Urn A contains 1 red and 3 blue balls, urn B contains 2 red and 5 blue balls. One randomly chosen ball is transferred from urn B to urn A. Next, a random ball is chosen from urn A. What is the probability that this ball is red?

Hint: condition on the color of the transferred ball.

$R_T = \{$ the transferred ball is red $\}$, $\quad B_T = \{$ the transferred ball is blue $\}$.

$$P(R_T) = \frac{2}{7}, \quad P(B_T) = \frac{5}{7}.$$

If R_T occurs, urn A will contain 2 red & 3 blue.

If B_T occurs, urn A will contain 1 red & 4 blue.

$$\Rightarrow \quad P(R) = P(R \mid R_T)\, P(R_T) + P(R \mid B_T)\, P(B_T)$$

$$= \frac{2}{5} \cdot \frac{2}{7} + \frac{1}{5} \cdot \frac{5}{7} = \boxed{\frac{9}{35}}.$$