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

AS381: Actuarial Contingencies I
Dr. Mohammad H. Omar
Major 1 Exam Term 161 FORM A
Monday October 19 2016
6.00pm-7.30pm

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+4=7		
2	13		
3	8		
4	4+5=9		
5	4+4=8		
6	4+1=5		
Total	50		

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1. (3+4=7 points) The probability that a property will not be damaged in a fire in the next year is 0.8. The probability density function (pdf) of a positive loss to fire is given by

$$f(x) = 0.2\left(0.01e^{-0.01x}\right) \qquad x > 0.$$

(That is, loss has a mixed probability distribution with point mass at $P(X = 0) = 0.8$). The owner of the property has a utility function given by

$$u(w) = -e^{-0.005w}.$$

Calculate

a) the Expected Loss

b) the maximum insurance premium the property owner will pay for complete insurance.

2. (13 points) Consider a portfolio of 36 marine insurance policies. For each 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.

$$f(y) = \begin{cases} 2e^{-2y} & y > 0 \\ 0 & \text{elsewhere.} \end{cases}$$

The probability of **2 or more claims** is assumed to be zero.
Let S be the total claims for the portfolio. Using a normal approximation, estimate $\Pr(S > 3)$.

3. (8 points) Independent loss random variables due to automobile accident, X_k, for three lives have the discrete probability functions given below

x	$\Pr(X_1 = x)$	$\Pr(X_2 = x)$	$\Pr(X_3 = x)$
0	0.8	0.6	0.9
1	0.15	0.0	0.1
2	0.05	0.3	
3		0.1	

The insurance company defines the sum, $S = X_1 + X_2 + X_3$. In the Table below, use a **convolution** process on the non-negative integer values of x to **obtain** $F_s(x)$ for $x = 0, 1, 2, ..., 6$. (Be sure to complete the necessary blanks in the table below and show one calculation example for each column.)

x	$F(y)$	$\Pr(X_2 = x)$	$F^{(2)}(y)$	$Pr(X_3 = x)$	$F^{(3)}(S = x)$
0	0.8	0.6		0.9	
1	0.95	0		0.1	0.561
2	1.0	0.3		-	
3	1	0.1	0.92	-	
4	1	-		-	
5	1	-	1.0	-	0.998
6	1	-	1	-	1

4. (4+5=9 points) Given that $\mu_t = kt$, for all $t > 0$, and ${}_{10}p_{35} = 0.81$, find the value of

   a) ${}_{20}p_{40}$

   b) ${}_{5}q_{40}$

5. (4+4=8 points) Using the illustrative life-table provided, calculate the following:

a. probability that (35) will die between ages 45 and 65
b. The expected future lifetime for (100), e_{100}.

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

(i) $s(x) = 1 - \frac{20}{\omega} \quad 0 < x < \omega$.

(ii) $\mathring{e}_{20} = 35$

Calculate q_{20}.

a) 1/60
b) 1/70
c) 1/80
d) 1/90
e) 1/100

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

Hence the answer is ( )

END OF TEST PAPER