Non-Business Statistics: Hyp Testing Flow Chart

- **Proportions**
  - 1 sample →
$$TS: z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}, \quad \hat{p} = \frac{x}{n}$$
  - 2 samples →
$$TS: z = \frac{(\hat{p}_1 - \hat{p}_2)}{\sqrt{\bar{p}(1-\bar{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$
$$CI: (\hat{p}_1 - \hat{p}_2) \pm z\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$$
$$\bar{p} = \frac{n_1\hat{p}_1 + n_2\hat{p}_2}{n_1 + n_2} = \frac{x_1 + x_2}{n_1 + n_2}$$

- **Means**
  - 1 sample
    - σ known or n≥30 →
$$TS: z = \frac{\bar{x} - \mu}{\left(\sigma / \sqrt{n}\right)}$$
    - σ unknown and n<30 →
$$TS: t = \frac{\bar{x} - \mu}{\left(s / \sqrt{n}\right)}, df = n - 1$$
  - 2 samples
    - Dependent samples (paired) →
$$TS: t = \frac{\bar{d} - \mu_d}{\left(s_d / \sqrt{n}\right)}, \quad CI: \bar{d} \pm t\left(\frac{s_d}{\sqrt{n}}\right), \; df = n - 1$$
    - Independent samples
      - σ's known or n≥30 →
$$TS: z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\left(\frac{\sigma_1^2}{n_1}\right) + \left(\frac{\sigma_2^2}{n_2}\right)}} \quad CI: (\bar{x}_1 - \bar{x}_2) \pm z\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$
      - σ's unknown or n<30
        - $\sigma_1^2 = \sigma_2^2$ →
$$TS: t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\left(\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$
$$CI: (\bar{x}_1 - \bar{x}_2) \pm t\sqrt{\left(\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$
$$df = n_1 + n_2 - 2$$
        - $\sigma_1^2 \neq \sigma_2^2$ →
$$TS: t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\left(\frac{s_1^2}{n_1}\right) + \left(\frac{s_2^2}{n_2}\right)}} \quad CI: (\bar{x}_1 - \bar{x}_2) \pm t\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$
$$df = \text{smaller of } (n_1 - 1) \text{ or } (n_2 - 1)$$

- **Variances**
  - 1 sample →
$$TS: \chi^2 = \frac{(n-1)s^2}{\sigma_0^2}$$
$$CI: \frac{(n-1)s^2}{\chi^2_{\alpha/2}} \le \sigma^2 \le \frac{(n-1)s^2}{\chi^2_{1-\alpha/2}}$$
  - 2 samples →
$$TS: F = \frac{s_1^2}{s_2^2}, Ndf = n_1 - 1, Ddf = n_2 - 1$$