Contingency Tables

Code 1.1 (Slide 5): Gender X Age Table:
```r
table(cda$gender, cda$agegrp)
```

Code 1.2 (Slide 7): Gender X Age Table with Pearson Chi-Square, Fisher Exact, and Expected Cell Counts:
```r
mytable = table(cda$gender, cda$agegrp)

Pearson Chi-Square
```r
chisq.test(mytable)
```r
Fisher’s Exact Chi-Square
```r
fisher.test(mytable)
```r
Expected Cell Counts
```r
chisq.test(mytable)$expected
```

Logistic Regression

Code 2.1 (Slide 14): Depression Model as Logit (Constant Only):
```r
mylogit1 <- glm(depressed ~ 1, data = cda, family = "binomial")
summary(mylogit1)
```

Code 2.2 (Slide 15): Depression Model as ORs (Constant Only):
```r
exp(cbind(OR = coef(mylogit1), confint(mylogit1)))
```

Code 2.3 (Slide 16): Depression Model as Logs (Age Predictor):
```r
mylogit2 <- glm(depressed ~ age, data = cda, family = "binomial")
summary(mylogit2)
```

Code 2.4 (Slide 18): GOF Tests after Logistic Model:
```r
hosmerlem = function(y, yhat, g=10) {
  cutyhat = cut(yhat, breaks = quantile(yhat, probs=seq(0, 1, 1/g)), include.lowest=TRUE)
  obs = xtabs(cbind(1 - y, y) ~ cutyhat)
  expect = xtabs(cbind(1 - yhat, yhat) ~ cutyhat)
  chisq = sum((obs - expect)^2/expect)
  P = 1 - pchisq(chisq, g - 2)
  return(list(chisq=chisq,p.value=P))
}
```
Logistic Regression Continued

**Code 2.4 (Slide 18): GOF Tests after Logistic Model Continued...:**

- **Applying Hosmer-Lemeshow**
  
  ```r
  hosmerlem(y=cda$depressed, yhat=fitted(mylogit2))
  ```

- **Pseudo R-Squared and ROC**
  
  ```r
  library(rms)
  mylogit3<lrm(depressed ~ age, data = cda)
  mylogit3$stats
  ```

**Code 2.5 (Slide 19): Diagnostic Measures of GOF**

```r
mylogit2 <- glm(depressed ~ age, data = cda, family = "binomial")

# Pearson Residuals
mylogit2$residuals

# Deviance Residuals
mylogit2$deviance
```

**Code 2.6 (Slide 21): Lowess/Loess Plot of Depressed vs Age:**

```r
plot(loess.smooth(y=cda$depressed, x=cda$age))
```

**Code 2.7 (Slide 22): Depression Model as ORs (Gender Predictor):**

```r
mylogit4 <- glm(depressed ~ as.factor(gender), data = cda, family = "binomial")
summary(mylogit4)
exp(cbind(OR = coef(mylogit4), confint(mylogit4)))
```

---

Ordinal Logistic Regression

**Code 3.1 (Slide 25): BMI 3 Groups Model (Age and Blood Pressure Predictors):**

- **As Logits**
  
  ```r
  library(MASS)
  myord1=polr(as.factor(bmi3grp) ~ age + blood_press , data = cda, Hess = TRUE)
  # TO OBTAIN P VALUES
  coeftable=coef(summary(myord1))
  p <- pnorm(abs(coeftable[, "t value"]), lower.tail = FALSE) * 2
  ctable <- cbind(coeftable, `p value` = p))
  ctable
  ```

- **As ORs**
  
  ```r
  exp(cbind(OR = coef(myord1), confint(myord1)))
  ```
Code 3.2 (Slide 26): GOF Tests of Proportional Odds Assumption:
No Test in R

Code 3.3 (Slide 27): GOF Tests after Ordinal Logistic Model:
No Test in R

Multinomial Logistic Regression

Code 4.1 (Slide 30): Religion Model (Supernatural Belief Predictor):
library(nnet)
cda$religion2 <- as.factor(cda$religion)
cda$ref <- relevel(cda$religion2, ref=1)
As Logits
multil <- multinom(ref ~ supernatural, data = cda)
#Calculate P values
z <- summary(multil)$coefficients/summary(multil)$standard.errors
p <- (1-pnorm(abs(z), 0, 1))/2
As ORs
exp(summary(multil)$coefficients)