Homework 3

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Question #1

(a) logit(p) = $\alpha_0 + \alpha_1 X_{TOB} + \beta X_{ALC}$

```
X(TOB) =  0 if tobacco use is 0-19 grams/day,
          1 if tobacco use is 80+ grams/day

X(ALC) =  0 if alcohol use is 0-79 grams/day
          1 if alcohol use is 80+ grams/day

p = probability of esophageal cancer given alcohol and tobacco use
```

(b) OR = e^(beta)

(c)

Table 1: Odds ratio of esophageal cancer associated with more than 80 g/day alcohol consumption as compared with less than 80 g/day and adjusted for tobacco consumption

	OR	2.5 %	97.5 %
bin_alc80+	5.61	3.97	7.93

(d)

The OR of being diagnosed with esophageal cancer associated with high alchohol consumption (80 g/day or more) compared to not high alcohol consumption (<80 g/day) and adjusted for tobacco consumption is 5.61 (95% CI: 3.97-7.93).

Question #2

(a) logit(p) = alpha(0) + alpha(1)X(tob) + betaX(alc) + gammaX(tob)X(alc)

```
X(tob) =  0 if tobacco use is 0-19 grams/day
          1 if tobacco use is 80+ grams/day

X(alc) =  0 if alcohol use is 0-79 grams/day
          1 if alcohol use is 80+ grams/day

p = probability of esophageal cancer among men given alchohol and tobacco use
```

(b) OR = e^(beta)

(c)

Table 2: Odds ratio of esophageal cancer among men who consume less than 20 g/day of tobacco associated with more than 80 g/day alcohol consumption as compared with less than 80 g/day

	OR	2.5 %	97.5 %
bin_alc80+	5.91	3.94	8.87

(d)

The OR of being diagnosed with esophageal cancer among men who consume less than 20 g/day of tobacco for those who consume more than 80 g/day of alcohol compared to those who consume less than 80 g/day of alchohol is 5.91 (95% CI: 3.94-8.87).

Question #3

(a) logit(p) = alpha(0) + alpha(1)X(1) + alpha(2)X(2) + alpha(3)X(3)

```
X(1) =  0 otherwise
        1 if tobacco use is 20+ g/day & alcohol use is less than 80 g/day

X(2) =  0 otherwise
        1 if tobacco use is less than 20 g/day & alcohol use is 80+ g/day

X(3) =  0 otherwise
        1 if tobacco use is 20+ g/day & alcohol use is 80+ g/day

p = probability of esophageal cancer among men given alchohol and tobacco use
```

(b) OR = e^(alpha(3))

(c)

Table 3: Odds ratio of esophageal cancer comparing men who consume more than 20 g/day of tobacco and 80 g/day of alcohol compared with those that consume less than 20 g/day of tobacco and 80 g/day of alcohol

	OR	2.5 %	97.5 %
bin_alctob_3	10.04	5.53	18.26

(d)

The OR of being diagnosed with esophageal cancer for men who consume 20 or more g/day of tobacco and 80 or more g/day of alcohol compared to men who consume less than 20 g/day and less than 80 g/day of alcohol and tobacco is 10.04 (95% CI: 5.53-18.26).

Appendix

```r
library(knitr)
library(devtools)
#install_github("bmckuw/UWbe536")
library(UWbe536)
library(kableExtra)
```

```r
link = "https://github.com/dmccoomes/Biostats_536/raw/master/Homework%203/esoph%20(2).rds"
esoph <- readRDS(url(link))
head(esoph)
summary(esoph)
str(esoph)


esoph$bin_alc <- as.numeric(esoph$alc) > 2
esoph$bin_alc <- factor(esoph$bin_alc, labels = c("0-79","80+"))

esoph$bin_tob <- as.numeric(esoph$tob) > 2
esoph$bin_tob <- factor(esoph$bin_tob, labels = c("0-19", "20+"))

with(esoph, table(alc, bin_alc))
with(esoph, table(tob, bin_tob))


bin_alc.mod_1 <- glm(case ~ bin_alc + bin_tob, data=esoph, family=binomial)
OR <- exp(coef(bin_alc.mod_1)[2])
ci <- exp(confint.default(bin_alc.mod_1))[2,]

kable(round(cbind(OR, t(ci)),2)) %>%
  kable_styling(full_width=F, position="left")



bin_alc.mod_2 <- glm(case ~ bin_alc*bin_tob, data=esoph, family=binomial)
OR <- exp(coef(bin_alc.mod_2)[2])
ci <- exp(confint.default(bin_alc.mod_2))[2,]

kable(round(cbind(OR, t(ci)),2)) %>%
  kable_styling(full_width=F, position="left")



esoph$bin_alctob_1[esoph$bin_tob=="20+" & esoph$bin_alc=="0-79"] <- 1
esoph$bin_alctob_1[esoph$bin_tob=="0-19" | esoph$bin_alc=="80+"] <- 0

esoph$bin_alctob_2[esoph$bin_tob=="0-19" & esoph$bin_alc=="80+"] <- 1
esoph$bin_alctob_2[esoph$bin_tob=="20+" | esoph$bin_alc=="0-79"] <- 0

esoph$bin_alctob_3[esoph$bin_tob=="20+" & esoph$bin_alc=="80+"] <- 1
esoph$bin_alctob_3[esoph$bin_tob=="0-19" | esoph$bin_alc=="0-79"] <- 0


bin_alc.mod_3 <- glm(case ~ bin_alctob_3 + bin_alctob_2 + bin_alctob_1, data=esoph, family=binomial)
OR <- exp(coef(bin_alc.mod_3)[2])
ci <- exp(confint.default(bin_alc.mod_3))[2,]

kable(round(cbind(OR, t(ci)),2)) %>%
  kable_styling(full_width=F, position="left")
```