterations: 5
```

```
summary(glm(miltcoup~oligarchy+pollib+parties+pctvote+popn+size, family=poisson,data=africa))
```

```
##
## Call:
## glm(formula = miltcoup ~ oligarchy + pollib + parties + pctvote +
##     popn + size, family = poisson, data = africa)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.5513  -0.8958  -0.2225   0.5258   1.6058
##
## Coefficients:
##               Estimate Std. Error z value Pr(>|z|)
```

```
## (Intercept)  0.0419757  0.5774100   0.073 0.942048
## oligarchy    0.0894951  0.0270440   3.309 0.000936 ***
## pollib1     -0.9673253  0.5605601  -1.726 0.084412 .
## pollib2     -1.5321126  0.5232779  -2.928 0.003412 **
## parties      0.0288170  0.0102173   2.820 0.004796 **
## pctvote      0.0149216  0.0093762   1.591 0.111513
## popn         0.0071647  0.0056842   1.260 0.207510
## size        -0.0002579  0.0002662  -0.969 0.332621
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 65.945  on 35  degrees of freedom
## Residual deviance: 29.081  on 28  degrees of freedom
## AIC: 109.89
##
## Number of Fisher Scoring iterations: 5
```

```
summary(glm(miltcoup~oligarchy+pollib+parties+pctvote+popn, family=poisson,data=africa))
```

```
##
## Call:
## glm(formula = miltcoup ~ oligarchy + pollib + parties + pctvote +
##     popn, family = poisson, data = africa)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.4197  -0.9952  -0.1443   0.5699   1.6107
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.231435   0.528887  -0.438  0.66168
## oligarchy    0.083468   0.025829   3.232  0.00123 **
## pollib1     -0.683589   0.495822  -1.379  0.16799
## pollib2     -1.320568   0.490268  -2.694  0.00707 **
## parties      0.029770   0.010310   2.887  0.00388 **
## pctvote      0.013925   0.009371   1.486  0.13728
## popn         0.005659   0.005483   1.032  0.30204
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 65.945  on 35  degrees of freedom
## Residual deviance: 30.040  on 29  degrees of freedom
## AIC: 108.85
##
## Number of Fisher Scoring iterations: 5
```

```
summary(glm(miltcoup~oligarchy+pollib+parties+pctvote, family=poisson,data=africa))
```

```
##
## Call:
## glm(formula = miltcoup ~ oligarchy + pollib + parties + pctvote,
```

```
##     family = poisson, data = africa)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.5300  -0.9794  -0.1833   0.5662   1.6721
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.116499   0.513751  -0.227  0.82061
## oligarchy    0.094712   0.023184   4.085  4.4e-05 ***
## pollib1     -0.620756   0.487526  -1.273  0.20292
## pollib2     -1.310374   0.489017  -2.680  0.00737 **
## parties      0.025745   0.009552   2.695  0.00704 **
## pctvote      0.012057   0.009072   1.329  0.18383
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 65.945  on 35  degrees of freedom
## Residual deviance: 31.069  on 30  degrees of freedom
## AIC: 107.88
##
## Number of Fisher Scoring iterations: 5
```

```r
summary(glm(miltcoup~oligarchy+pollib+parties, family=poisson,data=africa))
```

```
##
## Call:
## glm(formula = miltcoup ~ oligarchy + pollib + parties, family = poisson,
##     data = africa)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.3609  -1.0407  -0.3153   0.6145   1.7536
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)  0.207981   0.445679   0.467   0.6407
## oligarchy    0.091466   0.022563   4.054 5.04e-05 ***
## pollib1     -0.495414   0.475645  -1.042   0.2976
## pollib2     -1.112086   0.459492  -2.420   0.0155 *
## parties      0.022358   0.009098   2.458   0.0140 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 65.945  on 35  degrees of freedom
## Residual deviance: 32.822  on 31  degrees of freedom
## AIC: 107.63
##
## Number of Fisher Scoring iterations: 5
```

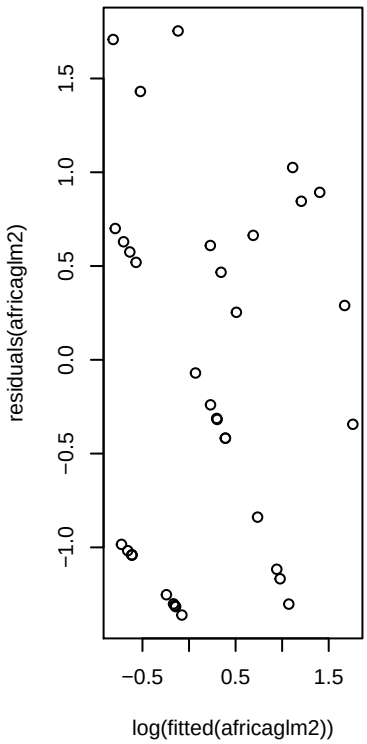
```r
africaglm2=glm(miltcoup~oligarchy+pollib+parties, family=poisson,data=africa)
with(summary(africaglm2), 1 - deviance/null.deviance)
```

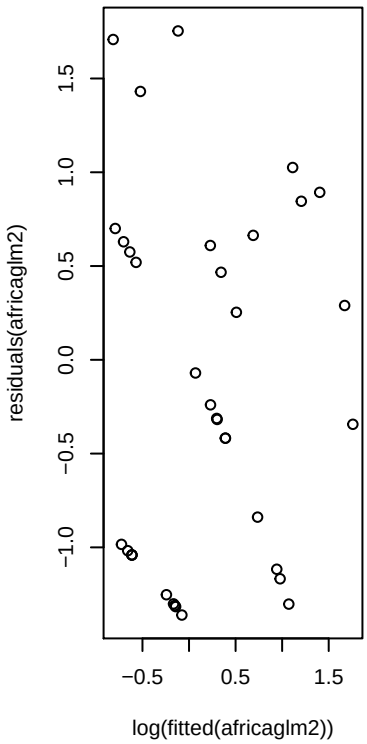
```
## [1] 0.502289
```

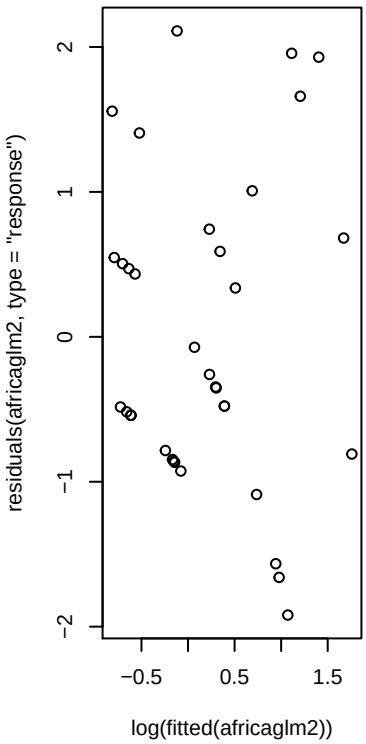
```r
summary(africaglm2)
```

```
##
## Call:
## glm(formula = miltcoup ~ oligarchy + pollib + parties, family = poisson,
##     data = africa)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.3609  -1.0407  -0.3153   0.6145   1.7536
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)  0.207981   0.445679   0.467   0.6407
## oligarchy    0.091466   0.022563   4.054 5.04e-05 ***
## pollib1     -0.495414   0.475645  -1.042   0.2976
## pollib2     -1.112086   0.459492  -2.420   0.0155 *
## parties      0.022358   0.009098   2.458   0.0140 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 65.945  on 35  degrees of freedom
## Residual deviance: 32.822  on 31  degrees of freedom
## AIC: 107.63
##
## Number of Fisher Scoring iterations: 5
```

```r
par(mfrow=c(1,3))
plot(log(fitted(africaglm2)),residuals(africaglm2))
plot(log(fitted(africaglm2)),residuals(africaglm2))
plot(log(fitted(africaglm2)),residuals(africaglm2, type="response"))
```


residuals(africaglm2)
−1.0
−0.5
0.0
0.5
1.0
1.5
−0.5
0.5
1.5
log(fitted(africaglm2))


residuals(africaglm2)
−1.0
−0.5
0.0
0.5
1.0
1.5
−0.5
0.5
1.5
log(fitted(africaglm2))


residuals(africaglm2, type = "response")
−2
−1
0
1
2
−0.5
0.5
1.5
log(fitted(africaglm2))