MATH 523: EXAMPLES - POISSON DATA SETS

RESULTS

EXAMPLE: Scottish Lip Cancer data

```
> anova(glm0.off,glm1.off,glm2.off,glm3.off)
Analysis of Deviance Table

Model 1: Y ~ 1 + offset(log(E))
Model 2: Y ~ AFF + offset(log(E))
Model 3: Y ~ AFF + LAT + offset(log(E))
Model 4: Y ~ AFF + LAT + LONG + offset(log(E))
  Resid. Df Resid. Dev Df Deviance
1        55     380.73
2        54     238.62  1  142.106
3        53     159.71  1   78.908
4        52     159.44  1    0.276
>
> summary(glm2.off)

Call:
glm(formula = Y ~ AFF + LAT + offset(log(E)), family = poisson,
    data = ScottishLip)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-3.3979  -1.0943   0.2294   1.3201   3.0078

Coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -24.586752   2.537728  -9.688  < 2e-16 ***
AFF           0.054241   0.006707   8.087  6.1e-16 ***
LAT           0.429060   0.045241   9.484  < 2e-16 ***
---
Signif. codes:  0  ***  0.001  **  0.01  *  0.05  .  0.1     1

(Dispersion parameter for poisson family taken to be 1)

    Null deviance: 380.73  on 55  degrees of freedom
Residual deviance: 159.71  on 53  degrees of freedom
AIC: 373.69

Number of Fisher Scoring iterations: 5

>
> anova(glm0.off,glm1.off,glm2.off,glm4.off)
Analysis of Deviance Table

Model 1: Y ~ 1 + offset(log(E))
Model 2: Y ~ AFF + offset(log(E))
Model 3: Y ~ AFF + LAT + offset(log(E))
Model 4: Y ~ AFF + LAT + AFF:LAT + offset(log(E))

  Resid. Df Resid. Dev Df Deviance
1        55     380.73
2        54     238.62  1  142.106
3        53     159.71  1   78.908
4        52     152.86  1    6.848
```

```
> summary(glm4.off)

Call:
glm(formula = Y ~ AFF + LAT + AFF:LAT + offset(log(E)), family = poisson,
    data = ScottishLip)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-3.6309  -1.1398   0.1526   1.3215   3.2172

Coefficients:
              Estimate Std. Error z value Pr(>|z|)
(Intercept) -34.594815   4.433805  -7.803 6.07e-15 ***
AFF           0.907269   0.333043   2.724  0.00645 **
LAT           0.606971   0.078845   7.698 1.38e-14 ***
AFF:LAT      -0.015117   0.005906  -2.560  0.01048 *
---
Signif. codes:  0  ***  0.001  **  0.01  *  0.05  .  0.1     1

(Dispersion parameter for poisson family taken to be 1)

    Null deviance: 380.73  on 55  degrees of freedom
Residual deviance: 152.86  on 52  degrees of freedom
AIC: 368.84

Number of Fisher Scoring iterations: 5


> glm5.off<-glm(Y~AFF+LAT+AFF:LAT+offset(log(E)),family=quasipoisson,data=ScottishLip)
> summary(glm5.off)

Call:
glm(formula = Y ~ AFF + LAT + AFF:LAT + offset(log(E)), family = quasipoisson,
    data = ScottishLip)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-3.6309  -1.1398   0.1526   1.3215   3.2172

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -34.59482    7.62767  -4.535 3.42e-05 ***
AFF           0.90727    0.57295   1.584    0.119
LAT           0.60697    0.13564   4.475 4.19e-05 ***
AFF:LAT      -0.01512    0.01016  -1.488    0.143
---
Signif. codes:  0  ***  0.001  **  0.01  *  0.05  .  0.1     1

(Dispersion parameter for quasipoisson family taken to be 2.959582)

    Null deviance: 380.73  on 55  degrees of freedom
Residual deviance: 152.86  on 52  degrees of freedom
AIC: NA

Number of Fisher Scoring iterations: 5
```

EXAMPLE: Political Affiliations of College Students:

```
> anova(glm3.aff,glm4.aff)
Analysis of Deviance Table

Model 1: Y ~ A + C
Model 2: Y ~ A * C
  Resid. Df Resid. Dev Df Deviance
1         6      16.39
2         0       0.00  6    16.39

> qchisq(0.95,6)
[1] 12.59159

> anova(glm2.aff,glm3.aff)
Analysis of Deviance Table

Model 1: Y ~ A
Model 2: Y ~ A + C
  Resid. Df Resid. Dev Df Deviance
1         9     36.175
2         6     16.390  3   19.785
> anova(glm1.aff,glm3.aff)
Analysis of Deviance Table

Model 1: Y ~ C
Model 2: Y ~ A + C
  Resid. Df Resid. Dev Df Deviance
1         8     49.822
2         6     16.390  2   33.432

> summary(glm4.aff)

Call:
glm(formula = Y ~ A * C, family = poisson, data = Affil)


            Estimate Std. Error z value Pr(>|z|)
(Intercept)  3.52636    0.17150  20.562  < 2e-16 ***
A2           0.58451    0.21402   2.731  0.00631 **
A3          -0.75377    0.30317  -2.486  0.01291 *
C2          -0.09237    0.24833  -0.372  0.70991
C3          -0.58192    0.28643  -2.032  0.04219 *
C4          -0.39087    0.26998  -1.448  0.14769
A2:C2       -1.07406    0.36152  -2.971  0.00297 **
A3:C2        0.15300    0.42778   0.358  0.72060
A2:C3       -0.39346    0.37672  -1.044  0.29628
A3:C3        0.58192    0.45502   1.279  0.20094
A2:C4       -0.05645    0.33901  -0.167  0.86776
A3:C4        0.10318    0.46768   0.221  0.82538
---
Signif. codes:  0  ***  0.001  **  0.01  *  0.05  .  0.1     1
(Dispersion parameter for poisson family taken to be 1)

    Null deviance:  6.9607e+01  on 11  degrees of freedom
Residual deviance: -2.2204e-15  on  0  degrees of freedom
AIC: 83.906        Number of Fisher Scoring iterations: 3

> fitted(glm4.aff)
 1  2  3  4  5  6  7  8  9 10 11 12
34 61 16 31 19 17 19 23 16 23 39 12
```

EXAMPLE: Classroom behaviour data:

```
>
> anova(glm7.Behav)
Analysis of Deviance Table

Model: poisson, link: log

Response: Y

Terms added sequentially (first to last)


                         Df Deviance Resid. Df Resid. Dev
NULL                                        11    100.718
Deviant                   1   44.430        10     56.288
AtRisk                    1    2.329         9     53.959
Adversity                 2   37.540         7     16.419
Deviant:AtRisk            1    1.442         6     14.977
Deviant:Adversity         2    3.656         4     11.321
AtRisk:Adversity          2   10.378         2      0.943
Deviant:AtRisk:Adversity  2    0.943         0      0.000
>
> glm6.Behav<-update(glm7.Behav,~.-Deviant:AtRisk:Adversity)
> summary(glm6.Behav)

Call:
glm(formula = Y ~ Deviant + AtRisk + Adversity + Deviant:AtRisk +
    Deviant:Adversity + AtRisk:Adversity, family = poisson, data = Behaviour)

Deviance Residuals:
       1         2         3         4         5         6         7         8
       9        10        11
 0.02682  -0.04026  -0.18240   0.12394   0.28502  -0.33107  -0.10345   0.11113   0.45288
-0.24649  -0.51762
      12
 0.37972

Coefficients:
                     Estimate Std. Error z value Pr(>|z|)
(Intercept)            0.4766     0.6576   0.725   0.4686
DeviantND              1.0026     0.7046   1.423   0.1548
AtRiskY                0.3945     0.7150   0.552   0.5811
AdversityLow          -0.3749     0.9530  -0.393   0.6940
AdversityMed           0.3487     0.7357   0.474   0.6355
DeviantND:AtRiskY     -0.5899     0.6151  -0.959   0.3375
DeviantND:AdversityLow 1.6615     0.9666   1.719   0.0856 .
DeviantND:AdversityMed 0.9269     0.7169   1.293   0.1961
AtRiskY:AdversityLow  -0.6094     0.7388  -0.825   0.4094
AtRiskY:AdversityMed   0.9456     0.6576   1.438   0.1504
---
Signif. codes:  0  ***  0.001  **  0.01  *  0.05  .  0.1     1

(Dispersion parameter for poisson family taken to be 1)

    Null deviance: 100.71803  on 11  degrees of freedom
Residual deviance:   0.94285  on  2  degrees of freedom
AIC: 61.692

Number of Fisher Scoring iterations: 4

>
```

```
> glm5.Behav<-update(glm6.Behav,~.-AtRisk:Adversity)
> summary(glm5.Behav)

Call:
glm(formula = Y ~ Deviant + AtRisk + Adversity + Deviant:AtRisk +
    Deviant:Adversity, family = poisson, data = Behaviour)

Deviance Residuals:
       1         2         3         4         5         6         7         8
 1.62458  -1.73653  -1.59441   1.30447   0.69645  -0.70855   0.48757  -0.36585  -0.13245
       9        10        11
 0.08402  -0.16704
      12
 0.10395

Coefficients:
                      Estimate Std. Error z value Pr(>|z|)
(Intercept)             0.1625     0.6254   0.260   0.7950
DeviantND               1.1184     0.7290   1.534   0.1250
AtRiskY                 0.8755     0.5323   1.645   0.1000
AdversityLow           -0.6931     0.8660  -0.800   0.4235
AdversityMed            1.0116     0.5839   1.733   0.0832 .
DeviantND:AtRiskY      -0.6748     0.5778  -1.168   0.2428
DeviantND:AdversityLow  1.7492     0.9584   1.825   0.0680 .
DeviantND:AdversityMed  0.8008     0.6974   1.148   0.2508
---
Signif. codes:  0  ***  0.001  **  0.01  *  0.05  .  0.1     1

(Dispersion parameter for poisson family taken to be 1)

    Null deviance: 100.718  on 11  degrees of freedom
Residual deviance:  11.321  on  4  degrees of freedom
AIC: 68.07

Number of Fisher Scoring iterations: 4

>
> anova(glm5.Behav,glm6.Behav,glm7.Behav)
Analysis of Deviance Table

Model 1: Y ~ Deviant + AtRisk + Adversity + Deviant:AtRisk + Deviant:Adversity
Model 2: Y ~ Deviant + AtRisk + Adversity + Deviant:AtRisk + Deviant:Adversity +
    AtRisk:Adversity
Model 3: Y ~ Deviant * AtRisk * Adversity

  Resid. Df Resid. Dev Df Deviance
1         4    11.3206
2         2     0.9428  2  10.3777
3         0     0.0000  2   0.9428
```