

**MATH 3630**  
**Actuarial Mathematics I**  
**Class Test 1 - 3:35-4:50 PM**  
**Wednesday, 30 September 2015**  
**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:**

For a life ( $x$ ), you are given  $\ell_x = 20,000$  and the following extract from a life table:

$k$	$d_{x+k}$
0	250
1	500
2	700
3	1000
4	1500

Calculate  ${}_{1|2}q_{x+1}$  and interpret this probability.

**Question No. 2:**

Suppose the force of mortality is:

$$\mu_x = c + e^x, \quad \text{for } x \geq 0 \text{ and } c > 0.$$

You are given:  $p_0 = 0.1623$ .

Calculate the value of  $c$ .

**Question No. 3:**

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.
- $l_{65} = 6800$

Calculate  $l_{35}$ .

**Question No. 4:**

You are given:

$$q_{65+k} = 0.02, \text{ for } k = 0, 1, 2, \dots$$

Calculate  $e_{65}$ , the curtate expectation of life for a person age 65.

**Question No. 5:**

Suppose the survival function for a newborn is given by

$$S_0(x) = e^{-0.002x^2}, \quad \text{for } x \geq 0.$$

Calculate  $\mu_{40}$ .

**Question No. 6:**

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

$$S_0(x) = \left(1 - \frac{x}{100}\right)^{2/3}, \text{ for } 0 \leq x \leq 100.$$

Calculate the probability that life (20) will die between ages 30 and 50.

**Question No. 7:**

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

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

Calculate  $e_{97:\overline{3}|}$ .



**Question No. 8:**

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

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

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

You are given:

- The probability that a standard life ( $x$ ) survives the next 5 years is 0.75.
- The probability that a substandard life ( $x$ ) survives the next 5 years is 0.40.

Calculate the value of  $c$ .

**Question No. 9:**

For a fixed age  $x$ , you are given the following probabilities:

- $p_x = 0.98$
- $p_{x+1} = 0.97$
- ${}_3p_{x+1} = 0.866$
- $q_{x+3} = 0.06$

Calculate  ${}_3p_x$ .

**Question No. 10:**

In a population consisting of 60% males and 40% females, you are given:

- Mortality for females has a constant force of  $\mu$ .
- Mortality for males also has a constant force of  $3\mu$ , three times that of females.
- Out of the survivors at the end of 10 years, the proportion of males is 50%.

Calculate the probability a female, of any age, survives a year.

EXTRA PAGE FOR ADDITIONAL OR SCRATCH WORK