# STAT 477/577
# Formula Sheet - Exam 1

Binomial Distribution:

$$P(Y=y)=\binom{n}{y}p^y(1-p)^{n-y} \qquad E(Y)=np \qquad V(Y)=np(1-p)$$

Multinomial Distribution:

$$P(Y_1=y_1,Y_2=y_2,\ldots,Y_j=y_j)=\binom{n}{y_1y_2\cdots y_j}p_1^{y_1}p_2^{y_2}\cdots p_j^{y_j}$$

Sampling Distribution:

$$\hat{p}=\frac{Y}{n} \qquad E(\hat{p})=p \qquad V(\hat{p})=\frac{p(1-p)}{n}$$

Hypothesis Test for $p$:

$$z=\frac{\hat{p}-p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$$

Confidence Intervals for $p$:

$$\hat{p}\pm z_{1-\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$$\frac{\hat{p}+\frac{1}{2n}z^2_{1-\alpha/2}\pm z_{1-\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}+\frac{z^2_{1-\alpha/2}}{4n}}}{1+\frac{1}{n}z^2_{1-\alpha/2}}$$

$$\tilde{p}\pm z_{1-\alpha/2}\sqrt{\frac{\tilde{p}(1-\tilde{p})}{\tilde{n}}} \qquad \text{where } \tilde{n}=n+z^2_{1-\alpha/2} \text{ and } \tilde{p}=\frac{Y+\frac{z^2_{1-\alpha/2}}{2}}{\tilde{n}}$$

Sample size calculations:

$$n\geq\left(\frac{0.5z_{1-\alpha/2}}{M}\right)^2 \qquad n\geq\left(\frac{z_{1-\alpha/2}}{M}\right)^2\hat{p}(1-\hat{p})$$

Goodness of Fit Test:

$$E(Y_i)=np_{i_0} \qquad X^2=\sum_{i=1}^{k}\frac{(Y_i-E(Y_i))^2}{E(Y_i)}$$