1. (a) 常態型分布   (a) $z = \frac{x-\mu}{\sigma}$, $f_z(x) = e^{-\frac{1}{2}x^2}$

$E(z_0 + z_1) = 0$; $E(z_0 + z_{-1})^2 = 1+1 = 2$

(b) 卡方分布   (b) $P(Q_1) = z^2$, $\chi^2 (df=1)$

(c) 卡方分布   (c) $P(Q_2) = z_1^2 + z_2^2 = \chi^2 (df=2)$

(d) 柯西分布

(e) 二項式分布

(f) 二項式分布

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2. (a). $P(z_0 + z_1 \leq 1) = 0.6914$, $(1-st.norm.sf\,(1,0,2))$

(b). $P(z_0^2 \leq 1) = 0.8413$, $(1-st.norm.sf\,(1,0,1))$

(c). $P(z_1^2 + z_2^2 \leq 1) = 0.6914$, $(1-st.norm.sf\,(1,0,2))$

(d) $P(\frac{z_1}{z} \leq 1) = \frac{0.9472}{0.2558}$

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3. (a) $\mu_A = 65$, $\frac{\sigma_A^2}{n} = \frac{3^2}{25} = \frac{9}{25}$

$z = \frac{\bar{x}_A - 65}{\frac{3}{5}}$

$P(\bar{x}_A < 64) = P\left(\frac{\bar{x}_A - 65}{\frac{3}{5}} \leq \frac{64-65}{\frac{3}{5}}\right) = P(z \leq -1.67) \doteq 0.04746 = 4.7\%$

(b.) $P(\bar{x}_B - \bar{x}_A > 5.5 \,|\, \mu_B = \mu_A)$

$= P\left(z > \frac{5.5-0}{\frac{\sqrt{5.5}}{\sqrt{30}}}\right) = P\left(z > \frac{5.5 \times \sqrt{31}}{\sqrt{50}}\right) = P(z > 4.26) \doteq 0$

$\sigma_{\bar{x}_B - \bar{x}_A} = \sqrt{\frac{5^2}{30} + \frac{5^2}{30}} = \sqrt{\frac{5}{3}} = 1.291$

(C).

$$\text{variance} = \frac{25}{n}$$

$$\bar{x} - \bar{x}_8 = \frac{5^2}{30} + \frac{\bar{x}}{30} = \frac{5}{3}$$

$$\frac{5}{3}\left(\frac{1}{\sqrt{30}}\right)^2 = \frac{5}{3} \cdot \frac{1}{30} = \frac{5}{3} \cdot \frac{30}{50} = 1.$$