MATH 3630
Actuarial Mathematics I
Sample Test 2
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 three-year term life insurance on (x), you are given:

- Z is the present value random variable for the death benefits;

- death benefits are payable at the end of the year of death;

- discount rate $i = 5\%$; and

k	b_{k+1}	q_{x+k}
0	10	0.01
1	5	0.02
2	1	0.04

Calculate $E(Z)$.

Question No. 2:

Denote by Y the present value random variable for a whole life annuity-due on (x). You are given that $v = 0.8$ and

$$q_{x+k} = 0.1, \quad \text{for all } k = 0, 1, 2, \cdots .$$

Calculate the expected value of Y.

Question No. 3:

Cindy is currently age 35. Her mortality follows DeMoivre's law with $\omega = 120$.

She purchases a whole life insurance policy that pays a benefit of 1,000,000 at the moment of death.

Compute the actuarial present value of her death benefits if $i = 10\%$.

Question No. 4:

For a special type of whole life insurance issued to (30), you are given:

- death benefits are 1,000 for the first 10 years and 5,000 thereafter;

- death benefits are payable at the moment of death;

- deaths are uniformly distributed over each year of age interval;

- $i = 5\%$; and

- the following table of actuarial present values:

x	$1000A_x$	1000_5E_x
30	112.31	779.79
35	138.72	779.20
40	171.93	777.14

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

Question No. 5:

In a club of 100 membership all age x, the members decided to each contribute an amount of G to a fund which will pay 1,000 at the moment of death of each member.

You are given:

- the future lifetimes of the members are independent;

- $i = 10\%$, $\bar{A}_x = 0.06$, and $^2\bar{A}_x = 0.01$; and

- the members want the total contributions to be sufficient to pay the club's promised obligations with probability 0.95.

Using Normal approximation, calculate G. (Note that the 95th percentile of a standard Normal is 1.645.)

Question No. 6:

A person age 40 wins 100,000 in an actuarial lottery. Rather than receiving the money at once, the winner is offered the actuarially equivalent option of receiving an annual payment of H (at the beginning of each year) guaranteed for 10 years and continuing thereafter for life.

You are given that interest rate $i = 4\%$ and the following values extracted from a mortality table:

- $A_{40} = 0.23056$;

- $A_{50} = 0.32907$; and

- $A_{\substack{1 \\ 40:\overline{10|}}} = 0.01151$.

Calculate the value of H.

Question No. 7:

For a whole life insurance of 1,000 on (x) with benefit payable at the moment of death, you are given:

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

and

$$\mu_{x+t} = \begin{cases} 0.006, & 0 < t \leq 10 \\ 0.007, & t > 10 \end{cases}.$$

Calculate the actuarial present value for this insurance.

Question No. 8:

For a continuous whole life insurance issued to (x), you are given:

- forces of mortality and interest are each constant; and

- $E(v^{2T_x}) = \frac{1}{4}$ where T_x denotes the future lifetime of (x).

Calculate $\bar{A}_x$.

Question No. 9:

Suppose you are given that:

- mortality follows the *Illustrative Life Table*; and

- $i = 6\%$.

Approximate the value of $\ddot{a}^{(2)}_{40:\overline{30}|}$ and interpret this value.

Question No. 10:

You are given:

- $A_x = 0.5263$;

- $\ddot{a}_{x+1} = 9.618$; and

- $i = 5\%$.

Calculate q_x.

EXTRA PAGE FOR ADDITIONAL OR SCRATCH WORK