

INSTITUTE OF ACTUARIES OF INDIA

EXAMINATIONS

29th November 2019

Subject CP2A – Actuarial Modelling (Paper A)

Time allowed: 3 Hour 15 Minutes (10.15 – 13.30 Hours)

Total Marks: 100

AT THE END OF THE EXAMINATION

Please return this question paper to the supervisor separately. You are not allowed to carry the question paper in any form with you. You are requested to save and submit the work before leaving the examination premises.

Examination instructions

- 1. Mark allocations are shown in brackets.*
- 2. Do save your work in Excel files on a regular basis.*
- 3. Please check if you have received complete Question Paper and no page is missing. If so, kindly get new set of Question Paper from the Invigilator.*
- 4. Please note that you should use your Roll Number and NOT your name on all of the material you submit for marking.*
- 5. You would be provided with a digital platform for the examination which will show the time remaining for the examination at all times, once the exam starts. Once the exam duration is over, any work done on MS Excel will automatically get submitted and the platform will get frozen.*
- 6. There will however be a 'Submit' button available. Ensure that you click the "Submit" button only when you have answered all questions including sub-parts and then final submission is made. If done erroneously at any point earlier, this step can't be un-done.*
- 7. Students are required to submit all their work i.e. model, audit and summary using MS excel only.*

Exam Requirements

- 1) Read the background document, which describes the scenarios that need to be modelled and documented for this project. Technical assistance for the modelling work, should you require it, can be found in the additional guidance contained in this booklet.

No marks will be deducted for the use of this guidance.

- 2) 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) Calculate the EMI for a 20 year loan under both the schemes. (6)
 - ii) Prepare the Home Loan Schedule that shows the repayment of principal and interest every month for the tenure of the loan and represent it by graph with explanation. (8)
 - iii) Calculate the total interest paid under both the schemes. (5)
 - iv) Repeat part (ii) and part (iii) under scenario 2 with repayments options available under both the schemes. Represent it by suitable graph showing cost analysis under both schemes. (8)
 - v) Repeat part (ii) and part (iii) under Scenario 3 with repayments options available under both the schemes. Represent it by suitable graph to show the different interest charge under two scenario for Home saver scheme. (6)

Marks available for spreadsheet model and checks:

Accurate completion of above modelling steps and data checks. (33)

Demonstration of good modelling technique and practice. (7)

Other (non-data) checks. (7)
[47]

Produce an audit trail for your spreadsheet model which includes the following aspects:

- Purpose of the model
- Data and assumptions used
- Methodology, i.e. description of how each calculation stage in the model has been produced
- Explanation of the checks performed

You should ensure that your audit trail 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.

Marks available for audit trail:

Audit approach

- Fellow student can review and check methods used in the model. (8)
- Senior actuary can scrutinise and understand what has been done. (8)
- Written in clear English. (4)
- Written in a logical order. (3)

Audit content

- All steps clearly explained. (7)
- Clear signposting included throughout. (5)
- Statement of assumptions made. (5)
- All model steps accurately covered. (13)

[53]

Background

Mr. Ashok is interested in purchasing a home for his family. He has spent a considerable amount of time looking and has recently been able to finalize a house. To finance the purchase he wants to take a home loan of amount Rs. 20 lacs for a tenure of 20 years.

The Bank he approached specialises in two kinds of loan:

1. Basic Loan Scheme
2. Smart Home Saver Scheme

Under the Basic loan scheme, Mr. Ashok will be offered a loan for 20 years which only allows part payment once a year. There is a part payment charge equivalent to 0.1% of the loan outstanding at the time of the part payment subject to a minimum of Rs 2000 and a maximum of Rs 10,000.

Under Home Saver Scheme, Mr. Ashok can park his idle money in Home Saver account anytime which will earn the same interest rate as the borrowing rate. The interest on the Outstanding Principal loan will be reduced to the extent of the interest earned on the cumulative deposits. He also has an option to withdraw money to the extent he has deposited voluntarily.

The information received by Mr. Ashok from the Bank manager is as follows:

- Under Basic Scheme, the interest charged is 8% p.a. payable monthly.
- Under Home Saver Scheme, the interest charged is 8.5% p.a. payable monthly.
- The interest is calculated on the principal outstanding as at the end of the month after considering any part-payment made.
- There will be no interest payable on the amount parked for that month.
- The anniversary of bonus receiving is the same as the home loan anniversary.

You are asked to prepare the Home Loan Schedule and answer the question based on the same.

Scenario 2

Mr. Ashok wants to compare both the schemes and asked for your help as he has two options with the following expected cash flows:

- To pay his bonus of Rs. 300,000 (or the final capital outstanding if less) that he receives at the end of every year as part payment along with the repayment fee under base scheme.
- Instead, park Rs 25,000 per month (or the final capital outstanding if less) under the Home Saver Scheme rather than waiting for the year end bonus to partly repay his loan and keep his savings in Home Saver account to reduce the interest paid to that extent and use the bonus for his own expenses rather than repayment of loan.

Scenario 3

Mr. Ashok informs his colleagues of the home saver scheme who also have similar saving payment pattern under Scenario 2.

Having seen the major shift in the home saver scheme of the people, the bank manager is sceptical of making losses on their investments. He decides to remove this arbitrage opportunity under Scenario 2 with immediate effect.

He wants your help in calculating the revised interest rate such that both the schemes are neutral under Scenario 2.
