Summary Tables of Sampling Distributions

Estimating $E(X) = \mu$ by $\bar{X} = \frac{\sum_{i=1}^{n} X_i}{n}$		
$X_i \sim i.i.d. N(\mu, \sigma^2)$		$X_i \sim i.i.d.\ (\mu, \sigma^2)$
for any n, σ^2 known	for small n, σ^2 unknown	for sufficiently large n
$\bar{X} \sim N(\mu, \frac{\sigma^2}{n})$ $\frac{\bar{X}-\mu}{\sqrt{\frac{\sigma^2}{n}}} \sim N(0, 1)$	$\bar{X} \sim t_{n-1}(\mu, \frac{s^2}{n})$ $\frac{\bar{X}-\mu}{\sqrt{\frac{s^2}{n}}} \sim t_{n-1}$	$\bar{X} \sim_{approx.} N(\mu, \frac{\sigma^2}{n})$ by CLT $\frac{\bar{X}-\mu}{\sqrt{\frac{\sigma^2}{n}}} \sim_{approx.} N(0, 1)$ by CLT
Estimating π by $P = \frac{\sum_{i=1}^{n} X_i}{n}$ where $\sum_{i=1}^{n} X_i \sim Bino(n, \pi)$		
for any n	for any n	for sufficiently large n
N/A	N/A	$P \sim_{approx.} N(\pi, \frac{\pi(1-\pi)}{n})$ by CLT $\frac{P-\pi}{\sqrt{\frac{\pi(1-\pi)}{n}}} \sim_{approx.} N(0, 1)$ by CLT

<table>
<tr><td colspan="4">Estimating $E(D) = \mu_D = \mu_X - \mu_Y$ by $\bar{D} = \frac{\sum_{i=1}^{n} Di}{n}$ where $D_i = X_i - Y_i$ with a matched pair X_i, Y_i</td></tr>
<tr><td colspan="3">$D_i \sim i.i.d.N(\mu_D, \sigma_D^2)$</td><td>$D_i \sim i.i.d.(\mu_D, \sigma_D^2);$</td></tr>
<tr><td>for any n, σ_D^2 known</td><td colspan="2">for small n, σ_D^2 unknown</td><td>for sufficiently large n</td></tr>
<tr><td>$\frac{\bar{D}-\mu_D}{\sqrt{\frac{\sigma_D^2}{n}}} \sim N(0,1)$</td><td colspan="2">$\frac{\bar{D}-\mu_D}{\sqrt{\frac{s_D^2}{n}}} \sim t_{n-1}, \quad (s_D^2 = \frac{\sum(D_i-\bar{D})^2}{n-1})$</td><td>$\frac{\bar{D}-\mu_D}{\sqrt{\frac{\sigma_D^2}{n}}} \sim_{approx.} N(0,1)$ by CLT</td></tr>
<tr><td colspan="4">Estimating $E(X-Y) = \mu_X - \mu_Y$ by $\bar{X} - \bar{Y}$ where $\bar{X} = \frac{\sum_{i=1}^{n_X} X_i}{n_X}, \bar{Y} = \frac{\sum_{i=1}^{n_Y} Y_i}{n_Y}, \quad (X_i, Y_i$ indep.)</td></tr>
<tr><td colspan="3">$X_i \sim i.i.d.N(\mu_X, \sigma_X^2); \quad Y_i \sim i.i.d.N(\mu_Y, \sigma_Y^2)$</td><td>$X_i \sim i.i.d.(\mu_X, \sigma_X^2); \quad Y_i \sim i.i.d.(\mu_Y, \sigma_Y^2);$</td></tr>
<tr><td>for any $n_X, n_Y, \quad \sigma_X^2, \sigma_Y^2$ known</td><td colspan="2">for small $n_X, n_Y, \quad \sigma_X^2, \sigma_Y^2$ unknown</td><td>for sufficiently large n_X, n_Y</td></tr>
<tr><td>$\frac{(\bar{X}-\bar{Y})-(\mu_X-\mu_Y)}{\sqrt{\frac{\sigma_X^2}{n_X}+\frac{\sigma_Y^2}{n_Y}}} \sim N(0,1)$</td><td>$\sigma_X^2 = \sigma_Y^2$
$\frac{(\bar{X}-\bar{Y})-(\mu_X-\mu_Y)}{s_p\sqrt{\frac{1}{n_X}+\frac{1}{n_Y}}} \sim t_{n_X+n_Y-2}$</td><td>$\sigma_X^2 \neq \sigma_Y^2$
$\frac{(\bar{X}-\bar{Y})-(\mu_X-\mu_Y)}{\sqrt{\frac{s_X^2}{n_X}+\frac{s_Y^2}{n_Y}}} \sim t_{df}$</td><td>$\frac{(\bar{X}-\bar{Y})-(\mu_X-\mu_Y)}{\sqrt{\frac{\sigma_X^2}{n_X}+\frac{\sigma_Y^2}{n_Y}}} \sim_{approx.} N(0,1)$ by CLT</td></tr>
<tr><td colspan="4">Estimating $\pi_X - \pi_Y$ by $P_X - P_Y$ where $P_X = \frac{\sum_{i=1}^{n_X} X_i}{n_X}, P_Y = \frac{\sum_{i=1}^{n_Y} Y_i}{n_Y}, \sum_{i=1}^{n_X} X_i \sim Bino(n_X, \pi_X); \sum_{i=1}^{n_Y} Y_i \sim Bino(n_Y, \pi_Y), \quad (X_i, Y_i$ indep.)</td></tr>
<tr><td>for any n_X, n_Y</td><td colspan="2">for any n_X, n_Y</td><td>for sufficiently large n_X, n_Y</td></tr>
<tr><td>N/A</td><td colspan="2">N/A</td><td>$\frac{(P_X-P_Y)-(\pi_X-\pi_Y)}{\sqrt{\frac{\pi_X(1-\pi_X)}{n_X}+\frac{\pi_Y(1-\pi_Y)}{n_Y}}} \sim_{approx.} N(0,1)$ by CLT</td></tr>
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