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Background**

You are an actuarial student working for an insurance company, Prudential Vietnam Assurance (PVA)

PVA is a growing life insurance company that writes various types of business, including

term assurance policies. Term assurance policies are life insurance policies which pay out a

lump sum, known as the sum assured, if the policyholder dies during the term of the policy.

All term assurance policies that have been issued by PVA have a term of 10 years and so

are referred to as T-10 policies.

The T-10 policies have a maximum sum assured of $10,000 and can be taken out on an individual’s birthday from age 30 up to age 50 inclusive. The policy expires the day before their birthday in 10 years’ time. If an individual dies during the term of the policy, the sum assured will be paid at the end of the policy year in which the death occurred.

PVA is currently considering its business plan for 2022 and wants to determine the level annual premium rates which should be charged for T-10 policies in 2022. These premium rates are determined by first calculating the level annual premium (payable for 10 years or until earlier death) which covers the expected cost of future claims and then applying a margin. In determining the level gross premium, PVA has historically applied a margin of 30% to the expected claims cost (i.e. level net premium). This margin is intended to cover PVA’s expenses (without commission) and profit margin. The level net premium is determined such that expected present value of net premium is equal to expected present value of claim outgo.

It is common practice in PVA to quote level annual premium rates as the amount of level annual premium required to purchase $1,000 of sum assured.

A flat discount rate of 3% p.a is used to determine the present value of cash flows.

**Experience Data**

The In-Force Management department of PVA has provided you with data covering the

results of an experience investigation into PVA’s term assurance business over the period

from 1 January 2020 to 31 December 2021.

The worksheet “Exposure” in the Data file provides details of the amounts exposed to risk during the investigation period. This is grouped in five year age bands, where age *x* denotes the exposed to risk period from age *x* exact to age *x*+1 exact. You have been informed that the exposure figures provided are initially exposed to risk that can be used directly with initial rates of mortality.

The worksheet “Claims” in the Data file provides details of each of the claims that occurred during the investigation period. This includes the age at the time of the claim and the claim amount. Age *x* at the time of the claim is equivalent to age *x* exactly at the start of the policy year in which the claim was made.

**New Business Data**

The Sales department of PVA has provided details of the T-10 business that it expects to

write during 2022. These can be found in the worksheet “New Business” in the Data file.

Like the exposure data, the expected new business has been split by age band (which denotes

age exact at entry). It has been confirmed that although in the past new policies have been

sold to individuals aged 50 exact, this is not going to be the case in 2022. Therefore the

maximum age at entry is 49 exact. The expected new business refers to percentage of the total sum assured expected to be written in each age band. The Sales department has indicated that it expects to write new business in 2022 for a total sum assured of $220m.

**Experience Analysis**

Your boss has asked you to analyse PVA’s experience. She first wants you to determine the total amount of claims that would have been expected to have arisen during the experience investigation period, had mortality been in line with PVA’s internal benchmark mortality table. This mortality table is unisex and provides initial rates of mortality split by age exact. A copy of the table can be found in the worksheet “Mortality Table” in the Data file.Your boss wants you to calculate the expected claim amounts by age band (consistent with the exposure data provided) and in total. She then wants you to compare these expected claim amounts against the actual amount of claims in order to determine the Actual over Expected (A/E) ratio. She has asked for this to be done for each age band and at the total portfolio level.

**Premium Calculation**

In order to determine the new business premium rates, your boss has asked you to apply the

overall A/E percentage to PVA’s internal mortality table in order to produce an adjusted

mortality table which can be used for pricing. Using this adjusted mortality table, you should determine the level annual premium rate which PVA should charge for each of the four age bands and also the weighted average premium rate at the total new business portfolio level. You should also determine the total amount of premium that PVA should expect to receive in 2022 from T-10 policies written in 2022.

**Exam Requirements**

**1.** Construct a spreadsheet model that produces the following calculations and charts. You

should ensure that your spreadsheet contains appropriate self-checks and that you have

performed robust reasonableness checks at each stage of your calculations.

(i) Perform appropriate checks on the claims data that have been provided. If necessary, make any changes to the data. **[6 points]**

(ii) Calculate the ratio of actual claim amounts against expected claim amounts (A/E)

for each age band (using the average age at each age band) and also at the total portfolio level. **[12 points]**

(iii) Use the calculated A/E ratio at the total portfolio level to adjust the mortality table as required and hence determine the assurance factors and annuity factors that are required to calculate the premium rates for each age band. **[24 points]**

(iv) Determine the net premium rate & gross premium rate for each age band, using these factors. Which of the above types of premium should be used as customer actual pay? Justify your choice. **[12 points]**

(v) According to your choice in (iv),determine the overall weighted average premium rate and the total new business

premium expected in 2022. **[6 points]**

**[Sub-total 60 points]**

**2.** Write a memo to your manager to describe the model include: purpose, data and assumptions used, methodology, i.e. description of how each calculation stage in the model has been produced, explanation of any checks performed. **[30 points]**

You should ensure that your memo is suitable for both a senior actuary, who has been

asked to approve your work, and a fellow student, who has been asked to peer review and

correct your model, or to continue work on it, or to use it again for a similar purpose in

the future.

**[Sub-total 30 points]**