ACSC/STAT 3720, Life Contingencies I
Winter 2018

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Homework Sheet 1

Due: Friday 26th January: 12:30 PM

Basic Questions

1. An insurance company models the future lifetime of an individual as having survival function $S(x) = e^{-\left(\frac{x}{85}\right)^3}$. Calculate the force of mortality.

2. An insurance company models the future lifetime of an individual as having survival function $S(x) = e^{-\frac{x^2}{360}}$. Calculate:

   (a) The mean and standard deviation of T_x.

   (b) The mean curtate future lifetime.

3. An insurance company uses a survival model with survival function ${}_tp_x = \left(1 - \frac{t}{120-x}\right)^{\alpha}$. The company wants to ensure that under this model, an individual aged 60 has probability 0.5 of surviving for 20 years. What value of α should they choose?

4. An insurance company uses a survival model given by

$$S_0(x) = \frac{1}{3}\left(1 - \frac{x}{105}\right)^{\frac{1}{4}} + \frac{2}{3}\left(1 - \frac{x}{120}\right)^{\frac{1}{3}}$$

   Using this model, prepare a life table for the ages from 40 to 45, using radix 10,000.

5. Using the lifetable:

x	l_x	d_x
35	10000.00	3.91
36	9996.09	4.37
37	9991.72	4.91
38	9986.81	5.52
39	9981.30	6.21
40	9975.09	7.00

   calculate the probability that an individual aged 36 years and five months survives another 3 years, using:

   (a) the uniform distribution of deaths assumption.

   (b) the constant force of mortality assumption.

Standard Questions

6. An insurance company wants to use a model of mortality of the form $\mu_x = \frac{a}{120-x} + \frac{1}{m-x}$ for $x < 120$. The company wants to ensure that the life expectancy for an individual aged 65 is 15 years and that the force of mortality at age 45 is $\mu_{65} = \frac{1}{44}$. What values of a and m should they use to match these values.

7. An insurance company prepares the following lifetable for an individual.

x	l_x	d_x
40	10000.00	51.16
41	9948.84	59.96
42	9888.87	70.24
43	9818.64	82.19
44	9736.44	96.08
45	9640.36	112.16
46	9528.20	130.72
47	9397.48	152.04
48	9245.44	176.41
49	9069.03	204.11
50	8864.92	235.34

Prepare a new life table for this individual over the age range 45–50 using radix 10,000.