

Math 402 HW 4 Spring 2023. Due Friday, Feb. 24. Quiz 4 Wed. Feb. 22.

x	$q_x^{(1)}$	$q_x^{(2)}$	$q_x^{(\tau)}$	$p_x^{(\tau)}$	$l_x^{(\tau)}$	$d_x^{(1)}$	$d_x^{(2)}$
45	0.011	0.2			1000		
46	0.012	0.2					
47	0.013	0.2					
48	0.014	0.2					
49	0.015	0.2					
50	0.016	0.2					

1) a) Complete the above table (on a separate sheet of paper). Note that the initial group size is 1000.

b) Find  ${}_3p_{46}^{(\tau)}$ .

c) Find  ${}_2d_{47}^{(2)}$ .

d) Find  ${}_2q_{46}^{(1)}$ .

e) Find  ${}_2|q_{46}^{(\tau)}$ .

f) For a person of age 46, find  ${}_2|q_{46}^{(1)}$  = probability of failing in the 3rd year due to cause 1.

g) For a person of age 46, find  ${}_3|q_{46}^{(\tau)} = p_{K_x}(3)$  = probability of failure in 4th year.

2) A multiple decrement model with two causes of decrement has  $\mu_{x+t}^{(1)} = \frac{1}{100 - x - t}$  and  $\mu_{x+t}^{(2)} = \frac{2}{100 - x - t}$  where  $0 < t < 100 - x$ .

a) Find  $\mu_{x+t}^{(\tau)}$ .

b) Given  $-\int_0^t \frac{3}{100 - x - s} ds = \log \left[ \left( \frac{100 - x - t}{100 - x} \right)^3 \right]$ , find  ${}_tp_x^{(\tau)}$ .

3) A multiple decrement model with two causes of decrement has  $\mu_{x+t}^{(1)} = 0.01$  and  $\mu_{x+t}^{(2)} = 0.02$  where  $t > 0$ .

a) Find  $\mu_{x+t}^{(\tau)}$ .

b) Find  ${}_tp_x^{(\tau)}$ .

Hint: see old quiz 4.

4) For the **illustrative service table**, the four decrements are (d) for death, (w) for withdrawal, (i) for disability, and (r) for retirement. Use this table to find the following quantities.

a) Find  ${}_4p_{30}^{(\tau)}$ . b) Find  ${}_4d_{30}^{(d)}$ .

c) Find  ${}_4d_{30}^{(w)}$ . d) Using  ${}_4d_{30}^{(r)} = {}_4d_{30}^{(i)} = 0$ , show that  $l_{34}^{(\tau)} = l_{30}^{(\tau)} - {}_4d_{30}^{(d)} - {}_4d_{30}^{(w)} - {}_4d_{30}^{(r)} - {}_4d_{30}^{(i)}$ .

Problems 5, 20, 33, 36, 42, 43, 58, 70, 82, 83, 100, 103, 117, 133, 135, 138, 144, 160, 167, 178, 187, 202, 206, 216, 224, 232, 234 from the SOA MLC practice exam may cover ch. 9 topics.