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

AS381: Actuarial Contingencies I
Dr. Mohammad H. Omar
Major 1 Exam Term 181 FORM A
Monday October 8 2018
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+1=7		
2	4+6=10		
3	4+4+3=11		
4	5+4=9		
5	4+4=8		
6	4+1=5		
Total	50		

Extra blank page

1. **(3+3+1=7 points)** A property will not be damaged in a fire in the next year with a probability of 0.85. The probability density function (pdf) of a positive loss to fire is given by

$$f(x) = 0.15\left(\frac{1}{100}e^{-x/100}\right) \qquad x > 0.$$

(That is, loss has a mixed probability distribution with point mass at $P(X = 0) = 0.85$). The utility function of the property owner is given by

$$u(w) = -e^{-0.005w-1/20} \qquad w \geq 0.$$

Calculate

a) the Expected Loss

b) the insurance **premium** for complete insurance the property owner is indifferent to pay .

c) provide mathematical support why the premium in (b) is a **maximum**.

2. (4+6=10 points) For a marine insurance policy, the probability q of **a claim** is $1/10$ and B, the **benefit amount** given that there is a claim, has a p.d.f.

$$f(y) = \begin{cases} 5e^{-5y} & y > 0 \\ 0 & \text{elsewhere.} \end{cases}$$

Calculate
a) the **Expected** claims $X = IB$.
b) the **Variance** of claims X.

3. (4+4+3=11 points) Independent loss random variables due to automobile accident, X_k, for thirty lives have the same continuous probability density function (pdf) given by

$$f(x_i) = \begin{cases} 0 & x \leq 0 \\ 0.01e^{-0.01x} & x > 0. \end{cases}$$

The insurance company defines the sum, $S = \sum_{i=1}^{30} X_i$ and found the following for the pdf of the partial sum, $S_{29} = \sum_{i=1}^{29} X_i$,

$$f_{S_{29}}(x) = \begin{cases} 0 & x \leq 0 \\ \frac{(0.01)^{28}}{28!} x^{28} e^{-0.01x} & x > 0. \end{cases}$$

a) Using the the **convolution method** with the partial sum, S_{29} above, find the pdf of the sum $S = \sum_{i=1}^{30} X_i$.
b) Use the **Central Limit Theorem** to find the approximate distibution for S.
c) Find the probability $P(S > 3500)$ using (b) above. Given that the answer using (a) is 0.177045, how close is your answer.

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4. **(5+4=9 points)** Given that $\mu_x = \dfrac{2}{x+1} + \dfrac{2}{100-x}$, for all $0 \leq x \leq 100$, in a life table with a radix (or l_0) of 10000, find

   a) the expected number of failures which occur between ages 1 and 4.

   b) the value of ${}_{5|2}q_4$.

5. **(4+4=8 points)** Using the illustrative life-table provided and assuming UDD (Uniform Distribution of Death) within each year is valid, calculate the following:

a. probability that (25) will die between ages 40 and 60.25
b. The complete expected future lifetime for (100), $\overset{o}{e}_{100}$.

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

i) $s(x) = 1 - \frac{x}{\omega} \quad 0 < x < \omega$.
ii) $\overset{\circ}{e}_{20} = 35$.

Calculate p_{20}.

a) 1/70
b) 5/100
c) 8/80
d) 69/70
e) 95/100

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

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Hence the answer is ( )

END OF TEST PAPER