

$$\begin{aligned}
 (4) \quad (a) \quad E_1(K) &= \frac{1}{3} \left\{ p \cdot 1(-10) + (1-p)(-4) \right\} \\
 &\quad + \frac{1}{3} \left\{ p \left[q(0) + (1-q)4 \right] + (1-p)(-4) \right\} \\
 &\quad + \frac{1}{3} \left\{ p \left[0 \cdot (10) + 1(4) \right] + (1-p)(-4) \right\} \\
 &= \frac{1}{3} \left\{ -10p + 4p(1-q) + 4p - 12(1-p) \right\}.
 \end{aligned}$$

$$\begin{aligned}
 (b) \quad (A, K) \quad \frac{\frac{1}{q}}{\frac{1}{q} + \frac{1}{q}(p) + \frac{1}{q}(0)} &= \frac{1}{1+p} \\
 (K, K) \quad \frac{\frac{1}{q}(p)}{\frac{1}{q} + \frac{1}{q}(p) + \frac{1}{q}(0)} &= \frac{p}{1+p} \\
 (Q, K) \quad \frac{0}{\frac{1}{q} + \frac{1}{q}p + \frac{1}{q}(0)} &= 0.
 \end{aligned}$$

$$\begin{aligned}
 (c) \quad E_2(K) &= \frac{1}{1+p} \left\{ q(-10) + (1-q)(-4) \right\} + \frac{p}{1+p} \left\{ q(0) + (1-q)(-4) \right\} + 0. \\
 &= \frac{1}{1+p} \left\{ -10q - 4(1-q) - 4p(1-q) \right\}.
 \end{aligned}$$

$$\begin{aligned}
 (d) \quad \frac{\partial}{\partial q} E_2(K) &= \frac{1}{1+p} \left\{ -10 + 4 + 4p \right\} = \frac{4p-6}{1+p} \\
 \text{This} &< 0 \text{ for all } 0 \leq p \leq 1 \text{ so } q^* = 0.
 \end{aligned}$$

$$\begin{aligned}
 (e) \quad \frac{\partial}{\partial p} E_1(K) &= \frac{1}{3} \left\{ -10 + 4 - 4q + 4 + 12 \right\} = \frac{1}{3} \left\{ 10 - 4q \right\} \\
 \text{for } q^* &= 0 \text{ choice is } p^* = 1 \text{ since } \frac{\partial E_1}{\partial p} > 0.
 \end{aligned}$$

(f)