

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

AS381: Actuarial Contingencies I  
Dr. Mohammad H. Omar  
Major 2 Exam Term 141 FORM A  
Wednesday November 12 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+3=9		
2	3+3+4=10		
3	6		
4	5		
5	5		
6	4+1=5		
Total	40		

Extra blank page

1. (3+3+3=9 points) Assume mortality is described by  $l_x = 100 - x$  for  $0 \leq x \leq 100$  and that the force of interest is  $\delta = 0.04$ .

a) Calculate  $\bar{A}_{1 \overline{40:25}|}$

b) Determine, at policy issue, the actuarial present value for a 25-year term insurance with benefit amount,  $b_t = e^{0.04t}$ , for death at time  $t$  of a person aged 40.

c) Assuming uniform distribution of death (UDD) at each age, calculate  $A_{1 \overline{40:25}|}$ .

2. (3+3+4=10 points) Under the assumptions of a constant force of mortality,  $\mu = 0.02$ , and a constant force of interest,  $\delta = 0.03$ , a whole life annuity on (40) is made.

Calculate

- a)  $\bar{a}_{40} = E[\bar{a}_{\overline{T}|}]$
- b)  $Var(\bar{a}_{\overline{T}|})$
- c) The probability that  $\bar{a}_{\overline{T}|}$  will exceed  $\bar{a}_{40}$ .

3. (6 points) A student loan of amount 10 000 is amortized over 20 years by continuous repayments at  $\delta_1 = 0.08$ . The loan is subject to default at a constant force of default  $\lambda = 0.01$ . A government agency guarantees (insures) the outstanding balance of the loan by paying at the moment of default on behalf of the borrower in case of a default. Using a force of interest  $\delta_2 = 0.05$ , calculate the APV of the guarantee. (Hint: consider the loan default as the random loss event).

4. (5 points) Calculate  $A_{77}$ , given that  $A_{76} = 0.800$ ,  $v.p_{76} = 0.90$  and  $i = 0.03$ .

5. (5 points) A benefit of 50000 is paid at the precise time of failure,  $t$  of an ARAMCO oil drilling instrument. The PDF of  $T_x$ , the random variable for time of failure, is given by

$$f_x(t) = \begin{cases} \frac{t}{50000} & \text{for } 0 < t \leq 100 \\ 0 & \text{otherwise} \end{cases}$$

Using the force of interest  $\delta = 0.10$ , find the APV of the benefit.

6. (4+1=5 points) You are given:

- (i) The force of mortality follows Gompertz's law with  $B = 0.000005$  and  $c = 1.2$ .
- (ii) The annual effective rate of interest is 3%.

Calculate  $A_{\overline{1}|50:\overline{2}|}$ .

- (A) 0.1024
- (B) 0.1018
- (C) 0.1009
- (D) 0.1000
- (E) 0.0994

(Hint: keep as many decimal points in your interim calculation so that your final answer is precise to at least 4 decimal places).

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

END OF TEST PAPER

So Answer is \_\_\_\_\_