MATH 3630
Actuarial Mathematics I
Class Test 2
Friday, 14 November 2008
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:

Let T_x denote the future lifetime random variable for (x). You are given:

- T_x has an exponential distribution with parameter μ.
- Force of interest is constant at δ.
- $\bar{A}_x = 0.4118$.

Calculate ${}^2\bar{A}_x$.

Question No. 2:

You are given:

x	q_x	$\ddot{a}_x$
75	.03814	7.4927
76	.04196	7.2226

Calculate the interest rate i.

Question No. 3:

For a continuous whole life annuity of 1 on (x), you are given that:

- T_x, the future lifetime, has a constant force of mortality of 0.06;
- the force of interest is also constant at 4%.

Calculate $P\left(\bar{a}_{\overline{T_x}|} > \bar{a}_x\right)$. Interpret this probability.

Question No. 4:

For a group of 25 individuals all age x, you are given:

- their future lifetimes are independent;
- each individual is paid 10 at the beginning of each year, if alive;
- $A_x = 0.369131$;
- ${}^2A_x = 0.1774113$; and
- $i = 6\%$.

Using Normal approximation, calculate the size of the fund needed at inception in order to be 95% certain of having enough money to pay the life annuities. (Note: the 95^{th} percentile of a standard Normal is 1.645.)

Question No. 5:

You are given the following extracted from a mortality table:

x	q_x
40	.010
41	.015
42	.020
43	.025

Calculate $\ddot{a}_{40:\overline{3}|}$ if $i = 10\%$.

Question No. 6:

For a special type of whole life insurance issued to (40), you are given:

- death benefits are 1,000 for the first 5 years and 500 thereafter;
- death benefits are payable at the end of the year of death;
- mortality follows the *Illustrative Life table*; and
- $i = 6\%$.

Calculate the actuarial present value of the benefits for this policy.

Question No. 7:

After calculating the value of $\ddot{a}_x$ at interest rate $i = 5\%$, a student discovers that the value of p_{x+1} is larger by 0.03 than the value used in the initial calculation.

You are given the following values used in the initial calculation:

$$q_x = 0.01, \quad q_{x+1} = 0.05, \text{ and } \ddot{a}_{x+1} = 6.951.$$

Find the amount by which the value of $\ddot{a}_x$ is increased when the correct value of p_{x+1} is used.

Question No. 8:

Michel is currently age 40. His survival pattern follows DeMoivre's law with $\omega = 100$.

He purchases a three-year temporary life annuity that pays a benefit of 100 at the beginning of each year.

Compute the actuarial present value of his benefits if $i = 5\%$.

Question No. 9:

You are given:

- deaths are uniformly distributed over each year of age;
- $i = .06$;
- $q_{69} = 0.02$; and
- $\bar{A}_{70} = 0.53$.

Calculate $A_{69}^{(2)}$ and interpret this value.

Question No. 10:

You are given:

- $\ddot{a}_{60:\overline{10|}} = 6.4745$;
- $A^{\,1}_{60:\overline{10|}} = 0.0786$; and
- $d = 0.0909$.

Calculate the actuarial present value of a 10-year pure endowment issued to (60).

EXTRA PAGE FOR ADDITIONAL OR SCRATCH WORK