Solution

3.4

a.

$\hat{\theta} = \frac{1085*441239}{703*55623} = 12.24$, $log\hat{\theta} = 2.50$.

$\hat{\sigma}(log\hat{\theta}) = \sqrt{1/1085 + 1/55623 + 1/703 + 1/441239} = 0.049$.

95% CI for $log\theta$: $2.50 \pm 1.96(0.049)$, or $(2.40, 2.60)$.

95% CI for θ: $(exp(2.40), exp(2.60))$, or $(11.02, 13.46)$.

b.

$\hat{\pi}_1 - \hat{\pi}_2 = 1085/(1085 + 55623) - 703/(703 + 441239) = 0.018$.

$\hat{\sigma}(\hat{\pi}_1 - \hat{\pi}_2) = \sqrt{\frac{0.019(1-0.019)}{1085+55623} + \frac{0.0016(1-0.0016)}{703+441239}} = 0.00058$.

95% CI for $\pi_1 - \pi_2$: $0.018 \pm 1.96(0.00058)$, or $(0.017, 0.019)$.

c.

$\hat{r} = \frac{1085/(1085+55623)}{703/(703+441239)} = 12.03$, $log\hat{r} = 2.49$.

$\hat{\sigma}(log\hat{r}) = \sqrt{\frac{1-0.019}{1085} + \frac{1-0.0016}{703}} = 0.048$.

95% CI for $logr$: $2.49 \pm 1.96(0.048)$, or $(2.40, 2.58)$.

95% CI for r: $(exp(2.40), exp(2.58))$, or $(11.02, 13.20)$.

3.8

a.

$z = \frac{60/104-2/63}{\sqrt{62/167(1-62/167)(1/104+1/63)}} = 7.07$. The z statistic relates to the chi-square test by $z^2 = X^2$.

3.11

a.

$X^2 = 177.31$, df = 2, p-value < 2.2e-16.

$G^2 = 197.39$, df = 2, p-value < 2.2e-16.

We would reject the null hypothesis of independence between party identificaiton and race. These statistics provide extremely strong evidence of an association.

b.

Table 1: Standardized residuals

	Democrat	Independent	Republican
Black	12.54	-3.6	-9.71
White	-12.54	3.6	9.71

Table 1 shows large positive residuals for black Democrats, white Independents and white Republicans. This means that significantly more subjects were at these combinations than H_0: independence predicts. Similarly, there were fewer black Independents, black Republicans and white Democrats than independence predicts.

c.

	Democrat	Independent
Black	192	75
White	459	586

$G^2 = 68.45$, df = 1, p-value < 2.2e-16. Reject the null hypothesis of independence.

	Democrat + Independent	Republican
Black	267	8
White	1045	471

$G^2 = 128.95$, df = 1, p-value < 2.2e-16. Reject the null hypothesis of independence.
White people seemed more likely than black people to be Republicans. Of those who were either Democrats or Independents, white people were more likely than black people to be Independents.