LAST NAME:_____________ FIRST NAME:_____________ STU. #:_____________

Concordia University

ACTU-257 Test 1, Thursday, February 4*th*, 2010

Duration: 75 min.

Present your solutions in the space provided. Use the back of pages if you need extra space. **Show all of your work**. The only aid permitted is a calculator. Good luck!
TOTAL MARKS: 32. The value of each question is indicated in parentheses.
Question 1 You are given

x	91	92	93	94	95	96	97
d_x	19	16	16	13	12	11	10

and $d_x = 0$ for $x = 98, 99, \ldots$ Find

(a) (2 marks) ${}_2q_{91}$.

(b) (2 mark) the variance of $K(95)$.

(c) (3 marks) the 2-year temporary complete life expectancy of $T(94)$ $e^o_{94:\overline{2}|}$ under UDD.

Question 2 You are given

$$f_{T(26)}(y) = \begin{cases} \frac{y}{800} & 0 \le y < 40 \\ 0 & otherwise. \end{cases}$$

Find

(b) (4 marks) the probability function of $K(63)$.

(c) (3 marks) $\mu(31+t)$.

Question 3 You are given

$$\mu(x) = \begin{cases} 0.01, & 0 \le x < 50 \\ \frac{1}{100-x}, & 50 \le x \le 100 \end{cases}$$

(a) (3 marks) Find the 10-year temporary curtate life expectancy of (31) given that he will die during this period.

(b) (4 marks) Find the complete-expectation-of-life e^o_{25}.

Question 4 If $q_{61} = 0.1$, $q_{62} = 0.2$, and $q_{63} = 0.3$, determine

(a) (3 marks) the probability that (61.2) will die between ages 61.5 and 62.4, under the uniform distribution of deaths (UDD) assumption in each year of age.

(b) (3 marks) the probability that (61.5) will die before age 63.4, under the Balducci assumption in each year of age.

Question 5 (5 marks) You are given the following information:

- the select period is 3 years
- $e_{[92]+2} = 1.86$ and $e_{96} = 1.5$
- $q_{[x]+k} = \left(0.9^{3-k}\right) q_{x+k}$ for $k = 0, 1, 2$ and all x
- ${}_2p_{94} = 0.44$

Find p_{95}.

LAST NAME:_____________ FIRST NAME:_____________ STU. #:_____________

Concordia University

ACTU-257 Test 2, Thursday, March 25*th*, 2010

Duration: 75 min.

Present your solutions in the space provided. Use the back of pages if you need extra space. **Show all of your work**. The only aid permitted is a calculator. Good luck!
TOTAL MARKS: 39. The value of each question is indicated in parentheses.
Question 1 (9 marks) You are given that $d = 10\%$ and

x	60	61	62	63	64	65
l_x	600	550	500	400	300	200

Let Z denote the present value random variable of a special 4-year endowment insurance issued to (60). The insurance death benefits (payable at the end of the year of death) are given by: $b_1 = 100$, $b_2 = 90$, $b_3 = 80$, and $b_4 = 70$. The survival benefit is 100.

(a) (2 marks) Define the present value random variable Z.

(b) (4 marks) Determine $Var\left[Z\right]$.

(c) (3 marks) Determine $\Pr\left[Z \leq 65\right]$.

Question 2 (11 marks) The following continuous policies with benefits payable at the moment of death are issued to (55):
Z_1= Present value random variable of a 10-year deferred, 20-year term life insurance of $100
Z_2=Present value random variable of a 20-year endowment insurance of $1000.
You are given that the force of mortality $\mu(x)$ is 2% for all x and $\delta = 8\%$.

(a) (4 marks) Define Z_1 and sketch the graph of Z_1 and identify the starting as well as ending values of each segment.

(b) (4 marks) Give an expression for $Cov[Z_1, Z_2]$ in terms of actuarial symbols.

(c) (3 marks) Find $P[Z_1 \leq 30]$.

Question 3 (9 marks) Consider a life insurance policy that pays \$100 at the end of the year of death if death occurs during the first 10 years, and \$300 at the moment of death if the death occurs after 20 years. Suppose the mortality follows DeMoivre's law with $\omega = 102$, $(x) = (55)$, and δ is 5%.

(a) (2 marks) Define the present value random variable Z.

(b) (2 marks) Give an expression for $Var[Z]$ in terms of actuarial symbols.

(c) (5 marks) Find $P[Z \leq 90]$.

Question 4 (10 marks) A fully discrete 30-year temporary life annuity-immediate paying \$1000 annually is issued to (50). You are given:

- $\mu(x) = \begin{cases} \frac{1}{100-x}, & 0 \leq x < 60 \\ 0.025, & x \geq 60 \end{cases}$
- $i = 5\%$

(a) (2 marks) Define the present value random variable Y of this annuity.

(b) (5 marks) Determine the actuarial present value of this annuity.

(c) (3 marks) Find $P[Y \leq 3500]$.