Homework 7

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1

a

```
ship <- read.csv('ships.csv')
ship <- ship[ship$service != 0, ]
ship$type <- as.factor(ship$type)
ship$year <- as.factor(ship$year)
ship$period <- as.factor(ship$period)
logservice <- log(ship$service)
m1 <- glm(accidents ~ type + year + period, offset=logservice, family=poisson, data = ship)
summary(m1)
```

```
##
## Call:
## glm(formula = accidents ~ type + year + period, family = poisson,
##     data = ship, offset = logservice)
##
## Deviance Residuals:
##    Min      1Q  Median      3Q     Max
## -1.677  -0.829  -0.437   0.506   2.791
##
## Coefficients:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept)   -6.406      0.217  -29.46  < 2e-16 ***
## typeB         -0.543      0.178   -3.06   0.0022 **
## typeC         -0.687      0.329   -2.09   0.0367 *
## typeD         -0.076      0.291   -0.26   0.7938
## typeE          0.326      0.236    1.38   0.1675
## year65         0.697      0.150    4.66  3.2e-06 ***
## year70         0.818      0.170    4.82  1.4e-06 ***
## year75         0.453      0.233    1.94   0.0518 .
## period75       0.385      0.118    3.25   0.0012 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 146.328  on 33  degrees of freedom
## Residual deviance:  38.695  on 25  degrees of freedom
## AIC: 154.6
##
## Number of Fisher Scoring iterations: 5
```

```
pchisq(38.695, 25, lower.tail=F)
```

```
## [1] 0.03951
```

$0.040 < 0.05$. Null hypothesis is rejected.

b

```
ei <- residuals(m1,type="pearson")
sigma2 <- sum(ei^2)/14
sigma2
```

```
## [1] 3.02
```

```
summary(m1,dispersion=sigma2)
```

```
##
## Call:
## glm(formula = accidents ~ type + year + period, family = poisson,
##     data = ship, offset = logservice)
##
## Deviance Residuals:
##     Min      1Q   Median      3Q     Max
## -1.677  -0.829  -0.437   0.506   2.791
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)    -6.406      0.378  -16.95   <2e-16 ***
## typeB          -0.543      0.309   -1.76   0.0783 .
## typeC          -0.687      0.572   -1.20   0.2293
## typeD          -0.076      0.505   -0.15   0.8804
## typeE           0.326      0.410    0.79   0.4270
## year65          0.697      0.260    2.68   0.0073 **
## year70          0.818      0.295    2.77   0.0055 **
## year75          0.453      0.405    1.12   0.2631
## period75        0.385      0.205    1.87   0.0614 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 3.02)
##
##     Null deviance: 146.328  on 33  degrees of freedom
## Residual deviance:  38.695  on 25  degrees of freedom
## AIC: 154.6
##
## Number of Fisher Scoring iterations: 5
```

$\hat{\sigma}^2 = 3.02$

c

```r
predicted <- fitted.values(m1)/ship$service
a <- sum(predicted[ship$period == 60])
b <- sum(predicted[ship$period == 75])
a/b
```

```
## [1] 0.5497
```

```r
c(0.3844 - 1.96 * sqrt(0.20552), 0.3844 + 1.96 * sqrt(0.20552))
```

```
## [1] -0.5042  1.2730
```