

MATH 3630
Actuarial Mathematics I
Class Test 2 - Section 1/2
Wednesday, 14 November 2012, 8:30-9:30 PM
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:

You are given:

- An extract of a select and ultimate life table with a 2-year select period:

$[x]$	$l_{[x]}$	$l_{[x]+1}$	l_{x+2}	$x+2$
65	80,625	79,954	78,839	67
66	79,137	78,402	77,252	68
67	77,575	76,870	75,578	69

- During the select period, deaths follow a constant force of mortality over each year of age.
- After the select period, deaths are uniformly distributed over each year of age.

Calculate ${}_{0.5|3.25}q_{[65]}$ and interpret this probability.

Question No. 2:

Suppose you are given:

- $q_{50} = 0.0025$
- $q_{51} = 0.0030$
- $e_{51.6} = 29.1$
- Deaths are uniformly distributed over each year of age.

Calculate $e_{50.6}$.

DISCARD

Question No. 3:

For a whole life insurance of \$100 on (x) with benefits payable at the moment of death, you are given:

$$\delta_t = 0.05, \text{ for all } t > 0$$

and

$$\mu_{x+t} = \begin{cases} 0.005, & 0 < t \leq 7 \\ 0.010, & t > 7 \end{cases}$$

Calculate the actuarial present value for this insurance.

Question No. 4:

Mr. Ow Sum is currently age 40. His mortality follows De Moivre's law with $\omega = 110$.

He buys a temporary life insurance policy that pays him a benefit of \$100 at the moment of his death, if he dies within the next 25 years. No benefits are made if death occurs after 25 years.

You are given that $i = 3.5\%$.

Calculate the actuarial present value of his death benefit.

Question No. 5:

You are given:

- Z is the present value random variable for a 30-year pure endowment of \$100 issued to (35).
- Mortality follows the Illustrative Life Table.
- $i = 5\%$

Calculate $\text{Var}[Z]$.

Question No. 6:

A club consists of n members all age x today. The club has unanimously agreed that starting today:

- A pooled fund will be established to pay a death benefit of \$100 at the end of the year of death of each member.
- Each member will contribute a one-time amount of \$50 to this pooled fund.

You are given the following values: $A_x = 0.455$ and ${}^2A_x = 0.235$. Assume that no member will leave the club prior to death.

Using Normal approximation, determine the smallest n so that there is at least a 0.95 probability that the pooled fund will be sufficient to cover the present value of all promised death benefits.

Question No. 7:

For a whole life insurance of \$1,000 issued to (65), you are given:

- Death benefits are payable at the end of the year of death.
- Mortality follows the Illustrative Life Table with the exception of the first year where you are given that $q_{65} = 0.03$.
- The annual effective interest rate is 2% in the first year, 3% in the second year, and 6% each year thereafter.

Calculate the actuarial present value of the death benefits.

Question No. 8:

Leo is currently age 45 who purchases a special endowment insurance policy which will pay him:

- \$20,000 at the end of the month of his death, if death occurs during the next 15 years,
- \$10,000 at the end of the month of his death, if death occurs the following 5 years, and
- \$25,000 at the end of 20 years, if alive.

You are given:

- Mortality follows the **Standard Ultimate Survival Model**.
- $i = 5\%$
- Deaths are uniformly distributed between integral ages.

Calculate the actuarial present value of Leo's insurance benefits.

Question No. 9:

For a cohort of individuals all age x consisting of 75% non-smokers (ns) and 25% smokers (sm), you are given:

k	q_{x+k}^{ns}	q_{x+k}^{sm}
0	0.01	0.08
1	0.03	0.12
2	0.05	0.20

Calculate $A_{x:\overline{2}|}^1$ for a randomly chosen individual from this cohort. You are given: $i = 3\%$.

Question No. 10:

For a special whole life insurance on (40) , you are given:

- Death benefit is payable at the end of the year of death.
- Death benefit is \$2,000 during the first 10 years, and \$1,000 thereafter.
- Mortality follows the **Illustrative Life Table**.
- $i = 6\%$

Calculate the Actuarial Present Value of this insurance.

EXTRA PAGE FOR ADDITIONAL OR SCRATCH WORK