ACSC/STAT 3720, Life Contingencies I
Winter 2017

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Homework Sheet 1

Due: Friday 27th January: 12:30 PM

Basic Questions

1. An insurance company models the future lifetime of an individual as having survival function $S(x) = e^{-\left(\frac{x}{90}\right)^4}$. Calculate the force of mortality.

2. An insurance company models the future lifetime of an individual as having survival function $S(x) = e^{-\frac{x}{63}}$. 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 ${}_tp_x = \left(1 - \frac{t}{130-x}\right)^{\alpha}$. The company wants to ensure that the life expectancy of an individual aged 60 under this model is 20 years. What value of α should they choose?

4. An insurance company uses a survival model given by

$$S_0(x) = \frac{1}{2}\left(1 - \frac{x}{95}\right)^{\frac{1}{6}} + \frac{1}{2}\left(1 - \frac{x}{125}\right)^{\frac{1}{3}}$$

   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
50	10000.00	31.10
51	9968.90	34.75
52	9934.15	38.84
53	9895.30	43.44
54	9851.86	48.59
55	9803.28	54.35

   calculate the probability that an individual aged 50 years and three months survives another 4 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 $\mu_x = \frac{a}{100-x} + \frac{b}{125-x}$. Based on the company's data, an individual aged 65 has probability 0.874 of surviving to age 80, and the probability of an individual aged 45 surviving to age 65 is 0.921. It is extremely important for these properties to match the observed data. The company chooses the values of a and b to ensure that these observations are matched by the model. What values of a and b should they choose?

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

x	l_x	d_x
35	10000.00	23.49
36	9976.51	27.30
37	9949.21	31.76
38	9917.44	37.00
39	9880.44	43.14
40	9837.30	50.33

After an examination, it determines that the individual's probability of death in each year should be twice as much as that given in this table. Prepare a new life table for this individual over the same range using radix 10,000.