MLC Module 1 Section 9 Exercises

1. Given a 3-state model with $\mu_x^{01} = .05, \mu_x^{02} = .10, \mu_x^{12} = .20$, and all other forces of transition equal to zero, determine

   (a) ${}_5p_x^{00}$

   (b) ${}_5p_x^{01}$

   (c) ${}_5p_x^{02}$

2. Given a 2-state model with $\mu_{x+t}^{01} = .02t$ and $\mu_{x+t}^{10} = 0$, determine

   (a) ${}_{10}p_x^{00}$

   (b) ${}_{10}p_x^{01}$

3. Given a 3-state model with $\mu_{x+t}^{01} = .01 + .02t$ and $\mu_{x+t}^{02} = .02 + .04t$, determine

   (a) ${}_{10}p_x^{00}$

   (b) ${}_np_x^{10}$

   (c) ${}_kp_x^{11}$

   (d) ${}_{10}p_x^{02}$

4. Given a 4-state model with $\mu_x^{01} = \mu_x^{03} = \mu_x^{23} = .1, \mu_x^{10} = \mu_x^{12} = \mu_x^{13} = .2$, and all other forces of transition equal to zero, determine

   (a) ${}_0p_x^{01}$

   (b) ${}_5p_x^{\overline{11}}$

   (c) ${}_{10}p_x^{22}$

   (d) ${}_t\dot{p}_x^{23}$

   (e) ${}_t\dot{p}_x^{10}$

5. Given independent lives (x) and (y), where (x) is the husband and (y) is the wife, define the following states of the joint-life, last-survivor process:

   State 0: Both Husband and Wife are Alive
   State 1: Husband is Dead and Wife is Alive
   State 2: Husband is Alive and Wife is Dead
   State 3: Both Husband and Wife are Dead

   Suppose $\mu_{xy}^{01} = .01 = \mu_x^{23}, \mu_{xy}^{02} = .02 = \mu_y^{13}$, and all other forces of transition equal 0.

   Determine the probability that at the end of 5 years the husband is dead and the wife is alive.

6. Given a three state model with $\mu_x^{01} = .02, \mu_x^{10} = .01, \mu_x^{02} = .03 = \mu_x^{20}, \mu_x^{12} = .04$, and $\mu_x^{21} = 0$, you are given ${}_{0.5}p_x^{00} = .975$, ${}_{0.5}p_x^{01} = .010$, and ${}_{0.5}p_x^{02} = .015$

   (a) determine the value of ${}_{0.5}\dot{p}_x^{00}$ according to Kolmogorov differential equations.

   (b) use Euler's method with step size 0.1 to approximate ${}_{0.6}p_x^{00}$