Exam 3

sampling distribution of a sample proportion

$\hat{p} = x/n$

$\hat{p} \sim N\left(p, \left(\sqrt{\frac{pq}{n}}\right)^2\right)$

Large-sample estimation of population mean

point
$\hat{\mu} = \bar{x}$

interval
$\bar{x} \pm z_{\alpha/2} \frac{s}{\sqrt{n}}$

small-sample estimation of population mean

point $\hat{\mu} = \bar{x}$

interval $\bar{x} \pm t_{\alpha/2} \frac{s}{\sqrt{n}}$ $d.f. = n-1$

large-sample estimation of difference between means

point
$\mu_1 - \mu_2 = \bar{x}_1 - \bar{x}_2$

interval
$\bar{x}_1 - \bar{x}_2 \pm z_{\alpha/2} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$

small-sample estimation of differences between means

point $\mu_1 - \mu_2 = \bar{x}_1 - \bar{x}_2$

interval
$\bar{x}_1 - \bar{x}_2 + t_{\alpha/2}\, s \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$

$s^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}$

$d.f. = n_1+n_2-2$

Estimation of binomial proportion

point
$\hat{p} = \frac{x}{n}$

interval $\hat{p} \pm z_{\alpha/2} \sqrt{\frac{\hat{p}\hat{q}}{n}}$

Estimation of difference in binomial proportions

point
$p_1 - p_2 = \hat{p}_1 - \hat{p}_2$

interval
$\hat{p}_1 - \hat{p}_2 \pm z_{\alpha/2} \sqrt{\frac{\hat{p}_1\hat{q}_1}{n_1} + \frac{\hat{p}_2\hat{q}_2}{n_2}}$

one-sided test for any of the previous estimations

lower
$(\text{point estimate}) - \begin{matrix} z_\alpha \\ \text{or} \\ t_\alpha \end{matrix} (SE)$

upper
$(\text{point estimate}) + \begin{matrix} z_\alpha \\ \text{or} \\ t_\alpha \end{matrix} (SE)$

choosing the sample size

$z_{\alpha/2} \cdot (SE \text{ of estimation}) = D$

then solve for (n)

SE formulas

mean
$SE_{\bar{x}} = \frac{s}{\sqrt{n}}$ $\boxed{4.5 = R}$

diff in mean
$SE_{\bar{x}_1 - \bar{x}_2} = \sqrt{\frac{s_1^2}{n} + \frac{s_2^2}{n}}$

proportion
$SE_{\hat{p}} = \sqrt{\frac{\hat{p}\hat{q}}{n}}$ for max p use .5

diff in proportion
$SE_{\hat{p}_1 - \hat{p}_2} = \sqrt{\frac{\hat{p}_1\hat{q}_1}{n} + \frac{\hat{p}_2\hat{q}_2}{n}}$

hypothesis test population mean large sample

$z_{obs} = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$

$z_{crit} = z_{\alpha/2}$ two-tail
$= z_\alpha$ one-tail

hypothesis test pop mean small sample
$t_{obs} = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$

$t_{crit} = t_{\alpha/2}$ two tail $d.f. = n-1$
$= t_\alpha$ one tail

hyp test diff of means large sample

$z_{obs} = \frac{(\bar{x}_1 - \bar{x}_2) - D_0}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$

$z_{crit} = z_{\alpha/2}$ two-tail
$= z_\alpha$ one tail

hyp test diff in mean small sample
$t_{obs} = \frac{(\bar{x}_1 - \bar{x}_2) - D_0}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$

$s = \sqrt{s^2}$

$t_{crit} = t_{\alpha/2}$ two tail
t_α one-tail
$d.f. = n_1 + n_2 - 2$

power of test
P(reject Ho when it is false) $= 1-\beta$
$\beta =$ P(fail to reject when you should reject)
Type II error

p-value
the smallest value of α for which hypothesis test results are statistically significant

$\alpha =$ significance level $=$ P(type I error)