Insurance annuity calculator in R
User Manual

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1 Introduction

This document describes the use and function of the *Annuity calculator* written in R. The program is intended to simulate 10,000 independent customers purchasing an annuities using a mortality table. An input file provided to the program will give a initial age range that will be used to randomly select a starting age, or the age that the person will purchase an annuity product. Then, the mortality table will be used to randomly select a death age based on the distribution provided by the mortality table. This can be used to calculate the amount of profit or loss for the insurance company for an individual annuity product.

2 Input

Two auxiliary comma-separated-value files are required to use the script: *simulation_input.csv* and *mortality.csv*. The *simulation_input.csv* contains the following input parameters that should be provided to the script, shown in Table 1:

age_range_start	The lower bound of the age range for purchasing annuity
age_range_end	The upper bound of the age range for purchasing annuity
maturity_age	The age at which the annuity matures
monthly_annuity	The desired monthly annuity benefit
interest_rate	The interest rate
iterations	The number of simulations to run
company_years	Number of years to simulate
ROI_interest	Interest rate of ROI

Table 1: Input parameter descriptions

Note that column headers age_range_start, age_range_end, etc are required for the script to function correctly. Each row of the input column will represent a single simulation. An example *simulation_input.csv* file is shown in Table 2. In this case, the program will simulate a group of 10000 individuals, aged 25 to 50, purchasing a $500 annuity benefit that matures at age 65, simulating 76 years of 5

age_range_start	age_range_end	maturity_age	monthly_annuity	interest_rate	iterations	company_years	ROI_interest
25	50	65	500	0.05	10000	76	0.05

Table 2: Example *simulation_input.csv* file

The *mortality.csv* file should contain two columns: an *age* column containing a list of integer ages, and a *mortality* column containing the probability of death at each age. An example *mortality.csv* file is given in Table 3.

Age	Mortality
0	0.02042
1	0.00133
2	0.00122
...	...
98	0.67499

Table 3: Example *mortality.csv* file

3 Use

To run the program, simply use the *source* command from within RStudio, or another R interface running R version 3.5.1 or greater. It may be necessary to first set the working directory to the directory containing the *input.csv* files using either the *setwd()* command or using *Session* $\rightarrow$ *Set working directory* $\rightarrow$ *to source file location*. The program will output a report and a set of tables containing the expected profit or loss to the company based on the simulated business block. Plots and output will be placed in the *output* folder, with a single subfolder for each row in the input file.