STAT702 Assignment 3, Problem 4-12

Daniel Lee

March 10, 2025

4-12.

a. First:
odds ratio $= \frac{exp(\hat{\beta}_0+\hat{\beta}_1 x)}{1}$
Then:
log(odds ratio) $= \hat{\beta}_0 + \hat{\beta}_1 x$

b. First:
odds ratio $= \frac{exp(\hat{\alpha}_{orange0}+\hat{\alpha}_{orange1} x)}{exp(\hat{\alpha}_{apple0}+\hat{\alpha}_{apple1} x)}$
Then:
log(odds ratio) $= \hat{\alpha}_{orange0} + \hat{\alpha}_{orange1} x - (\hat{\alpha}_{apple0} + \hat{\alpha}_{apple1} x)$
$= (\hat{\alpha}_{orange0} - \hat{\alpha}_{apple0}) + (\hat{\alpha}_{orange1} - \hat{\alpha}_{apple1}) x$

c. Since my friend's equation is also written as $\hat{\beta}_0 + \hat{\beta}_1 x$, we can set:
$2 = \hat{\alpha}_{orange0} - \hat{\alpha}_{apple0}$, $-1 = \hat{\alpha}_{orange1} - \hat{\alpha}_{apple1}$
Then we could solve this system of equations
(or something else, maybe set $\hat{\alpha}_{orange0}$ = (a function of $\hat{\alpha}_{apple0}$),
and the same for $\hat{\alpha}_{orange1}$?)

d. Based on the same formats of the two equations, we can do:
$\hat{\beta}_0 = 1.2 - 3 = -1.8, \hat{\beta}_1 = (-2) - 0.6 = -2.6$

e. Because we made the two models the same in d), I will expect the predictions for the two models to be the same 100%.