$Q_2$ Let $E_1$ be the event of choosing bag 1 and $E_2$ be the event of choosing bag 2.

$$P(E_1) = P(E_2) = 1/2$$

now

$P$(drawing black ball from Bag 1) $= P(A/E_1) = \frac{6}{6+4} = \frac{6}{10} = \frac{3}{5}$

and $P$(Drawing black ball from Bag 2) $= P(A/E_2) = \frac{3}{3+4} = \frac{3}{7}$

$$\therefore P(E_1/A) = \frac{P(E_1) \times P(A/E_1)}{P(E_1) \times P(A/E_1) + P(E_2) \times P(A/E_2)}$$

$$= \frac{\frac{1}{2} \times \frac{3}{5}}{\frac{1}{2} \times \frac{3}{7} + \frac{1}{2} \times \frac{3}{5}} = \frac{\frac{3}{10}}{\frac{3}{10} + \frac{3}{14}}$$

$$= \frac{\frac{3}{5}}{\left(\frac{3}{7} + \frac{3}{5}\right)} = \frac{3}{5} \times \frac{35}{15+21}$$

$$= \frac{3}{5} \times \frac{35}{36} = \frac{7}{12}$$

$$\boxed{P(E_1/A) = \frac{7}{12}}$$

Q3 Let $E_1$ be the event that 4 occurs & $E_2$ be the event the 4 does not occur.

$\therefore P(E_1) = 1/6$

and, $P(E_2) = \frac{5}{6}$

$P($ man tells the truth and 4 occurs $) = P(A/E_1) = 2/3$

$P($ man tells otherwise and 4 but 4 does not occur $) = P(A/E_2) = \frac{1}{3}$

$$\therefore P(E_1/A) = \frac{P(E_1) \times P(A/E_1)}{P(E_1) \times P(A/E_1) + P(E_2) \times P(A/E_2)}$$

$$= \frac{\frac{1}{6} \times \frac{2}{3}}{\frac{1}{6} \times \frac{2}{3} + \frac{5}{6} \times \frac{1}{3}}$$

$$= \frac{2}{7}$$