EXAM M QUESTIONS OF THE WEEK

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A company insures the lives of two senior executives. The following assumptions are made.

- both executives have the same constant force of mortality
- mortality of the two executives is modeled with a common shock model
- the force of interest is 7.2%
- single benefit premium for $1,000,000 continuous insurance on one of the lives is $200,000
- single benefit premium for $1,000,000 continuous insurance payable on the first death of the two lives is $294,118

Find the expected time until the second death.

The solution can be found below.

Week of August 28/06 - Solution

μ_x^* , μ_y^* and λ are the common shock components, and we are given that $\mu_x^* = \mu_y^*$, which we will denote μ^* .

The overall force of mortality for (x) is $\mu^* + \lambda$ and same for (y).
The force of mortality for the joint status of (x) and (y) is $\mu^* + \mu^* + \lambda = 2\mu^* + \lambda$.

The expected time until the second death is
$\mathring{e}_{\overline{xy}} = \mathring{e}_x + \mathring{e}_y - \mathring{e}_{xy} = \frac{1}{\mu^*+\lambda} + \frac{1}{\mu^*+\lambda} - \frac{1}{2\mu^*+\lambda}$.

The single premium for a continuous whole life insurance of 1 for (x) is $\overline{A}_x = \frac{\mu^*+\lambda}{\mu^*+\lambda+.072}$ and the same for (y). The single premium for a continuous whole life insurance of 1 for the joints status (xy) is $\overline{A}_{xy} = \frac{2\mu^*+\lambda}{2\mu^*+\lambda+.072}$.

We are given that based on common shock parameter λ, we have
$\frac{\mu^*+\lambda}{\mu^*+\lambda+.072} = .200$ and $\frac{2\mu^*+\lambda}{2\mu^*+\lambda+.072} = .294118$.

Writing these two equations as
$\mu^* + \lambda = .2(\mu^* + \lambda + .072)$ and $2\mu^* + \lambda = .294118(2\mu^* + \lambda + .072)$
gives us two equations in the two unknown quantities μ^* and λ .
Solving the equations results in $\mu^* = .012$ and $\lambda = .006$.

Expected time until second death is $\frac{1}{\mu^*+\lambda} + \frac{1}{\mu^*+\lambda} - \frac{1}{2\mu^*+\lambda} = 77.8$.