

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

AS381: Actuarial Contingencies I  
Dr. Mohammad H. Omar  
Major Exam 2 Term 122 FORM A  
Sunday Apr 21 2013  
6.30pm-8.00pm

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 financial 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	1+4=5		
2	1+4=5		
3	1+4=5		
4	1+6=7		
5	1+4=5		
6	1+4=5		
7	4+4=8		
<b>Total</b>	<b>40</b>		

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1 (1+4 = 5 points) For a group of individuals all age  $x$ , you are given :

(i) 25% are smokers (s); 75% are non smokers ( $ns$ )

	Smokers	Non-smokers
(ii)	$q_{x+k}^s$	$q_{x+k}^{ns}$
0	0.10	0.05
1	0.20	0.10
2	0.30	0.15

(iii)  $i = 0.03$

Calculate  $10,000 A_{x:\overline{2}|}^1$  for an individual chosen at random from this group,

- a) 1690
- b) 1703
- c) 1730
- d) 1750
- e) 1770

Work Shown (4 points)

Hence the answer is \_\_\_\_

2. (1+4 = 5 points) For a special whole life insurance on  $(x)$ , you are given:

(i)  $Z$  is the present value random variable for this insurance.

(ii) Death benefits are paid at the moment of death.

(iii)  $\mu_{x+t} = 0.14, t \geq 0$

(iv)  $\delta = 0.08$

(v)  $b_t = e^{0.03t}$

Calculate  $\text{Var}(Z)$ .

- a) 0.075
- b) 0.080
- c) 0.085
- d) 0.090
- e) 0.095

Work Shown (4 points)

Hence the answer is \_\_\_\_

3. (1+4=5 points) For a continuous whole life annuity of 1 on  $(x)$ , you are given :

(i)  $T_x$ , the future lifetime of  $(x)$ , follows a constant force of mortality 0.03

(ii) The force of interest is 0.02

Calculate  $\Pr(\bar{a}_{\overline{T_x}|} > \bar{a}_x)$

a) 0.40

b) 0.44

c) 0.46

d) 0.48

e) 0.50

Work Shown (4 points)

Hence the answer is \_\_\_

4. (1+6=7 points) For a special 3-year temporary life annuity-**due** on  $(x)$ , you are given:

$t$	Annuity Payment	$p_{x+t}$
0	15	0.95
1	20	0.90
2	25	0.85

(ii)  $i = 0.05$

Calculate the **variance** of the present value random variable for this annuity.

a) 91

b) 102

c) 114

d) 118

e) 139

Work Shown (6 points)

Hence the answer is \_\_\_

5. (1+4=5 points) For a special fully discrete 2-year endowment insurance of 979 on  $(x)$ , you are given :
- (i) The first year benefit premium is 654.0709309
  - (ii) The second year benefit premium is 252.6202098
  - (ii)  $d = 0.06$

Using the **equivalence** principle calculate the level annual premium .

- a) 469
- b) 479
- c) 489
- d) 499
- e) 509

Work Shown (4 points)

Hence the answer is \_\_\_\_

6. (1+4=5 points) For a fully discrete whole life insurance of 1000 on  $(30)$ :
- (i)  $\pi$  denotes the annual premium and  $L(\pi)$  denotes the loss-at-issue random variable for this insurance
  - (ii) Mortality follows the Illustrative Life Table
  - (ii)  $i = 0.06$

Calculate the lowest premium  $\pi'$  such that the probability is less than 0.5 that the loss  $L(\pi')$  is positive

- a) 3.46
- b) 3.66
- c) 3.68
- d) 3.90
- e) 3.91

Work Shown (4 points)

Hence the answer is \_\_\_\_

7. (4+4 = 8 marks) On the basis of the Illustrative Life Table with interest at the effective annual rate of 6%, calculate the values of

- (i)  $\ddot{a}_{25:40}^{(12)}$
- (ii)  $\ddot{s}_{25:40}^{(12)}$ .

Work Shown (3 points each) and final answer (1 point each)

Hence the answer is \_\_\_\_

END OF TEST PAPER