02424 Week 6

Exercise 1

Prove that in an exponential dispersion family the mean value is given by:

$$E(Y) = \kappa'(\theta)$$

Hint: Start with the result from theorem 2.2.

Solution

$$E(\ell'_\theta(\theta,Y)) = 0 \qquad\qquad \Leftrightarrow$$

$$E\left(\frac{d}{d\theta}\left\{\log(c(Y,\lambda)) + \lambda(\theta Y - \kappa(\theta))\right\}\right) = 0 \qquad\qquad \Leftrightarrow$$

$$E\left(\lambda(Y - \kappa'(\theta))\right) = 0 \qquad\qquad \Leftrightarrow$$

$$E(Y) = \kappa'(\theta))$$

Exercise 2

Exercise 4.3 from the textbook.

Solution

```
> dat<-read.table('challenger.txt', head=TRUE)
> par(mfrow=c(1,2))
> plot(dat$temp, dat$damage, xlab='Temperature', ylab='No damaged (out of 6)')
> plot(dat$pres, dat$damage, xlab='Pressure', ylab='No damaged (out of 6)')

> dat$resp<-cbind(dat$damage,dat$n-dat$damage)
> fit0<-glm(formula = resp ~ temp+pres,
+           family = binomial(link = logit),
+           data = dat)
> drop1(fit0, test='Chisq')


Single term deletions

Model:
resp ~ temp + pres
       Df Deviance    AIC    LRT  Pr(Chi)
```

```
<none>         9.4309 26.769
temp    1  19.3816 34.720 9.9508 0.001608 **
pres    1   9.5270 24.865 0.0962 0.756451
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


> fit1<-glm(formula = resp ~ temp,
+          family = binomial(link = logit),
+          data = dat)
> drop1(fit1, test='Chisq')


Single term deletions

Model:
resp ~ temp
       Df Deviance    AIC    LRT   Pr(Chi)
<none>      9.527 24.865
temp    1  20.706 34.044 11.179 0.0008274 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


> pred<-predict(fit1, type='response', newdata=data.frame(temp=31:85))
> plot(31:85, pred, type='l', lwd=3, col='red', xlab='Temperature',
+      ylab='P(damage)')
> coef(fit1)

(Intercept)        temp
  8.8169241  -0.1794922


> exp(-10*coef(fit1)[2])

    temp
6.019003
```