

MATH 3631 - Actuarial Mathematics II
 Spring 2012 - Valdez
 Homework No. 2
 due Monday, 7:00 PM, February 27, 2012

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

Name: SUGGESTED SOLUTION Student ID: EMIL

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

Signature: _____ Date: _____

DEF Life Insurance Company issued 10,000 fully discrete whole life insurance policies to lives all exactly age 50 on January 1, 2008. Each policy issued has a death benefit of \$100,000 with an annual gross premium of \$5,297. G B

Premiums and reserves are both calculated on the following basis:

- Interest: 6% per year
- Expenses: 50% of the first year premium
5% of each subsequent premium

You are given the following gross premium reserves per policy together with relevant mortality rates for the first 5 years:

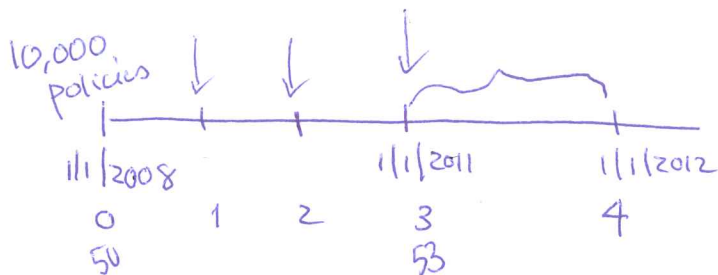
k	$1000 q_{50+k}$	${}_kV$
0	26.7502	0.00
1	28.8357	136.30
2	31.0831	2672.55
3	33.5044	5221.47
4	36.1126	7779.54
5	38.9216	10343.15

-3V
-4V

You are provided the following additional information:

- 9,000 policies remain in force as of January 1, 2011.
 - The company incurred expenses on January 1, 2011, related to these policies, for a total of \$2,200,000.
 - The company earned an interest of 5.5% on its assets backing these policies during 2011.
 - During 2011, the total number of deaths is 380.
- (a) Calculate the total gain or loss of DEF Life Insurance Company during year 2011 out of this block of policies.
- (b) Allocate this total gain or loss according to the following sources (in the given order): expenses, interest and mortality.

Year 2011 is actually
Year 4 from issue



$$(a) \text{ Actual} = \underbrace{(9000(3V + G) - 2,200,000)(1.055) - (B - 4V)(380)}_{62,508,098}$$

$$\text{Expected} = \underbrace{(9000(3V + G - .05G))}_{9000 \cdot 953} (1.06) - (B - 4V) * 9000 \cdot 953$$

$$70,011,414$$

Thus a loss of

$$\text{Gain} = 62,508,098 - 70,011,414 = \underline{\underline{-7,503,316}}$$

$$(b) \text{ gain from expenses: } (.05G * 9000 - 2,200,000)(1.06) = \textcircled{+} 194,669$$

$$\text{gain from interest: } \underbrace{(9000(3V + G) - 2,200,000)}_{\textcircled{-} 462,331.10} (.055 - .06)$$

$$\text{gain from mortality: } \underbrace{(B - 4V)(9000 \cdot 953 - 380)}_{\textcircled{-} 7,235,654}$$

add all gains, you get part (a). Clearly, most of the losses come from the ~~large~~ large number of actual deaths. Indeed, we only expect $9000 * 953 \approx 302$ deaths against the actual 380 !!!