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$$p(y, x)$$

$$= p(y, x, \{c(x)=1\} \text{ or } \{c(x)=2\})$$

$$= p(y, x, c(x)=1) + p(y, x, c(x)=2)$$

$$= p(y|x, c(x)=1) p(x, c(x)=1)$$

$$+ p(y|x, c(x)=2) p(x, c(x)=2)$$

$$= p(y|x, c(x)=1) p(x|c(x)=1) p(c(x)=1)$$

$$+ p(y|x, c(x)=2) p(x|c(x)=2) p(c(x)=2)$$

$\vdots$

$$p(y|x) = \begin{cases} 0.2 f(x|c(x)=1) 0.5 + \\ 0.7 f(x|c(x)=2) 0.5 \end{cases}$$

$$\text{if } y=0$$

$$\begin{cases} 0.8 f(x|c(x)=1) 0.5 + \\ 0.3 f(x|c(x)=2) 0.5 \end{cases}$$

$$\text{if } y=1$$

$$p(y|x) = \begin{cases} 0.1 f(x|c(x)=1) + 0.35 f(x|c(x)=2) & \text{if } y=0 \\ 0.4 f(x|c(x)=1) + 0.15 f(x|c(x)=2) & \text{if } y=1 \end{cases}$$