MT 143 Formulas

Data:

Relative frequency: $\frac{count}{total}$ percentile: $\frac{rank}{total}$ rank: $percentile \times total$

$\mu = \bar{x} = \sum \frac{x_i}{n}$ $\sigma = \sqrt{\sum \frac{(x_i - \bar{x})^2}{N}}$ $s = \sqrt{\sum \frac{(x_i - \bar{x})^2}{n-1}}$

$IQR = Q_3 - Q_1$ outliers: $< Q_1 - 1.5IQR \text{ or } > Q_3 + 1.5IQR$

Extreme outliers: $< Q_1 - 3IQR \text{ or } > Q_3 + 3IQR$

$$z = \frac{(x-\mu)}{\sigma} = \frac{x - \bar{x}}{s}$$

Probability Distributions:

Binomial distribution: $\binom{n}{x} p^x (1-p)^{n-x}$ $\mu = np$ $\sigma^2 = np(1-p)$

Counting:

Combinations: $\binom{n}{r} = \frac{n!}{r!(n-r)!}$ permutations: $P(n,r) = \frac{n!}{(n-r)!}$ special permutations: $\frac{n!}{n_1! n_2! \ldots n_k!}$

Expected value: $\bar{x} = \mu = \sum x_i p(x_i)$ Variance: $\sigma^2 = \sum (x_i - \mu)^2 p(x_i) = \sum (x^2) p(x) - \mu^2$

$$P(A \text{ and } B) = P(A|B)P(B)$$
$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

Standard errors: $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$ $s_{pooled} = \sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}}$

$s_{x_1 - x_2} = s_{pooled}\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$

Sample sizes: $n > \hat{p}(1-\hat{p})\left(\frac{z_{\alpha/2}}{E}\right)^2$ $n > \left(\frac{z_{\alpha/2}\sigma}{E}\right)^2$ $m = n = \frac{4z_{\alpha/2}^2(\sigma_1^2 + \sigma_2^2)}{w^2}$

Confidence intervals:

One sample: $\bar{x} \pm t_{\alpha/2, n-1} \frac{s}{\sqrt{n}}$ $\hat{p} \pm z_{\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

Two samples (independent): $(\bar{x}_1 - \bar{x}_2) \pm t_{\alpha/2, n-1}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$ $(\hat{p}_1 - \hat{p}_2) - z_{\alpha/2}\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$

Test statistics:

One sample: $z \text{ or } t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$ $z = \frac{\hat{p} - p_0}{\sqrt{p_0(1-p_0)/n}}$

Two samples: dependent: $z \; or \; t = \frac{\bar{d}_0 - \delta}{\frac{s_d}{\sqrt{n}}}$

Independent: $z \; or \; t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$

$z = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\frac{p_1(1-p_1)}{n_1} + \frac{p_2(1-p_2)}{n_2}}}$

Degrees of freedom (two samples, unpooled) $\nu = \frac{\left(\frac{s_1^2}{m} + \frac{s_2^2}{n}\right)^2}{\frac{\left(\frac{s_1^2}{m}\right)^2}{m-1} + \frac{\left(\frac{s_2^2}{n}\right)^2}{n-1}}$

χ^2Tests: $\chi^2 = \sum_{all\ cells} \frac{(obs - \mathrm{exp})^2}{exp}$