

King Saud University
College of Sciences
Mathematics Department

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Premium and Reserve Calculations using Simpson's Numerical Method with R

Consider a permanent disability model with three states: State 0: Healthy, State 1: Permanently disabled, and State 2 : Dead. Suppose that

$$\mu_x^{01} = A + Be^{\alpha x}, \mu_x^{02} = C + De^{\beta x}, \mu_x^{12} = E + Fe^{\gamma x} \text{ for } x > 0$$

An insurance company uses the model to calculate premiums for a 30-year term insurance policy issued to a life aged 30 who is now healthy. The death benefit is S , payable at the moment of death. Premiums of annually rate G are paid provided that the policyholder is healthy.

Use Simpson's Numerical Method with 300 subintervals to

1. Calculate the gross premium rate for this policy on the following basis:
Interest: constant force of interest of 4% per year.
Initial expense: 40% of the gross premium.
Renewal expenses: 10% of each of the premium except the first.
Each group can choose freely the parameters $A, B, C, D, E, F, \alpha, \beta, \gamma$, and S .
2. Calculate the gross premium reserve at the end of each year for a policyholder who is healthy by that times and plot the reserve.
3. Calculate the gross premium reserve at the end of each year for a policyholder who is permanently disabled by that times and plot the reserve.

Kindly submit both the R code and the PDF version of your report via email to (meddahbi@ksu.edu) no later than 4:00 PM on May 8, 2025.