

Dept of Mathematics and Statistics
King Fahd University of Petroleum & Minerals

AS381: Actuarial Contingencies I
Dr. Mohammad H. Omar
Major 3 Exam Term 141 FORM B
Wednesday December 03 2014
5.30pm-7.00pm

Name _____ ID#: _____ Serial #: _____

Instructions.

1. Please turn off your cell phones and place them under your chair. Any student caught with mobile phones on during the exam will be considered under the **cheating rules** of the University.
2. If you need to leave the room, please do so quietly so not to disturb others taking the test. No two person can leave the room at the same time. No extra time will be provided for the time missed outside the classroom.
3. Only materials provided by the instructor can be present on the table during the exam.
4. Do not spend too much time on any one question. If a question seems too difficult, leave it and go on.
5. Use the blank portions of each page for your work. Extra blank pages can be provided if necessary. If you use an extra page, indicate clearly what problem you are working on.
6. Only answers supported by work will be considered. Unsupported guesses will not be graded.
7. While every attempt is made to avoid defective questions, sometimes they do occur. In the rare event that you believe a question is defective, the instructor cannot give you any guidance beyond these instructions.
8. Mobile calculators, I-pad, or communicable devices are disallowed. Use regular scientific calculators or financail calculators only. Write important steps to arrive at the solution of the following problems.

The test is 90 minutes, GOOD LUCK, and you may begin now!

Question	Total Marks	Marks Obtained	Comments
1	3+3+4=10		
2	6		
3	10		
4	4+5=9		
5	3+3+4=10		
6	4+1=5		
Total	50		

Extra blank page

1. (3+3+4=10 points) Consider the following portfolio of annuities-due currently being paid from the assets of a pension fund.

Age	Number of Annuitants
60	40
70	30
80	20

Each annuity has an *annual* payment of 1 as long as the annuitant survives. Assume an earned interest rate of $i = 6\%$ and a mortality as given in the Illustrative Life Table. For the present value of these obligations of the pension fund and assuming the lives are mutually independent, calculate the

- expectation
- variance
- 95th percentile of its approximate distribution.

2. (6 points) A 40-year-old home buyer takes out a 25-year mortgage of 100 000 at an interest rate $i = 5\%$, and purchases a 25-year decreasing term insurance contract with a death benefit that will exactly pay off the mortgage at the end of the year of death of the borrower. Calculate the net level annual premium for the term insurance, given the following values:

$$\ddot{a}_{40:25|} = 14$$

$${}_{25}p_{40} = 0.80$$

3. (5*2=10 points) A 10-year term insurance issued to (30) for amount 10 000 has benefit paid at the end of the year of failure. Level true fractional premiums are determined under the equivalence principle and the UDD assumption. Calculate the difference (keep accuracy to four decimals) between the annual premium rate if premiums are paid monthly versus semiannually, given the following values:

$$A^1_{30:\overline{10}|} = 0.015$$

$$\ddot{a}_{30:\overline{10}|} = 8$$

$${}_{10}E_{30} = 0.604$$

$$i = 0.05.$$

4. (4+5=9 points) A fully continuous whole life insurance unit benefit has a level premium. The time until death random variable, $T(x)$ has an exponential distribution with $E[T(x)] = 25$ and the force of interest is $\delta = 0.06$.

- a) If the principle of equivalence is used, find the benefit premium rate.
- b) Find the premium rate if it is to be such that $\Pr(L > 0) = 0.50$.

5. (3+3+4=10 points) On the basis of the Illustrative Life Table and an interest rate of 6%, calculate values for the annual premiums in the following table.

i) $P_{35:\overline{25}|}$

ii) $P(\overline{A}_{35:\overline{25}|})$

iii) $\overline{P}(\overline{A}_{35:\overline{25}|})$

Note any patterns of inequalities that appear in the matrix of results.

6. (4+1=5 points) For a special fully discrete 10-payment whole life insurance on (40), you are given:

- (i) The death benefit in the first 10 years is the refund of all benefit premiums paid with interest at 6%.
- (ii) The death benefit after 10 years is 1000.
- (iii) Level benefit premiums are payable annually for 10 years.
- (iv) Mortality follows the Illustrative Life Table.
- (v) $i = 0.06$.

Calculate the benefit premium P .

- (A) 17.2
- (B) 17.4
- (C) 17.6
- (D) 17.8
- (E) 18.0

(Hint: keep as many decimal points in your interim calculation (i.e. store in your calculator memory buttons) so that your final answer is precise to at least 2 decimal places).

Final answer (1 point) + Work shown (4 points)

Answer is ____

END OF TEST PAPER