MLC Module 1 Section 3 Exercises

ILT – Illustrative Life Table (the one provided on the exam)

1. Using the ILT, determine each of the following:
   
   (a) $\mathcal{P}_{25}$
   (b) $\mathcal{Q}_{33}$
   (c) $\mathcal{q}_{27}$
   (d) $\mathcal{q}_{38}$

2. Given $l_x = 500(100 - x)$ where $0 \leq x \leq 100$, determine
   
   (a) $\mathcal{P}_{50}$
   (b) $\mathcal{e}_0$
   (c) $\mathcal{e}_{27}$
   (d) $\mathcal{e}_{42}$

3. Given $l_x = 500(100 - x)^2$ where $0 \leq x \leq 100$, determine
   
   (a) $\mathcal{P}_{25}$
   (b) $\mu_{47}(18)$
   (c) $\mathcal{e}_{55}$

4. Suppose $l_x = 500(100 - x^2)$ where $0 \leq x \leq 10$, determine
   
   (a) $\mathcal{P}_{5}$
   (b) $\mathcal{e}_{7}$

5. Given a uniform distribution of deaths and $d_{10} = 500$, determine
   
   (a) $d_{x+5}$
   (b) $d_x$

6. Given a uniform distribution of deaths with $q_x = .02$, determine
   
   (a) $d_{10}$
   (b) $d_{5}$
   (c) $d_{10}$
   (d) $d_{x+5}$
7. Given a uniform distribution of deaths, \( l_{20} = 4000 \), and \( _{10}d_{50.25} = 500 \), determine

(a) the terminal age, \( \omega \), for this cohort of 20-year olds
(b) \( _{35}p_{40} \)

8. Given a collection of newborns with terminal age 100, deaths are uniformly distributed, but with different death rates over the age ranges (0,25), (25,75), and (75, 100). If there are 1000 newborns, with 500 surviving to become 25 year olds and 400 surviving to become 75 year olds, (i.e. \( l_0 = 1000 \), \( l_{25} = 500 \), and \( l_{75} = 400 \)) determine

(a) \( l_{15} \)
(b) \( l_{35} \)
(c) \( _{20}p_{15} \)

9. Given mortality for (30) is DML(90), determine

(a) \( E[T_{30}] \), the expected value of \( T_{30} \)
(b) \( Var(T_{30}) \), the variance of \( T_{30} \)

10. Given mortality for (x) is CF(.025), determine

(a) \( E[T_x] \), the expected value of \( T_x \)
(b) \( Var(T_x) \), the variance of \( T_x \)

11. Suppose \( l_x = 500e^{-0.02x} \), determine

(a) \( _t p_x \)
(b) \( _0 e_x \)
(c) \( e_x \)

12. Suppose \( l_x = 500(0.95)^x \), determine

(a) \( _t p_x \)
(b) \( _0 e_x \)
(c) \( e_x \)

13. Given \( k!q_x = 0.1(0.9)^k \), for \( k = 0, 1, 2, \ldots \), determine

(a) \( p_x \), \( 2p_x \), \( 3p_x \), and generally \( kp_x \)
(b) \( e_x \)