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

AS381: Actuarial Contingencies I
Dr. Mohammad H. Omar
Major 3 Exam Term 151 FORM
Wednesday December 09 2015
5.10pm-6.40pm

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	6+5=11		
2	3+3+4+3=13		
3	7+4=11		
4	5+5=10		
5	3+3+4=10		
6	4+1=5		
Total	60		
Bonus	6		

Extra blank page

1. (6+5=11 points) Under the assumptions that the force of mortality is a constant $\mu = 0.04$, the force of interest $\delta = 0.06$, and a 10-year term insurance contract, calculate

   a) $\overline{P}(\bar{A}^{1}_{x:\overline{10}|})$ and

   b) $Var(L)$.

2. (3+3+4+3=13 points) Consider a **fully discrete** whole life insurance with benefit of 1000 . Let π denote an annual premium for this policy and $L(\pi)$ denote the loss at issue random variable for one such policy on the basis of the Illustrative Life Table, 6% interest and issue age 35.

(a) Determine the premium π_a, such that the distribution of $L(\pi_a)$ has mean 0.

(b) Calculate the variance of $L(\pi_a)$.

(c) Approximate the smallest non negative premium π_b, such that the probability is less than 0.5 that the loss $L(\pi_b)$ is positive.

(d) Find the variance of $L(\pi_b)$.

3. (7+4=11 points) A 20 years endowment insurance contract issued to (30) has proceeds (or benefits) of 10000 paid in the event of death. Mortality is based on the Illustrative Life Table with interest at the effective annual rate of 6%. Assuming a uniform distribution of deaths (UDD) in each year of age:

(a) Calculate the level annual benefit **premium** payable in **semiannual** installments with proceeds paid **at the end** of the policy **year of death**.

(b) Determine the corresponding **premium** payable in **semiannually** with proceeds paid at the **moment of death**.

4. (5+5=10 points) If interest is at the effective annual rate of 5% and $\overline{P}(\overline{A}_x) = 0.03$, calculate

   a) the present value of an annuity contract payable semiannually with **apportionable** feature.

   b) the semiannual benefit premium for a 50000 whole life insurance on (x) where premiums are **apportionable**.

5. (3+3+4=10 points) On the basis of De Moivre's law with $l_x = 100 - x$ and the interest rate of 6%, calculate

(a) $\bar{P}\left(\bar{A}_{30}\right)$
(b) ${}_{15}\overline{V}\left(\bar{A}_{30}\right)$ and $Var[{}_{15}L|T(30) > 15]$

6. (4+1=5 points) For a fully continuous whole life insurance of 1 on (x), you are given:

(i) The forces of mortality and interest are constant.
(ii) ${}^2\bar{A}_x = 0.20$
(iii) The benefit premium is 0.03.
(iv) ${}_0L$ is the loss-at-issue random variable based on the benefit premium.
Calculate $Var({}_0L)$.

(A) 0.24
(B) 0.23
(C) 0.22
(D) 0.21
(E) 0.20

(Hint: keep as many decimal points in your interim calculation (i.e. store in your calculator memory butttons) so that your final answer is precise to at least 4 decimal places).
Final answer (1 point)
Work shown (4 points)

Answer is (__)

END OF TEST PAPER

9. (Bonus question = 6 points) Consider a **fully discrete** whole life insurance with benefit of 1000 . Let π_c denote an annual premium for this policy and $L(\pi_c)$ denote the loss at issue random variable for one such policy on the basis of the Illustrative Life Table, 6% interest and issue age 35.

Determine the premium π_c, such that the probability of a positive total loss on 100 such independent policies is 0.05 by the normal approximation.