414Quiz4

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1

The odds ratio that compares the odds of approval on the second survey to the odds of approval on the first survey is 0.57. The 95% CI is (0.441, 0.748). Compared to the results from conditional logisitic regression that odds ratio is 0.57, the two results are very similar.

```
subj <- gl(1600,2)
srvy <- rep(c(0,1),1600)
appdapp <- c(rep(c(1,1),794),rep(c(1,0),150),rep(c(0,1),86),rep(c(0,0),570))
m1 = glmer(appdapp ~ srvy + (1|subj),nAGQ=20, family=binomial)
summary(m1)
```

```
## Generalized linear mixed model fit by maximum likelihood (Adaptive
##   Gauss-Hermite Quadrature, nAGQ = 20) [glmerMod]
##  Family: binomial  ( logit )
## Formula: appdapp ~ srvy + (1 | subj)
##
##      AIC      BIC   logLik deviance df.resid
##   3508.9   3527.1  -1751.4   3502.9     3197
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.1892 -0.3073  0.1797  0.2372  1.1098
##
## Random effects:
##  Groups Name        Variance Std.Dev.
##  subj   (Intercept) 26.06    5.105
## Number of obs: 3200, groups:  subj, 1600
##
## Fixed effects:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept)   1.2293     0.1824   6.739 1.59e-11 ***
## srvy         -0.5550     0.1350  -4.109 3.97e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##      (Intr)
## srvy -0.433
```

```
exp(-0.5550)
```

```
## [1] 0.5740723

exp(-0.5550+c(-1, 1)*1.96*0.1350)

## [1] 0.4406079 0.7479643
```

2

a. The estimates and standard errors of parameters do not change except the intercept term. The residual deviance do not change as well. With wald test, since the p-vale=0.31, do not reject H0. We conclude there is no significant difference in accident rates between tracks with one trailer and two trailers.

```
m2 = glm(acc ~ truck + road + time + area + road*time + road*area,family=pois
son, offset=logtrav, data=dataf)
summary(m2)

##
## Call:
## glm(formula = acc ~ truck + road + time + area + road * time +
##     road * area, family = poisson, data = dataf, offset = logtrav)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.6388  -0.5644  -0.1062   0.4557   2.2073
##
## Coefficients:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.07549    0.06673  -1.131  0.25793
## truck2       0.09039    0.08861   1.020  0.30772
## road2        0.70600    0.08857   7.971 1.57e-15 ***
## road3        1.92451    0.09271  20.758  < 2e-16 ***
## time2        0.36547    0.11540   3.167  0.00154 **
## area2       -0.47201    0.10255  -4.603 4.17e-06 ***
## road2:time2  0.17539    0.16662   1.053  0.29252
## road3:time2  0.61055    0.19121   3.193  0.00141 **
## road2:area2  0.28262    0.14726   1.919  0.05496 .
## road3:area2 -0.63468    0.14424  -4.400 1.08e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 711.086  on 23  degrees of freedom
## Residual deviance:  18.982  on 14  degrees of freedom
## AIC: 156.06
##
## Number of Fisher Scoring iterations: 4

# Wald test
wald.test(b=coef(m2), Sigma=vcov(m2), Terms = 2)
```

```
## Wald test:
## ----------
##
## Chi-squared test:
## X2 = 1.0, df = 1, P(> X2) = 0.31

# model.matrix(m2)
```

b. The estimates and standard errors of the parameters are different from the previous model. However, the p-value of Wald test is the same as before, so we have the same conclusion that there is no significant difference in accident rates between tracks with one trailer and two trailers. The fitted accident rates are same as before.

```
options(contrasts=c("contr.sum","contr.poly"))
m3 = glm(acc ~ truck + road + time + area + road*time + road*area,family=pois
son, offset=logtrav, data=dataf)
summary(m3)

##
## Call:
## glm(formula = acc ~ truck + road + time + area + road * time +
##     road * area, family = poisson, data = dataf, offset = logtrav)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.6388  -0.5644  -0.1062   0.4557   2.2073
##
## Coefficients:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept)  0.86559    0.05177  16.719  < 2e-16 ***
## truck1      -0.04519    0.04431  -1.020  0.30772
## road1       -0.94915    0.05249 -18.082  < 2e-16 ***
## road2       -0.01414    0.05447  -0.260  0.79516
## time1       -0.31373    0.03767  -8.328  < 2e-16 ***
## area1        0.29468    0.02982   9.883  < 2e-16 ***
## road1:time1  0.13099    0.05026   2.606  0.00915 **
## road2:time1  0.04330    0.05121   0.845  0.39788
## road1:area1 -0.05868    0.04201  -1.397  0.16245
## road2:area1 -0.19999    0.04265  -4.689 2.75e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 711.086  on 23  degrees of freedom
## Residual deviance:  18.982  on 14  degrees of freedom
## AIC: 156.06
##
## Number of Fisher Scoring iterations: 4

wald.test(b=coef(m3), Sigma=vcov(m3), Terms = 2)
```

```
## Wald test:
## ----------
##
## Chi-squared test:
## X2 = 1.0, df = 1, P(> X2) = 0.31

# model.matrix(m3)
```

c.

The posterior estimates for beta1 – beta9 and sigma are shown below (i.e., the estim ates are shown in the "mean" column). The interval from the posterior distribution is (-0.13 78, 0.0681). The interval covers zero.

node	mean	sd	MC error	2.5%	median	97.5%	start	sample
sigma	0.08871	0.06445	0.003324	0.02165	0.06969	0.2608	10001	40000

node	mean	sd	MC error	2.5%	median	97.5%	start	sample
beta[1]	-0.03827	0.05181	0.001417	-0.1378	-0.03965	0.0681	10001	40000
beta[2]	-0.9598	0.06574	0.001924	-1.098	-0.9583	-0.8366	10001	40000
beta[3]	-0.02129	0.06598	0.001828	-0.1562	-0.0199	0.1056	10001	40000
beta[4]	-0.2996	0.04759	0.001458	-0.3864	-0.3014	-0.203	10001	40000
beta[5]	0.2938	0.04169	9.34E-4	0.2099	0.2941	0.3756	10001	40000
beta[6]	0.1314	0.06141	0.0015	0.01216	0.1307	0.2539	10001	40000
beta[7]	0.04581	0.06429	0.001803	-0.07428	0.0437	0.1795	10001	40000
beta[8]	-0.04778	0.05941	0.001851	-0.1553	-0.05161	0.07697	10001	40000
beta[9]	-0.195	0.06095	0.001629	-0.3083	-0.1972	-0.07143	10001	40000