MLC Module 1 Section 2 Exercises

1. In each part, you are given $\mu_x(t) = 0.1(1.01)^{x+t}$ and assume that "moment" means in the next 12-hour period. Also assume there are 360 days in a year.

(a) approximate the probability that an 80-year old dies the moment after turning 80
(b) given ${}_{20}p_{60} = .018$, approximate the probability that a 60-year old survives to age 80 and then dies the moment after turning 80

2. Given ${}_tp_x = e^{-.05t}$, determine μ_{x+t}

3. Given ${}_tp_x = (.9)^t$, determine μ_{x+t}

4. Given ${}_tq_x = \frac{t}{100-x}$, determine μ_{50}

5. Given ${}_tp_x = \left(\frac{100-x-t}{100-x}\right)^2$, determine μ_{50}

6. Given ${}_tp_x = \left(\frac{100-x-t}{100-x}\right)^{1/2}$, determine μ_{50}

7. Given ${}_tp_0 = \begin{cases} 1, & 0 \le t < 1 \\ 1 - \frac{e^t}{100}, & 1 \le t < 4.5 \\ 0, & 4.5 \le t \end{cases}$ determine μ_4

8. Given $\int_0^{10} {}_tp_{20}\mu_{20+t}\, dt = .05$, determine ${}_{10}p_{20}$

9. Given ${}_{20}p_{30} = .85$ and $\int_0^{15} {}_tp_{50}\mu_{50+t} dt = .2$, determine ${}_{35}q_{30}$

10. Given $\int_{10}^{30} {}_tp_{30}\mu_{30+t} dt = \frac{2}{7}$ and ${}_{10}q_{30} = \frac{1}{7}$, determine ${}_{30}p_{30}$

11. Given $\mu_{20+t} = \frac{1}{60-t}$, $0 < t < 60$, determine ${}_{10}p_{20}$

12. Given $\mu_t = \frac{1}{80-t}$, $0 < t < 80$, determine ${}_{10}p_{20}$

13. Given $\mu_x = \sqrt{\frac{1}{100-x}}$, $0 < x < 100$, determine ${}_{17}p_{19}$

14. Given $\mu_{25+t} = 0.1(1-t)$ for $0 \le t \le 1$, determine p_{25}

15. Given $\mu_x = e^{2x}$, determine ${}_{0.4}p_0$

16. Given $\int_{71}^{75} \mu_x \, dx = .107$ and $\int_0^5 \mu_{70+t} dt = .189$, determine q_{70}

17. Given $\mu_x = .02$, determine ${}_3p_{x+10}$

18. Given $\mu_x = \begin{cases} .05 & 50 \le x < 60 \\ .04 & 60 \le x < 70 \end{cases}$, determine

(a) ${}_4q_{50}$
(b) ${}_{18}q_{50}$

19. Given smokers (s) have a constant force of mortality of 0.2 and non-smokers (ns) have a constant force of mortality of 0.1, determine

(a) ${}_{10}q_x^s$ (i.e. the probability that an x-year old smoker dies within 10 years)
(b) ${}_{10}q_x^{ns}$
(c) ${}_{10}q_x$ for a population of x-year olds, 30% of whom are smokers
(d) the 75th percentile of T_x for the population of x-year olds in part (c).

20. Given males (m) have a constant force of morality of 0.1 and females (f) have a constant force of mortality of 0.08, determine

(a) ${}_{60}p_0^m$ (i.e. the probability that a newborn male lives 60 years)
(b) ${}_{60}p_0^f$
(c) ${}_{60}p_0$ for a population of newborns, 50% of whom are male
(d) for the population of newborns in part (c) the proportion of 60-year olds who are male
(e) q_{60} for the population of newborns in part (c)

21. If the force of mortality, μ, is constant for (x), determine
(a) the expression for ${}_5p_x$, as a function of μ
(b) the value of ${}_5p_x$ if $\mu = .02$ for 30% of x-year olds, and $\mu = .03$ for the other 70%
(c) the value of ${}_5p_x$ if μ is drawn from the uniform distribution on the interval [0.01,0.02]

22. Given $\mu_x^m = \mu_x^f + .02$ and $p_x^m = .95$, determine p_x^f

23. Given $\mu_x^m = \mu_x^f + k$, ${}_{10}p_x^f = .74$, and ${}_{10}p_x^m = .64$, determine k.

24. Given $\mu_x^s = 1.1\mu_x^{ns}$ and ${}_kp_x^{ns} = .75$, determine ${}_kp_x^s$

25. Given $\mu_x^{ns} = c \cdot \mu_x^s$, ${}_kp_x^s = .54$, and ${}_kp_x^{ns} = .6$, determine c