2019/10/05

(3) $\boxed{\text{Categorical Distribution}}$

$$\prod_{i=1}^{4}\prod_{k=1}^{4}\theta_k^{x_{i,k}} = \prod_{i=1}^{4}\left(\prod_{k=1}^{4}\theta_k^{x_{i,k}}\right)$$

$$= \prod_{i=1}^{4}\left(\theta_1^{x_{i,1}}\cdot\theta_2^{x_{i,2}}\cdot\theta_3^{x_{i,3}}\cdot\theta_4^{x_{i,4}}\right)$$

$$= \left(\theta_1^{x_{1,1}}\cdot\theta_2^{x_{1,2}}\cdot\theta_3^{x_{1,3}}\cdot\theta_4^{x_{1,4}}\right)\cdot\left(\theta_1^{x_{2,1}}\cdot\theta_2^{x_{2,2}}\cdot\theta_3^{x_{2,3}}\cdot\theta_4^{x_{2,4}}\right)\cdot$$
$$\left(\theta_1^{x_{3,1}}\cdot\theta_2^{x_{3,2}}\cdot\theta_3^{x_{3,3}}\cdot\theta_4^{x_{3,4}}\right)\cdot\left(\theta_1^{x_{4,1}}\cdot\theta_2^{x_{4,2}}\cdot\theta_3^{x_{4,3}}\cdot\theta_4^{x_{4,4}}\right)$$

(4) $\boxed{\text{Gaussian Mixture Model}}$

$$\prod_{i=1}^{4}\sum_{k=1}^{2}\pi_k x_i \mu_k = \prod_{i=1}^{4}\left(\sum_{k=1}^{2}\pi_k x_i \mu_k\right)$$

$$= \prod_{i=1}^{4}\left((\pi_1 x_i \mu_1)+(\pi_2 x_i \mu_2)\right)$$

$$= \left((\pi_1 x_1 \mu_1)+(\pi_2 x_1 \mu_2)\right)\cdot\left((\pi_1 x_2 \mu_1)+(\pi_2 x_2 \mu_2)\right)\cdot$$
$$\left((\pi_1 x_3 \mu_1)+(\pi_2 x_3 \mu_2)\right)\cdot\left((\pi_1 x_4 \mu_1)+(\pi_2 x_4 \mu_2)\right)$$

$\boxed{\text{Practice}}$

$x_i : x_1, x_2, x_3, x_4$

$y_i :\ 0, 1, 0, 0$

(1) $\prod_i x_i^{y_i} = x_1^0 \cdot x_2^1 \cdot x_3^0 \cdot x_4^0 = x_2$

(2) If $y_i : 0, 0, 1, 0$, find $\prod_i x_i^{y_i}$

$$\prod_i x_i^{y_i} = x_1^0 \cdot x_2^0 \cdot x_3^1 \cdot x_4^0 = x_3$$