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

AS381: Actuarial Contingencies I
Dr. Mohammad H. Omar
Major 2 Exam   Term 151   FORM A
Tuesday November 10 2015
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	3+3+3+3=12		
2	4+2+4=10		
3	6		
4	3+4=7		
5	3+3+4=10		
6	4+1=5		
Total	50		

Extra blank page

1. (3+3+3+3=12 points) The p.d.f of the future lifetime, T, for (x) is assumed to be

$$f_T(t) = \begin{cases} 1/90 & 0 \le t \le 90 \\ 0 & \text{elsewhere.} \end{cases}$$

At a force of interest, $\delta = 0.04$, the present value random variable for a whole life insurance of unit amount issued to (x) is $Z = v^T$. Calculate

(a) The actuarial present value, $E[Z]$

(b) The variance, $Var(Z)$

(c) The cumulative density function (cdf) of Z.

(d) The 90th percentile of Z, $\xi_Z^{0.9}$.

2. (4+2+4=10 points) On the basis of the Illustrative Life Table and $i = 0.05$, determine the **mean** and **variance** of the present value random variable for a 10 year term insurance with a unit benefit payable at the **end of the year** of death issued on (30).

In order to do this, you have used the following table and a recursive relationship to get the following partial results.

a) Complete the blank cells (Be sure to show your work for at least one cell in each column)

x	k	$A^1_{30+k:\overline{10-k}|}$	$^2A^1_{30+k:\overline{10-k}|}$
31	1	0.014188835	0.01117267
32	2	0.013310792	0.010726226
33	3	0.0123007	
34	4	0.011143011	0.009410551
35	5		0.008493253
36	6	0.008314985	0.007365042
37	7	0.006604669	0.005992584
38	8		
39	9		
40	10		

b) Find the **mean** present value of this contract.

c) Find the **variance** of the present value of this contract.

3. (6 points) A policy is issued at age 20 with the following graded scale of death benefits payable at the moment of death.

Age	Death Benefits
20	1000
21	2000
22	4000
23	6000
24	8000
25 - 40	10000
41 and over	50000

Calculate the actuarial present value on the basis of the **illustrative Life Table** (ILT) with **uniform distribution of deaths** over each year of age and $i = 0.06$ [hint: use the correct parts of the ILT].

4. (3+4=7 points) Using the assumption of a **uniform distribution of deaths** in each year of age and the **Illustrative Life Table** (ILT) with interest at the effective annual rate of 6%, calculate

(a) $\bar{a}_{25}$ and $\bar{a}_{85}$

(b) $Var\left(\bar{a}_{\overline{T}|}\right)$ for $x = 25,\ 85$.

5. (3+3+4=10 points) A whole life annuity contract on (30) 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, $\bar{a}_{30} = E[\bar{a}_{\overline{T}|}]$

b) The variance of the present value of the contract, $Var\left(\bar{a}_{\overline{T}|}\right)$

c) The probability that $\bar{a}_{\overline{T}|}$ will exceed $\bar{a}_{30}$.

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

(i) The force of mortality follows Makeham's law where $A = 0.00020$, $B = 0.000003$ and $c = 1.10000$.

(ii) The annual effective rate of interest is 5%.

Calculate $_{1|}a_{70:\overline{2}|}$.

(a) 1.73

(b) 1.76

(c) 1.79

(d) 1.82

(e) 1.85

(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)

So Answer is (__)

END OF TEST PAPER