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

AS482: Actuarial Contingencies I
Dr. Mohammad H. Omar
Major 1 Exam Term 131 FORM A
Wednesday Oct 2 2013
7.15pm-8.30pm

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	6		
2	6		
3	6		
4	6		
5	1+2+3+3+1=10		
6	1+5=6		
Total	40		

Extra blank page

1. (6 points) At all ages greater than 50, the force of failure for smokers is double that for non-smokers. Suppose the age-at-failure random variable for non-smokers has a **uniform** distribution with $\omega = 75$. If (65) and (55) have independent lifetimes, where(65) is nonsmoker and (55) is a smoker, find the value of $\mathring{e}_{65:55}$.

2. (6 points) Lives (x) and (y) have independent future lifetime exponential random variables T_x^* and T_y^* with respect to risk factors **unique** to (x) and (y) that are subject to a constant common hazard rate $\lambda = 0.01$. Given that $p_x = 0.96$ and $p_y = 0.97$, calculate the value of ${}_5p_{xy}$.

3. (6 points) A contingent contract pays a benefit of amount b at the end of the year of the second failure of independent lives (x) and (y). The net annual premium is 110 paid at the beginning of each year while both (x) and (y) survive and 40 per year after the first failure. Find the value of b, given the following values: $A_{xy} = 0.80$ $\ddot{a}_x = 8$ $\ddot{a}_y = 7$ $d = 0.05$

4. (6 points) For a 2-state survival model in the Figure below, solve the Kolmogorov differential equation for ${}_rp_{12}^{(t)}$, and translate the result into standard actuarial notation.

5. (1+2+3+3+1=10 points) .Consider the following probability matrix $\mathbf{P} = \begin{bmatrix} 0.80 & 0.20 & 0 \\ 0.30 & 0.60 & 0.10 \\ 0 & 0 & 1 \end{bmatrix}$

Answer the following questions:

(a) What type of Markov chain model is represented by this transition matrix?

(b) Draw a diagram that shows the way in which the states communicate.

(c) Assume that the Markov chain model is homogeneous. Provide the 2-step transition matrix P^2

(d) If the Markov chain is not homogeneous where the next transition matrix is given below

$\begin{bmatrix} 0.80 & 0.20 & 0 \\ 0.40 & 0.50 & 0.20 \\ 0 & 0 & 1 \end{bmatrix}$,

provide the correct value for ${}_2P_{12}^{(0)}$.

(e) If the 3 states are 1 = Normal life, 2 = Sickness, and 3 = Death, provide the meaning of ${}_2P_{12}^{(0)}$

6. (1+5=6 points) For a four-state model with states numbered 1, 2, 3,4 you are given:
(i) The only possible transitions are 1 to 2, 1 to 3, and 1 to 4.
(ii) $\lambda_{12}(x+t) = \mu_{x+t}^{(12)} = 0.3, \qquad t \geq 0$

(iii) $\lambda_{13}(x+t) = \mu_{x+t}^{(13)} = 0.5, \qquad t \geq 0$

(iv) $\lambda_{14}(x+t) = \mu_{x+t}^{(14)} = 0.7, \qquad t \geq 0$

Calculate $p_{13}^{(x)}$.

a) 0.26
b) 0.30
c) 0.33
d) 0.36
e) 0.39

Work Shown (5 points):

Hence the answer is (_____)

END OF TEST PAPER