

## Chapter 10: Solutions to Problems 1-5

$$1. \quad D = x_1 - p_1 q_1$$

$$D = x_1 - (x_1 + x_2)(x_1 - x_3)$$

$$D = x_1 - (x_1^2 - x_1 x_3 - x_2 x_1 - x_2 x_3)$$

$$D = x_1(1 - x_1 - x_3 - x_2) - x_2 x_3$$

$$D = x_1 x_4 - x_2 x_3$$

$$x_2' = x_1 x_2 + x_2^2 + c x_1 x_4 + (1 - c)x_2 x_3 + x_2 x_4$$

$$x_2' = x_1 x_2 + x_2^2 + c x_1 x_4 + x_2 x_3 + x_2 x_4 - c x_2 x_3 - c x_2 x_4$$

$$x_2' = x_2(x_1 + x_2 + x_3 + x_4) + c(x_1 x_4 - x_2 x_3)$$

$$x_2' = x_2 + c D_0$$

$$2. \quad D = x_1 x_4 - x_2 x_3$$

$$D = (0.3)(0.4) - (0.1)(0.2) = 0.1$$

$$D' = \frac{D}{D_{\max}}$$

$$D_{\max} = \text{lesser of } p_1 q_2 \text{ or } p_2 q_1$$

$$p_1 q_2 = x_2 + D = 0.1 + 0.1 = 0.2$$

$$p_2 q_1 = x_3 + D = 0.2 + 0.1 = 0.3$$

$$D' = \frac{0.1}{0.2} = 0.5$$

$$r^2 = \frac{D^2}{p_1 p_2 q_1 q_2}$$

$$r = \sqrt{\frac{0.1^2}{(0.4)(0.6)(0.5)(0.5)}} = \sqrt{\frac{0.01}{0.06}} = 0.408$$

$$3. \quad D_{t+1} = \frac{1}{2} \left\{ \frac{1+l+S}{2} + \left[ \left( \frac{1+l+S}{2} \right)^2 - 2Sl \right]^{0.5} \right\} D_t \text{ where } l = 1-2c$$

$$l = 1 - 2(0.1) = 0.8$$

$$D_{t+1} = \frac{1}{2} \left\{ \frac{1+0.8+0.9}{2} + \left[ \left( \frac{1+0.8+0.9}{2} \right)^2 - 2(0.9)(0.8) \right]^{0.5} \right\} 0.1 = 0.0984$$

$$D_{t+2} = \frac{1}{2} \left\{ \frac{1+0.8+0.9}{2} + \left[ \left( \frac{1+0.8+0.9}{2} \right)^2 - 2(0.9)(0.8) \right]^{0.5} \right\} 0.0984 = 0.0968$$

$$D_{t+3} = \frac{1}{2} \left\{ \frac{1+0.8+0.9}{2} + \left[ \left( \frac{1+0.8+0.9}{2} \right)^2 - 2(0.9)(0.8) \right]^{0.5} \right\} 0.0968 = 0.0953$$

$$4. \quad E(r^2) \approx \frac{1}{1+4N_e c}$$

$$E(r^2) \approx \frac{1}{1+4(500)(0.01)} = 0.048$$

$$5. \quad D = m_x m_y (p_{1,x} - p_{1,y})(q_{1,x} - q_{1,y})$$

$$D = (0.2)(0.8)(0.3 - 0.6)(0.4 - 0.5) = 0.0048$$