## **Formulas for exam 1**:

Binomial $P(y) = \frac{n!}{y!(n-y)!}\pi^y(1-\pi)^{n-y}$ , $y = 0, 1, 2, ..., n$, $\mu = n\pi$, $\sigma = \sqrt{n\pi(1-\pi)}$

Hypergeometric $P(n_{11}) = \frac{\binom{n_{1+}}{n_{11}}\binom{n_{2+}}{n_{+1}-n_{11}}}{\binom{n}{n_{+1}}}$, $\binom{a}{b} = a!/[b!(a-b)!]$

Poisson $E(Y) = \mu$, $Var(Y) = \mu$

odds $= \pi/(1-\pi)$, $\pi =$ odds/(1 + odds), relative risk $= \pi_1/\pi_2$

odds ratio $\theta = \frac{\pi_1/(1-\pi_1)}{\pi_2/(1-\pi_2)}$, $\hat{\theta} = \frac{n_{11}n_{22}}{n_{12}n_{21}}$

$$\text{SE}(\log\hat{\theta}) = \sqrt{\frac{1}{n_{11}} + \frac{1}{n_{12}} + \frac{1}{n_{21}} + \frac{1}{n_{22}}}$$

$$X^2 = \Sigma\frac{(n_{ij}-\hat{\mu}_{ij})^2}{\hat{\mu}_{ij}}, \quad \hat{\mu}_{ij} = (n_{i+}n_{+j})/n, \quad df = (I-1)(J-1)$$

$$G^2 = 2\Sigma n_{ij}\log\left(\frac{n_{ij}}{\hat{\mu}_{ij}}\right), \quad df = (I-1)(J-1)$$

$$r_{ij} = \frac{n_{ij}-\hat{\mu}_{ij}}{\sqrt{\hat{\mu}_{ij}(1-p_{i+})(1-p_{+j})}}$$

Poisson, negative binomial loglinear model for counts: $\log(\mu) = \alpha + \beta x$

GLMs for binary data: $\pi = \alpha + \beta x$, $\log[\pi/(1-\pi)] = \alpha + \beta x$

For logistic model, $\hat{\pi} = .5$ at $x = -\hat{\alpha}/\hat{\beta}$, rate of change $= \hat{\beta}\hat{\pi}(1-\hat{\pi})$, $e^{\hat{\beta}} =$ odds ratio

Inference: Wald $z = \hat{\beta}/SE$, CI: $\hat{\beta} \pm z_{\alpha/2}(SE)$, LR statistic $= -2(L_0 - L_1)$

Multiple logistic regression:

$\text{logit}(\pi) = \alpha + \beta_1x_1 + \cdots + \beta_kx_k$ $\quad \pi = \frac{\exp(\alpha+\beta_1x_1+\cdots+\beta_kx_k)}{1+\exp(\alpha+\beta_1x_1+\cdots+\beta_kx_k)}$