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

AS388: Actuarial Science Problem Lab II - SOA Probability Exam Prep

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Major 2 Exam Term 131 FORM A
Monday November 04 2013
5.30pm-7.00pm

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. Financial calculators, mobile calculators, or communicable devices are disallowed. Use regular scientific calculator 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	5		
2	5		
3	5		
4	5		
5	5		
6	5		
7	5		
8	5		
9	5		
10	5		
Total	50		

Extra blank page

1. (1+4=5 marks) Let A, B C and D be events such that $B = A'$, $C \cap D = \varnothing$, and $P[A] = \frac{1}{4}$, $P[B] = \frac{3}{4}$, $P[C|A] = \frac{1}{2}$, $P[C|B] = \frac{3}{4}$, $P[D|A] = \frac{1}{4}$, $P[D|B] = \frac{1}{8}$, Calculate $P[C \cup D]$.

   a) $\frac{5}{32}$

   b) $\frac{1}{4}$

   c) $\frac{27}{32}$

   d) $\frac{3}{4}$

   e) 1

Work Shown (4 points)

The answer is .

2. (1+4=5 marks) The probability that a randomly chosen male has a circulation problem is 0.25. Males who have a circulation problem are twice as likely to be smokers as those who do not have a circulaton problem. What is the conditional probability that a male has a circulation problem, given that he is a smoker?

   a) $\frac{1}{4}$ b) $\frac{1}{3}$ c) $\frac{2}{5}$ d) $\frac{1}{2}$ e) $\frac{2}{3}$

Work Shown (4 points)

The answer is .

3. (1+4=5 marks) An auto insurance company insures drivers of all ages. An actuary compiled the following statistics on the company's insured drivers:

Age of Driver	**Probability of Accident**	**Portion of Company's Insured Drivers**
16-20	0.06	0.08
21-30	0.03	0.15
31-65	0.02	0.49
66-99	0.04	0.28

A randomly selected driver that the company insures has an accident.
Calculate the probability that the driver was age 16 - 20.
a) 0.40
b) 0.23
c) 0.19
d) 0.16
e) 0.13
Work Shown (4 points)

The answer is .

4. (1+4=5 marks) A box contains 35 gems, of which 10 are real diamonds and 25 are fake diamonds. Gems are randomly taken out the box, one at time *without* replacement. What is the probability that **exactly** 2 fakes are selected before the **second** real diamond is selected?.

a) $\frac{225}{5236}$ b) $\frac{675}{5236}$ c) $\frac{\binom{25}{2}\binom{10}{2}}{\binom{35}{4}}$

d) $\binom{3}{2}\left(\frac{10}{35}\right)^2\left(\frac{25}{35}\right)^2$ e) $\binom{4}{2}\left(\frac{10}{35}\right)^2\left(\frac{25}{35}\right)^2$

Work Shown (4 points)

The answer is

5. (1+4=5 marks) An insurance company determines that N the number of claims received in a week, is a random variable with $P[N = n] = \frac{1}{2^{n+1}}$, where $n \geq 0$. The company also determines that the number of claims received in a given week is independent of the number of claims received in any other week. Determine the probability that **exactly** seven claims will be received during a **two-week** period.

   a) $\frac{1}{256}$

   b) $\frac{1}{128}$

   c) $\frac{7}{512}$

   d) $\frac{1}{64}$

   e) $\frac{1}{32}$

Work Shown (4 points)

The answer is .

6. (1+4=5 marks) A store has 80 modems in its inventory, 30 coming from source A and the remainder from source B. Of the modems from source A, 20% are defective. Of the modems from source B, 8% are defective. Calculate the probability that **exactly two** out of a random sample of **five** modems from the store's inventory are defective.

a) 0.010
b) 0.078
c) 0.102
d) 0.105
e) 0.125

Work Shown (4 points)

The answer is .

7. (1+4=5 marks) In modeling the number of claims filed by an individual under an automobile policy during a three-year period, an actuary makes the simplifying assumption that for all integers $n \geq 0$, $p_{n+1} = \frac{1}{5}p_n$, where p_n represents the probability that the policyholder files n claims during the period. Under this assumption, what is the probability that a policyholder files **more than one** claim during the period?

   a) 0.04
   b) 0.16
   c) 0.20
   d) 0.80
   e) 0.96

Work Shown (4 points)

The answer is .

8. (1+4=5 marks) In a small metropolitan area, annual losses due to storm, fire and theft are independently distributed random variables. The pdf's are:

	Storm	**Fire**	**Theft**
$f(x)$	e^{-x}	$\frac{2e^{-2x/3}}{3}$	$\frac{5e^{-5x/12}}{12}$

Determine the probability that the **maximum** of these losses **exceeds 3**.

a) 0.002
b) 0.050
c) 0.159
d) 0.287
e) 0.414

Work Shown (4 points)

The answer is .

9. (1+4=5 marks) An insurance company insures a large number of homes. The insured value, X of a randomly selected home is assumed to follow a distribution with density function:

$$f(x) = \begin{cases} 3x^{-4} & \text{for } x > 1 \\ 0 & \text{otherwise.} \end{cases}$$

Given that a randomly selected home is insured for at least 1.5, what is the probability that it is insured for **less than 2**?

a) 0.578
b) 0.684
c) 0.704
d) 0.829
e) 0.875

Work Shown (4 points)

The answer is .

10. (1+4=5 marks) The loss due to a fire in a commercial bulding is modeled by a random variable X with density function:

$$f(x) = \begin{cases} 0.005(20-x) & \text{for } 0 < x < 20 \\ 0 & \text{otherwise.} \end{cases}$$

Given that a fire loss exceeds 8, what is the probability that it **exceeds 16**?

a) $\frac{1}{25}$

b) $\frac{1}{9}$

c) $\frac{1}{8}$

d) $\frac{1}{3}$

e) $\frac{3}{7}$

Work Shown (4 points)

The answer is .

END OF TEST PAPER