MATH 3630
Actuarial Mathematics I
Class Test 1 - 3:35-4:50 PM
Wednesday, 27 September 2017
Time Allowed: 1 hour
Total Marks: 100 points

Please write your name and student number at the spaces provided:

Name: _____   Student ID: _____

- There are ten (10) written-answer questions here and you are to answer all ten. Each question is worth 10 points.

- Please provide details of your workings in the appropriate spaces provided; partial points will be granted.

- Please write legibly.

- Anyone caught writing after time has expired will be given a mark of zero.

Question No. 1:

In a population today, all of equal age x, consisting of 25% non-smokers and 75% smokers, you are given:

- Mortality for non-smokers follows a constant force of mortality of 0.01.

- Mortality for smokers follows a constant force of mortality of $0.01h$, for some positive h.

- In 55 years, there will exactly be equal proportions of non-smokers and smokers.

Calculate h.

Question No. 2:

You are given:

- $_5p_x = 0.96$

- $_8p_x = 0.90$

Calculate $_3q_{x+5}$.

Question No. 3:

You are given the following survival function of a newborn:

$$S_0(x) = \exp\left[-(2x/15)^{3/4}\right], \quad \text{for } x \geq 0.$$

Calculate the force of mortality at age 45, μ_{45}.

Question No. 4:

For a life (x), you are given the following extract from a life table:

k	ℓ_{x+k}
0	10,000
1	9,875
2	9,625
3	9,275
4	8,775
5	8,025

Calculate $_{3|2}q_x$ and interpret this probability.

Question No. 5:

You are given:

- Mortality follows De Moivre's law with parameter ω.

- $\mathring{e}_{20:\overline{20|}} = 18$

Calculate $_{30|10}q_{30}$.

Question No. 6:

Suppose you are given the following extract from a life table:

x	ℓ_x
94	15,000
95	12,500
96	8,750
97	4,375
98	1,530
99	380
100	40
101	0

Calculate e_{95}.

Question No. 7:

You are given:

- The probability that (35) survives to reach age 50 is 0.83.

- The probability that (35) dies between the ages of 50 and 65 is 0.15.

- $\ell_{65} = 6800$

Calculate ℓ_{35}.

Question No. 8:

Mortality follows the Generalized De Moivre's law expressed as:

$$S_0(x) = \left(1 - \frac{x}{100}\right)^{1/2}, \text{ for } 0 \leq x \leq 100.$$

Calculate the probability that life (35) will die between ages 50 and 65.

Question No. 9:

The force of mortality for a substandard life (x) is expressed as

$$\mu_{x+t}^s = \mu_{x+t} + a,$$

for some constant $a > 0$, where μ_{x+t} is the force of mortality of a standard life (x).

You are given:

- The probability that a standard life (x) survives the next 10 years is 0.70.

- The probability that a substandard life (x) survives the next 10 years is 0.63.

Calculate the value of the constant a.

Question No. 10:

Please complete the rest of the life table below:

x	ℓ_x	d_x	p_x	q_x
96	100			
97	85			
98	65			
99	35			
100	0	na	na	na

na = not applicable

EXTRA PAGE FOR ADDITIONAL OR SCRATCH WORK