Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016

COURSE NAME	:	ACTUARIAL MATHEMATICS I
COURSE CODE	:	BWA 31403
PROGRAMME CODE	:	BWA
EXAMINATION DATE	:	JUNE / JULY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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Q1 (a) Actuaries apply scientific principles and techniques to problems involving risks and others. List out the other two problems which involve actuaries.

(2 marks)

(b) Describe the meaning of *term insurance*. Also, clarify the advantage of convertible term insurance.

(6 marks)

(c) Consider a new entrant to a life insurance where the benefit is payable on death. Analyze the major risk for the insurance company. Justify your answer.

(3 marks)

(d) Actuarial science has developed its own notation for survival probabilities and mortality probabilities.

Formulate the meaning of these sentences to actuarial notations.

(i) The probability that (u) dies before age $u + x$.
(ii) The probability that (u) survives to at least age $u + x$.
(iii) The probability that (u) survives t years, and dies in the subsequent x years.

(6 marks)

(e) On the basis of the application and supporting medical information, potential life policyholders will generally be categorized into four different groups. Determine the four groups and elaborate each group considerably.

(8 marks)

Q2 Let $S_0(t) = \left(1 - \frac{t}{100}\right)^{\frac{1}{5}}$.

(a) Determine the implied limiting age, t.

(5 marks)

(b) Calculate to five decimal places,

(i) the probability that a newborn life survives beyond age 25,
(ii) the probability that a life aged 25 dies before age 55,
(iii) the probability that a life aged 35 survives beyond age 70,
(iv) the force of mortality at age 60.

(20 marks)

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Q3 (a) An insurance on a life aged 25 pays a sum of RM 7025 on survival to age 60. Based on 6% annual rate of interest,

(i) determine $A_{25:35]}^{1}$,

(ii) find the present value of the insurance,

(iii) revise the standard deviation of the insurance.

(10 marks)

(b) A whole life insurance with a sum insured RM 4275 payable at the moment of death is taken out by a person aged 30. Using a 6% annual interest,

(i) find $\overline{A}_{30}$,

(ii) determine the present value of the insurance,

(iii) revise the standard deviation.

(10 marks)

(c) A person aged 40 buys an annuity-immediate of RM 5550 per annum, whose payments start at the end of year 10 and go on for 20 years, while the insured is still alive. Based on 6% annual rate of interest, produce the present value of the annuity.

(5 marks)

Q4 (a) The net premiums are determined by two factors which are beyond the control of an insurance company. List out the two factors.

(3 marks)

(b) The following insurance is issued to a life aged 40. If the insured dies within 20 years, a death benefit of RM 7000 is payable at the end of the year of death. Otherwise, a sum of RM 3000 is payable yearly in advance from the age of 60. By 6% annual rate of interest,

(i) determine $A_{40:20]}^{1}$,

(ii) find ${}_{20|}\ddot{a}_{40}$.

(iii) Finally, calculate the net single premium for the insurance.

(12 marks)

(c) A person aged 35 takes out a 20 year pure endowment insurance of RM 45000. Based on 6% annual rate of interest, determine the annual premium.

(10 marks)

- END OF QUESTION -

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FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2015/2016 PROGRAMME : BWA
COURSE : ACTUARIAL MATHEMATICS 1 COURSE CODE : BWA 31403

$${}_tp_x = \frac{l_{x+t}}{l_x} \qquad d_x = l_x - l_{x+1} \qquad d_x = l_x q_x \qquad \mu_x = -\frac{S'(x)}{S(x)}$$

$${}_t p_x = \Pr[T_x > t] = S_x(t) = \frac{s(x+t)}{s(x)}$$

$${}_t q_x = \Pr[T_x \le t] = 1 - S_x(t) = 1 - \frac{s(x+t)}{s(x)} = F_x(t)$$

$${}_{t|u} q_x = \Pr[t < T_x \le t+u] = \frac{s(x+t) - s(x+t+u)}{s(x)}$$

$${}_nE_x = \frac{v^{x+n}\, l_{x+n}}{v^x l_x}$$

$$A_{x:n}^{1} = {}_nE_x = \frac{D_{x+n}}{D_x} \qquad V(A_{x:n}^{1}) = v^n\, {}_nE_x - {}_nE_x^2 = v^n(1 - {}_nP_x)\, {}_nE_x$$

$$A_x = \frac{M_x}{D_x} \qquad V(A_x) = {}^2A_x - (A_x)^2$$

$$A_{x:n}^{1} = \frac{M_x - M_{x+n}}{D_x} \qquad V(A_{x:n}^{1}) = {}^2A_{x:n}^{1} - (A_{x:n}^{1})^2 \qquad {}^2A_{x:n}^{1} = {}^2A_x - v^n\, {}_nE_x\, {}^2A_{x+n}$$

$${}_m|A_x = \frac{M_{x+m}}{D_x} \qquad V({}_m|A_x) = {}^2_m|A_x - ({}_m|A_x)^2 \qquad {}^2_m|A_x = v^m\, {}_mE_x\, {}^2A_{x+m}$$

$$\overline{A}_x^1 = (1+i)^{\frac{1}{2}} A_x^1 \qquad V(\overline{A}_{x:n}^{1}) = (1+i)\,({}^2A_x - (A_x)^2)$$

$$\ddot{a}_{x:n} = \frac{N_x - N_{x+n}}{D_x} \qquad V(\ddot{a}_{x:n}) = \frac{1}{d^2}({}^2A_{x:n} - (A_{x:n})^2)$$

$${}_m|a_x = \frac{N_{x+m+1}}{D_x} \qquad {}_m|\ddot{a}_x = \frac{N_{x+m}}{D_x} \qquad P_{x:n}^{1} = \frac{A_{x:n}^{1}}{\ddot{a}_{x:n}}$$

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