

STAT 705: Homework 9, due 1:30 in LeConte 219C

**Happiness and political ideology**

Consider data relating happiness to political ideology obtained from the 2008 General Social Survey. The table below cross-classifies degree of happiness ( $H$ ) by political ideology ( $D$ ) for all subjects aged over 65.

Political Ideology	Happiness		
	Not too happy	Pretty happy	Very happy
Liberal	13	29	15
Moderate	23	59	47
Conservative	14	67	54

- (a) Compute and report the results of the Pearson and likelihood ratio test for independence,  $H_0 : H \perp D$ . What do you conclude at the 5% level?
- (b) Obtain exact p-values for the tests in part (a). Do your conclusions change?
- (c) Compute the standardized Pearson residuals under  $H_0 : H \perp D$  and make a table of '+' and '-' as shown in class, boxing those residuals greater than 2. Interpret this figure.
- (d) Compute and report a statistic measuring the concordance vs. the discordance for these two ordinal outcomes; include a 95% confidence interval. What do you conclude at the 5% level?
- (e) (Extra Credit): Obtain and interpret the polychoric correlation (and 95% CI) for these data; compare to (d).
- (f) How do your conclusions change from (a) to (d)? Why does this happen?

## Elk crossings

Gagnon et al. (2007) studied elk use of wildlife underpasses on a highway in Arizona. Using video surveillance cameras, they recorded each elk that started to cross under the highway. When a car or truck passed over while the elk was in the underpass, they recorded whether the elk continued through the underpass (crossing) or turned around and left (retreat). Overall traffic volume was categorized as low (fewer than 4 vehicles per minute) or high. The data are tabled below.

Location	Vehicle	Car	Truck
Low traffic	Crossing	287	40
	Retreat	57	42
High traffic	Crossing	237	57
	Retreat	52	12

The goal of the experiment is to determine how the odds of crossing changes from car to truck, adjusting for low vs. high traffic; you will analyze these data with this goal in mind.

- Obtain the estimated odds ratio for crossing for car vs. truck at low traffic locations directly from the  $2 \times 2$  upper subtable.
- Obtain the estimated odds ratio for crossing for car vs. truck at high traffic locations directly from the  $2 \times 2$  lower subtable.
- Now use logistic regression to model the probability of crossing vs. retreat. Does an additive model fit? What does the additive model imply about the odds for crossing in parts (a) and (b)?
- Fit the interaction logistic regression model. Comment on the Pearson and likelihood ratio goodness-of-fit tests.
- Show how to get the estimates in (a) and (b) via exponentiated regression coefficients from (d).
- Use the estimate command in proc logistic to obtain the estimates in (a,b,e) along with confidence intervals.
- Carefully interpret the data in light of (f).