**STAT 477/STAT 577**

**HW 9**

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1. After Life

a. Equation for Probability of Belief in Afterlife = Yes

log(pY/pN) = BY0 + BY1\*Race + BY2\*Sex

Equation for Probability of Belief in Afterlife = Undecided

log(pU/pN) = BU0 + BU1\*Race + BU2\*Sex

Equation for Probability of Belief in Afterlife = No

log(pN) = BN

b. Probability of Belief in Afterlife = Yes

Race = White, Sex = Female: 0.7729105

Race = Black, Sex = Female: 0.325241

Race = White, Sex = Male: 0.5

Race = Black, Sex = Male: N/A

Probability of Belief in Afterlife = Undecided

Race = White, Sex = Female: 0.325241

Race = Black, Sex = Female: 0.325241

Race = White, Sex = Male: 0.5

Race = Black, Sex = Male: N/A

Probability of Belief in Afterlife = No

Race = White, Sex = Female: 0.4808107

Race = Black, Sex = Female: 0.325241

Race = White, Sex = Male: 0.5

Race = Black, Sex = Male: N/A

c. Test for Significance of Sex variable in Model

Null Hypothesis: the model without Sex variable is sufficient to explain the variation in belief in the afterlife.

Alternative Hypothesis: Including Sex variable in the model improves its explanatory power significantly.

Test Statistic: 7.192648

P-value: 0.02742434

Conclusion: The Sex variable significantly improves the model’s explanatory power for predicting belief in the afterlife.

d. Test for Significance of Race variable in Model

Null Hypothesis: the model without the Race variable is sufficient to explain the variation in belief in the afterlife.

Alternative Hypothesis: Including Race variable in the model improves its explanatory power significantly.

Test Statistic: 1.994243

P-value: 0.36894

Conclusion: including the Race variable does not significantly improve the model’s explanatory power for predicting belief in the afterlife.

2. Gun Control – Death Penalty

a. Log-Linear Model assuming Independence

Expected value of each cell

* Cell 1: 1116900
* Cell 2: 308040
* Cell 3: 412815
* Cell 4: 113854

Does this model fit the data? To determine if the model fits the data, I conducted a goodness-of-fit test.

Null Hypothesis: The log-linear model assuming independence fits the data well.

Alternative Hypothesis: The log-linear model assuming independence doesn’t fit the data well.

Test Statistic: 5.32065

P-value: 0.02107415

Conclusion: There is strong evidence to suggest that the log-linear model assuming independence doesn’t fit the data well at the 0.05 significance level.

b. Saturated Log-Linear Model

Odds Ratio: The odds ratio for favoring both gun registration and the death penalty compared to opposing both policies is approximately 11.88.

Interpretation: The odds of favoring both gun registration and the death penalty simultaneously are approximately 11.88 times higher compared to opposing both policies.

3. Shower

Log-Linear model that best fits the data: Based on the comparison of various log-linear models, the Joint Independence (Wet:Rinse) model appears to be the best fit for the data. This model has the lowest deviance (1.639088e+01) and a significant p-value (9.427968e-04), indicating a good fit to the data.

Interpret all interaction terms in model: The interaction term Wet:Rinse in the Joint Independence (Wet:Rinse) model indicates the association between the direction students face when wetting their hair and when rinsing it, while considering the direction they lather. Specifically, it provides information on how the relationship between wetting and rinsing behavior varies depending on whether students lather towards or away from the shower.