

$$1. f_{R(u)}(r|H_1) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(r-\mu_E)^2}{2\sigma^2}}$$

$$f_{R(u)}(r|H_2) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(r+\mu_E)^2}{2\sigma^2}}$$

$$\frac{f_{R(u)}(r|H_1)}{f_{R(u)}(r|H_2)} \underset{H_1}{\underset{H_2}{\geq}} \frac{p_2}{p_1} \Rightarrow e^{\frac{(2r+\mu_{E1}+\mu_{E2})(\mu_{E2}-\mu_{E1})}{2\sigma^2}} \underset{H_1}{\underset{H_2}{\geq}} \frac{p_2}{p_1}$$

$$(2) \gamma \underset{H_1}{\underset{H_2}{\geq}} \frac{\mu_{E1}-\mu_{E2}}{\sigma}$$

$$\therefore \beta_p = \int_{\frac{\mu_{E1}-\mu_{E2}}{\sigma}}^{+\infty} f_{R(u)}(r|H_2) dr + \int_{-\infty}^{\frac{\mu_{E1}-\mu_{E2}}{\sigma}} f_{R(u)}(r|H_1) dr$$

$$= 1 + \frac{1}{2} \left(\operatorname{erf}\left(\frac{\mu_{E1}+\mu_{E2}}{2\sqrt{2}\sigma}\right) - \operatorname{erf}\left(\frac{\mu_{E1}-\mu_{E2}}{2\sqrt{2}\sigma}\right) \right)$$

$$13) P[R(u)] = E[R(u)^2] - E[R(u)]^2 = \frac{9}{4} E_1 (p_1 + p_2)$$

$$\therefore \gamma = \frac{\mu_{E1}-\mu_{E2}}{\sigma} \quad \therefore R(u) \underset{H_1}{\underset{H_2}{\geq}} \gamma = \frac{\mu_{E1}-\mu_{E2}}{\sigma}$$

$$2. f_{R(u)}(r|H_0) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(r-1-\beta B(u))^2}{2\sigma^2}}, \quad f_{R(u)}(r|H_1) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(r+1+\beta B(u))^2}{2\sigma^2}}$$

$$\frac{f_{R(u)}(r|H_0)}{f_{R(u)}(r|H_1)} \underset{H_0}{\underset{H_1}{\geq}} \frac{p_0}{p_1} \Rightarrow e^{4(r-\beta B(u))} \underset{H_0}{\underset{H_1}{\geq}} 1 \Rightarrow r \underset{H_0}{\underset{H_1}{\geq}} \beta B(u)$$

$$(2) \beta = \int_{\beta B(u)}^{+\infty} f_{R(u)}(r|H_1) dr + \int_{-\infty}^{\beta B(u)} f_{R(u)}(r|H_0) dr = 1 + \frac{1}{2} \left[\operatorname{erf}\left(\frac{1}{\sqrt{2}\sigma}\right) - \operatorname{erf}\left(-\frac{1}{\sqrt{2}\sigma}\right) \right]$$

$$3. \hat{X}^{(10)} = \begin{pmatrix} x_1(u) \\ x_2(u) \end{pmatrix} \therefore f_{X(u)}(X|H_1) = \frac{1}{2\pi\sqrt{2}} e^{-\frac{1}{2} \left[\frac{(x_1-1)^2}{4} + \frac{(x_2-1)^2}{4} \right]}$$

$$f_{X(u)}(X|H_2) = \frac{1}{2\pi\sqrt{2}} e^{-\frac{1}{2} \left[\frac{(x_1-3)^2}{4} + \frac{(x_2-3)^2}{4} \right]}$$

$$\frac{f_{X(u)}(X|H_1)}{f_{X(u)}(X|H_2)} \underset{H_2}{\overset{H_1}{>}} 1 \Rightarrow e^{\frac{1}{2}(2x_1 + 2x_2 - 8)} \underset{H_2}{\overset{H_1}{>}} 1 \Rightarrow$$

$$x_1 + x_2 \underset{H_2}{\overset{H_1}{>}} 4 + \ln 17$$

$$4. \text{ in ans} = \arg \max_{Re} \left\{ S_m^H \sum_{k=1}^L (G_k^* K_k) \right\}$$

$$(2) \lg(BBR) = \lg R_2 - \lg \left(L \cdot \frac{T_b}{T_0} \right)$$

$$Y = \lg p_0 - D \lg D - \frac{p_x}{T_0}$$

$$(a) \therefore D = 1.05$$

$$(b) D = 2$$

$$\begin{aligned} \Rightarrow \begin{cases} T_{00}K_1 + K_2 = 4 \\ T_{00} = \frac{1}{2}K_1 = \frac{2K}{39} \end{cases} \Rightarrow \begin{cases} 4K_2 - 14K_1 + K_2 = 0 \\ 5K_2 - 10K_1 = 0 \end{cases} \end{aligned}$$