

## Tests of hypotheses

Hypotheses	Rejection Region of $H_0$
$H_0: \mu = \mu_0$ $H_1: \mu > \mu_0$	$\frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}} \geq z(\alpha)$ <i><math>\sigma</math> known</i>
$H_0: \mu = \mu_0$ $H_1: \mu > \mu_0$	$\frac{\bar{x} - \mu_0}{s/\sqrt{n}} \geq t(\alpha; n-1)$ <i><math>\sigma</math> unknown <math>n &lt; 50</math></i>
$H_0: \mu_1 = \mu_2$ $H_1: \mu_1 > \mu_2$	$\frac{\bar{x} - \bar{y}}{\sqrt{\sigma_1^2/n_1 + \sigma_2^2/n_2}} \geq z(\alpha)$
$H_0: \mu_1 = \mu_2$ $H_1: \mu_1 > \mu_2$	$\frac{\bar{x} - \bar{y}}{\sqrt{\frac{(n_1-1)s_x^2 + (n_2-1)s_y^2}{n_1 + n_2 - 2} \left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \geq t(\alpha; n_1 + n_2 - 2)$
$H_0: p = p_0$ $H_1: p > p_0$	$\frac{y/n - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} \geq z(\alpha)$
$H_0: p_1 = p_2$ $H_1: p_1 > p_2$	$\frac{y_1/n_1 - y_2/n_2}{\sqrt{\left(\frac{y_1 + y_2}{n_1 + n_2}\right)\left(1 - \frac{y_1 + y_2}{n_1 + n_2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \geq z(\alpha)$
$H_0: \beta_1 = \beta_{10}$ $H_1: \beta_1 > \beta_{10}$	$\frac{\hat{\beta}_1 - \beta_{10}}{\sqrt{\frac{\sum (y_i - \hat{y}_i)^2 / (n-2)}{\sum (x_i - \bar{x})^2}}} \geq t(\alpha; n-2)$

## Tolerance regions

With normal assumptions,  $\bar{x} \pm ks$  covers at least  $(100)p$  percent of the population with probability  $1 - \alpha$ .

## Confidence intervals

Parameter	Assumptions	Endpoints
$\mu$	$N(\mu, \sigma^2)$ or $n$ large $\sigma^2$ known	$\bar{x} \pm z(\alpha/2) \frac{\sigma}{\sqrt{n}}$
$\mu$	$N(\mu, \sigma^2)$ $\sigma^2$ unknown	$\bar{x} \pm t(\alpha/2; n - 1) \frac{s}{\sqrt{n}}$
$\mu_1 - \mu_2$	Independent Distributions $\sigma_1^2, \sigma_2^2$ known $n_1, n_2$ large	$\bar{x} - \bar{y} \pm z(\alpha/2) \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$
$\mu_1 - \mu_2$	Independent Normal Distributions $\sigma_1^2, \sigma_2^2$ unknown but equal	$\bar{x} - \bar{y} \pm t(\alpha/2; n_1 + n_2 - 2) \times \sqrt{\frac{(n_1 - 1)s_x^2 + (n_2 - 1)s_y^2}{n_1 + n_2 - 2} \left( \frac{1}{n_1} + \frac{1}{n_2} \right)}$
$p$	Binomial $b(n, p)$ $n$ large	$\frac{y}{n} \pm z(\alpha/2) \sqrt{\frac{(y/n)(1 - y/n)}{n}}$
$p_1 - p_2$	Independent Binomial Distributions $n_1, n_2$ large	$\frac{y_1}{n_1} - \frac{y_2}{n_2} \pm z(\alpha/2) \times \sqrt{\frac{(y_1/n_1)(1 - y_1/n_1)}{n_1} + \frac{(y_2/n_2)(1 - y_2/n_2)}{n_2}}$
$\beta_1$	$N(\beta_0 + \beta_1 x, \sigma^2)$	$\hat{\beta}_1 \pm t(\alpha/2; n - 2) \sqrt{\frac{\sum (y_i - \hat{y}_i)^2 / (n - 2)}{\sum (x_i - \bar{x})^2}}$

## Control charts

$$\bar{x}: \bar{\bar{x}} \pm A_2 \bar{R}$$

$$p: \bar{p} \pm 3 \sqrt{\frac{\bar{p}(1 - \bar{p})}{n}}$$

$$R: LCL = D_3 \bar{R}, UCL = D_4 \bar{R}$$

$$c: \bar{c} \pm 3\sqrt{\bar{c}}$$