2.6 we have x_E (observed), x_j (unobserved)

$$P(x_j \mid x_E, \theta, \pi) = \frac{P(x_j, x_E \mid \theta, \pi)}{P(x_E \mid \theta, \pi)}$$

$$= \frac{\sum_{c=0}^{9} P(x_j, x_E, c \mid \theta, \pi)}{\sum_{c=0}^{9} P(x_E, c \mid \theta, \pi)}$$ marginalize over c

$$= \frac{\sum_{c=0}^{9} P(x_j, x_E \mid \theta, \pi) P(c \mid \pi)}{\sum_{c=0}^{9} P(x_E \mid \theta, \pi) P(c \mid \pi)}$$ since $P(x, c \mid \theta, \pi) = P(c \mid \pi) P(x \mid c, \theta)$

$$= \frac{\sum_{c=0}^{9} P(x_j \mid \theta, \pi) P(x_E \mid \theta, \pi) P(c \mid \pi)}{\sum_{c=0}^{9} P(x_E \mid \theta, \pi) P(c \mid \pi)}$$ by conditional independence

where

$$P(x_j \mid \theta, \pi) = \theta_{jc}^{x_j} (1 - \theta_{jc})^{1 - x_j}$$

$$P(c \mid \pi) = \pi_c$$

Since $x_E = \{x_p : \text{pixel } p \text{ is observed}\}$

we can express $P(x_E \mid c, \theta) = \prod_{\text{all } p} P(x_p \mid c, \theta)$

$$= \prod_{\text{all } p} \left(\theta_{pc}^{x_p} + (1 - \theta_{pc})^{1 - x_p} \right)$$