

**Unless otherwise indicated, all lives in the following questions are subject to the same law of mortality and their times until death are independent random variables.**

1. For two lives with lifetime variables  $S$  and  $T$ , you are given that  $f(s, t) = (s+t)/125$  for  $0 < s < 5$ ,  $0 < t < 5$ .

Calculate  $p_{2:2}$ .

2. Three lives have independent future lifetimes. The forces of mortality are  $\mu_x(t) = 0.02$  for the first life,  $\mu_y(t) = 0.03$  for the second life, and  $\mu_z(t) = 0.04$  for the third life.

Calculate the probability that the first death from the three lives will occur at least five years from the current date, but no later than ten years from the current date.

3. For two lives with future lifetimes  $S$  and  $T$ , you are given

$$f(s, t) = \frac{s^2 + t}{540}, \quad 0 < s, t \leq 6$$

Calculate the probability that the joint status survives at least three years.

4. Let  $T$  be the random variable for the future lifetime of the joint status  $(x, y)$  where  $(x)$  is female and  $(y)$  is male.  $(x)$  and  $(y)$  are independent.

You are given:

1)  $\mu_x^F = (2 + x)^{-1}$  where  $\mu_x^F$  is the force of mortality for females.

2)  $\mu_y^M = a(2 + y)^{-1}$  where  $\mu_y^M$  is the force of mortality for males.

3)  $F_{T(3,2)}(20) = 179/180$ .

Calculate  $a$ .

5. For two lives (x) and (y) with independent future lifetimes, the force of mortality for each is 0.01.

Calculate  $\mu_{\overline{xy}|10}$ .

6. You are given:

1) Mortality follows De Moivre's law with  $w=105$ .

2) (45) and (65) have independent future lifetimes.

Calculate  $e_{\overline{45:65}}^{\circ}$ .

7. For a partnership for two partners, you are given:

1) The partnership is dissolved if either partner quits.

2) The probability that one of the partners will quit by time  $t$  is  $t/20$  for  $t < 20$ .

3) The probability that the other partner will quit by time  $t$  is  $t/10$  for  $t < 10$ .

4) The amounts of time until a partner quits are independent.

5) The partnership will be dissolved at the end of five years if not dissolved sooner due to a partner quitting.

Calculate the expected lifetime of the partnership.

8. Mortality for two lives follows De Moivre's law with  $w=105$ . Future lifetimes for the two lives are independent.

Calculate  $\mathbf{Cov}(T(35 : 30), T(\overline{35 : 30}))$ .

GOOD LUCK!