MATH 3631 - Actuarial Mathematics II
Spring 2010 - Valdez
Homework No. 4
due Monday, 4:50 PM, 29 March 2010

Please return this page with your signature. Please write your name and student number at the spaces provided:

Name: Emil **Student ID:** Suggested Solution

I certify that this is my own work, and that I have not copied the work of another student.

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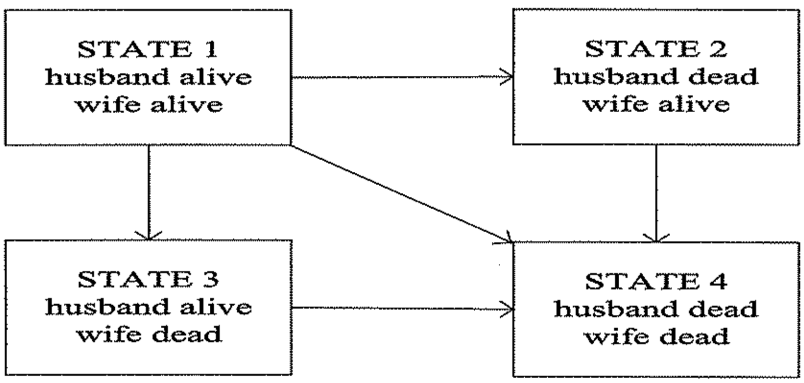
A four-state homogeneous Markov model represents the joint mortality of a married couple: a husband and a wife. The states are: 1 = husband alive, wife alive; 2 = husband dead, wife alive; 3 = husband alive, wife dead, and 4 = both husband and wife dead.



The one-year transition probabilities are:

$$\begin{array}{c c} & \begin{array}{cccc} 1 & 2 & 3 & 4 \end{array} \\ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \end{array} & \begin{pmatrix} 0.95 & 0.02 & 0.02 & 0.01 \\ 0.00 & 0.95 & 0.00 & 0.05 \\ 0.00 & 0.00 & 0.94 & 0.06 \\ 0.00 & 0.00 & 0.00 & 1.00 \end{pmatrix} \end{array}.$$

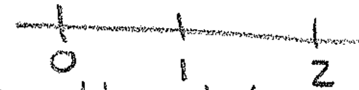
A life insurer sells a two-year term insurance contract to a married couple who are both age 60. The death benefit of 100,000 is payable at the end of the year in which the second life dies, if both die within 2 years.

Premiums are payable annually in advance. Interest rate $i = 6\%$.

Calculate the annual benefit premium.

HW4

It is a two-year term policy



Assume premium P (annual) is payable at beginning of year so long as at least one is alive.

Year	transitions	probability		amount	A.P.V.
0	—	1		P	P
1	$1 \to 1$	.95	.99	P	$.99Pv = .934P$
	$1 \to 2$	.02			
	$1 \to 3$	.02			$\Sigma = 1.934P$

Benefits (only at end of year, 2nd death)

Year	transitions	probability	amount	A.P.V.
1	$1 \to 4$	.01	100,000	$.01 \times 100{,}000v = 943.40$
2	$1 \to 1 \to 4$	$.95(.01) = .0095$		$.0095 \times 100{,}000v^2 = 845.50$
	$1 \to 2 \to 4$	$.02(.05) = .001$		$.001 \times 100{,}000v^2 = 89.00$
	$1 \to 3 \to 4$	$.02(.06) = .0012$		$.0012 \times 100{,}000v^2 = 106.80$
				$\Sigma = 1984.70$

APV(Premiums) = APV(Benefits)

$$1.934P = 1984.70$$

$$P = \frac{1984.70}{1.934} = 1{,}026.22$$ is the annual benefit premium