ACSC/STAT 4720, Life Contingencies II
Fall 2016

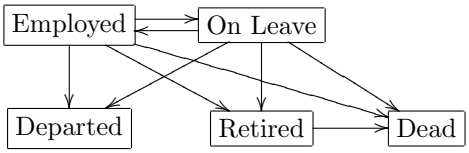
Toby Kenney

Homework Sheet 1

Due: Friday 30th September: 12:30 PM

Basic Questions

1. An insurance company is developing a new policy. The policy considers 4 states: Employed, On leave, Retired, and Dead. The transition diagram is shown below:



   Which of the following sequences of transitions are possible? (Indicate which parts of the transition sequence are not possible if the sequence is not possible.)

   (i) Employed—Departed—On leave—Dead

   (ii) Employed—Departed—Dead

   (iii) Employed—On leave—Employed—Retired

   (iv) Employed—On leave—Dead—Retired

   (v) Employed—On leave—Retired—Departed

2. Consider a permanent disability model with transition intensities

$$\mu_x^{01} = 0.004 + 0.000003x$$
$$\mu_x^{02} = 0.001 - 0.000001x$$
$$\mu_x^{12} = 0.002 + 0.000004x$$

   where State 0 is employed, State 1 is retired and State 2 is dead.

   (a) Calculate the probability that an employed individual aged 31 is still employed at age 44.

   (b) Calculate the probability that an employed individual aged 31 is dead by age 42.

3. Under a disability income model with transition intensities

$$\mu_x^{01} = 0.001$$
$$\mu_x^{10} = 0.002$$
$$\mu_x^{02} = 0.003$$
$$\mu_x^{12} = 0.005$$

calculate the probability that a healthy individual dies within the next 4 years. [State 0 is healthy, State 1 is sick and State 2 is dead.]

4. Under a critical illness model with transition intensities

$$\mu_x^{01} = 0.001$$
$$\mu_x^{02} = 0.001$$
$$\mu_x^{12} = 0.005$$

calculate the premium for a 5-year policy with premiums payable continuously while the life is in the healthy state, which pays a death benefit of \$130,000 upon entry into state 2, and a benefit of \$50,000 upon entry into state 1, sold to a life in the healthy state (state 0). The interest rate is $\delta = 0.04$ [State 0 is healthy, State 1 is sick and State 2 is dead.]

5. A whole life insurance policy can end either through death or withdrawl. The transition intensities are

$$\mu_x^{01} = 0.002 + 0.000003x$$
$$\mu_x^{02} = 0.001 + 0.000004x$$

Calculate the probability that an individual aged 43 withdraws from the policy before age 64. [State 0 is healthy, State 1 is withdrawn and State 2 is dead.]

Standard Questions

6. An insurance company is developing a new model for transition intensities in a disability income model. Under these transition intensities it calculates

$\overline{A}_{39}^{02} = 0.18$	$\overline{A}_{44}^{02} = 0.20$	$\overline{A}_{44}^{12} = 0.31$
$\overline{a}_{39}^{00} = 17.47$	$\overline{a}_{44}^{00} = 17.33$	$\overline{a}_{44}^{10} = 0.17$
$\overline{a}_{39}^{01} = 0.84$	$\overline{a}_{44}^{01} = 0.71$	$\overline{a}_{44}^{11} = 13.42$
${}_{10}p_{34}^{00} = 0.919$	${}_{10}p_{34}^{01} = 0.026$	$\delta = 0.04$

Calculate the premium for a 5-year policy for a life aged 39, with continuous premiums payable while in the healthy state, which pays a continuous benefit while in the sick state, at a rate of \$40,000 per year, and pays a death benefit of \$520,000 immediately upon death.