

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

AS381: Actuarial Contingencies I
Dr. Mohammad H. Omar
Major 2 Exam Term 161 FORM A
Wednesday November 30 2016
6.00pm-7.20pm

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 80 minutes, GOOD LUCK, and you may begin now!

Question	Total Marks	Marks Obtained	Comments
1	4+3+3=10		
2	8		
3	4+4=8		
4	7		
5	4+4+4=12		
6	4+1=5		
Total	50		

Extra blank page

1. (4+3+3=10 points) Assume mortality is described by $l_x = 80 - x$ for $0 \leq x \leq 80$ and that the force of interest is $\delta = 0.04$.

a) Calculate $(\bar{IA})_{30:\overline{3}|}$

b) Determine, at policy issue, the actuarial present value for a 3-year term insurance with benefit amount, $b_t = e^{0.04t}$, for death at time t of a person aged 30.

c) Assuming uniform distribution of death (UDD) at each age, calculate $(IA)_{30:\overline{3}|}$.

2. (8 points) A house mortgage loan amount, L , of 300 000 is amortized over 20 years by *continuous* repayments at $\delta_t = 0.08$. The loan is subject to default at a constant **force of default** $\mu = 0.01$. An insurance 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 **actuarial present value** (APV) of the guarantee. (Hint: consider the *loan default* as the *random loss* event and use the *outstanding balance*, OB_t , as the *benefit amount* b_t).

3. (4+4=8 points) On the basis of the Illustrative Life Table with interest at the effective annual rate of 6%, calculate the values of

(i) $\ddot{a}_{40:\overline{25}|}^{(12)}$

(ii) $\dot{s}_{40:\overline{25}|}^{(12)}$

Work Shown (3 points each) and final answer (1 points each)

4. (7 points) Calculate the **actuarial present value** for a 25 year term insurance providing the death benefit of 10000 at the moment of death of a person age 40 at issue of the policy. Use the illustrative Life Table, the *uniform distribution of deaths* over each year of age assumption, and $i = 0.05$. By using this Table, we also know that $A_{\overline{42:23}|} = 0.09344772$.

5. (4+4+4=12 points) A 30 year **deferred** whole life annuity contract on (25) is made under the following assumptions of:

- (i) a constant force of mortality, $\mu = 0.075$, and
- (ii) a constant force of interest, $\delta = 0.025$.

Given these assumptions, calculate

- a) The mean present value of the contract, ${}_{30|\bar{a}}_{25} = E[\bar{a}_{\overline{T}|}]$
- b) The variance of the present value of the contract, $Var(\bar{a}_{\overline{T}|})$
- c) The probability that $\bar{a}_{\overline{T}|}$ will exceed ${}_{30|\bar{a}}_{25}$.

6. (4+1=5 points) For a life table with a one-year select period, you are given:

x	$l_{[x]}$	$d_{[x]}$	l_{x+1}	${}^o e_{[x]}$
(i) 80	1000	90	-	8.5
81	920	90	-	-

(ii) Deaths are uniformly distributed over each year of age.

Calculate ${}^o e_{[81]}$.

a) 8.0

b) 8.1

c) 8.2

d) 8.3

e) 8.4

Work Shown (4 points)

Hence the answer is ()

END OF TEST PAPER