4.40 a. $P(K) = .7$

b. $P(R|K) = 1$

c. $P(K|R) = \dfrac{P(R|K)P(K)}{P(R)} = \dfrac{.7 \cdot 1}{P(R)}$

$$P(R) = P(R \cap K) + P(R \cap K^c)$$
$$= .7 + P(R|K^c)P(K^c)$$
$$= .7 + \frac{1}{n} \cdot .3$$

$$P(K|R) = \frac{.7}{.7 + \frac{1}{n} \cdot .3}$$

d. $P(K|R) = \dfrac{.7}{.7 + \frac{1}{n} \cdot .3} \geq .99$

$$.7 \geq .693 + .297\frac{1}{n}$$
$$\frac{1}{n} \leq .0236$$
$$n \geq 42.4$$

$\boxed{n_{min} = 43 \text{ options}}$

4.41 r_3 isn't random. By the definition of r_3, revealing a goat in door 2 guarantees a car behind door one. Thus, $P(C_1|G_2, r_3) = \boxed{1 \text{ or } 100\%}$

4.42 $P(C_1|G_2, r_4) = \dfrac{P(C_1 \cap G_2)}{P(G_2 \cap C_1) + P(G_2 \cap C_2) + P(G_2 \cap C_3)}$

$$= \frac{P(G_2|C_1) \cdot P(C_1)}{P(G_2|C_1)P(C_1) + 0 + P(G_2|C_3)P(C_3)}$$

$$= \frac{\frac{1}{6}}{\frac{1}{6} + \frac{1}{6}} = \boxed{\frac{1}{2}}$$