Chapter-wise Question Workbook

# Chapter 1

## Question 1 (Year: 2024) - [Unknown marks]

Q. 1) Modelling steps and data checks
Read the background document, which describes the scenarios that need to be modelled and documented for this project.
Construct a spreadsheet model that produces the following calculations. You should ensure that your spreadsheet contains appropriate self-checks and that you have performed (and documented in the audit trail) reasonableness checks at each stage of your calculations.
**i) Carry out checks on the data provided for customer and loan information and premium rate,** making any adjustments wherever necessary to confirm that the data is complete, reasonable, and fit to use. (8)
**ii) Verify that the random numbers data provided for computing probability of default does** follow a Normal (0,1) distribution by carrying out the graphical checks that the normal distribution appears as a bell curve.
Note: You are not expected to make any changes to the random numbers data. You will also be able to continue to complete the model using the random numbers provided even if you have not completed the required verification. (3)
**iii) Calculate the interest rate on loan and hence the interest amount for the first year. (4.5)**
iv) Calculate the annual interest rate on deposit and annual repo rate for the first year. (2)
v) Calculate the age wise insurance premium rate (per 1000 SA) for female customers. (1)
vi) Calculate the following customer level information for first year:
a) Premium amount and hence commission amount (3.5)
b) Expected loan default amount (2)
vii) Calculate the expected profit of the bank at the end of the first year. (3)
viii) Determine the required capital, net assets of the bank and hence whether the regulatory requirement is expected to be met at the end of first year. (2)
ix) Determine the impact of draft regulatory proposal on vii) and viii) and hence whether the regulatory requirement is expected to be met at the end of first year. (4)
[Note: all scenarios outlined above should be modelled separately in your spreadsheet. The user should not need to change the parameters to see the results.]
[33 Marks]
Q. 2) Modelling technique and practice
**i) Auto checks or reasonableness checks on the modelling completed in (**

# Chapter 2

## Question 2 (Year: 2024) - [Unknown marks]

Q. 2) Modelling technique and practice
**i) Auto checks or reasonableness checks on the modelling completed in (Q.1). (3)**
**ii) Demonstration of good modelling techniques and practice. (7)**
[10 Marks]

# Chapter 3

## Question 3 (Year: 2024) - [Unknown marks]

Q. 3) Audit trail
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Produce an audit trail for your spreadsheet model that 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 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, to continue work on it or to use it again for a similar purpose in the future.
Marks available for audit trail:
Audit approach
**i) Communication skills (the audit trail provides enough detail to be read as a stand-alone** document). (4)
**ii) Fellow students can review and check methods used in the model. (7)**
**iii) Senior Actuary can scrutinize and understand what has been done. (7)**
iv) Written in clear English. (4)
v) Written in a logical order. (3)
Audit content
**i) All steps clearly explained. (8)**
**ii) Clear signposting included throughout. (4)**
**iii) Statement of assumptions made. (5)**
iv) All model steps accurately covered. (15)
[57 Marks]
Background:
A private company has received a license from the regulator to commence the banking operations in the country. The bank will commence its operation with the initial investment of INR 150 Crores. The banks are required to ensure that the net assets are at least 180% of the required capital at all the times by the regulator.
The bank has reached out to your actuarial firm, STU Actuarial Services, to help them evaluate the following:
a) Expected profit of the bank at the end of first year
b) Whether the expected net assets at the end of the first year will be sufficient to meet the regulatory requirement of the required capital
c) Impact of regulatory draft proposal on a) and b) at the end of first year
The following information has been provided by the bank for the purpose of evaluation:
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The bank will write the following types of loans namely, Home Loan (Secured), Vehicle Loan (Secured), Education Loan (Unsecured) and Personal Loan (Unsecured). The loans expected to be availed by 400 customers and the details pertaining to age, gender, bank staff, type of loan and loan amount is provided. These loans are expected to be sanctioned on the first day of the commencement

of the bank operation with moratorium period of 3 years where the interest amount is payable during the moratorium period and it can be assumed that no new loans or top up in the existing loans are sanctioned during the first year.
The calculation of the required capital by the banks as per the regulatory requirement is as below:
10% of initial loan amount for secured loans + 20% of initial loan amount for unsecured loans + Expected loan default amount
The bank is expected to receive the deposit from customers on the first day of the commencement of operations and this amount is equivalent to the total amount of loan. The deposit rate is expected to be weighted average interest rate on loan less 5% and the interest is payable at the end of the year. The deposits cannot be redeemed or increased by the customers during the first year and it can be assumed that no new customers have provided the deposit during the first year.
The cost of running the bank operation, like rent, salary etc., is expected to be INR 1 Crores p.a. plus 1% of loan amount in the first year. The initial investment in the bank will earn interest at the prevailing reverse repo rate. The expected reverse repo rate during the first year is mentioned below:
First quarter of the year: 5.00% p.a.
Second quarter of the year: 5.15% p.a.
Third quarter of the year: 5.05% p.a.
Fourth quarter of the year: 4.90% p.a.
In order to generate additional income, the bank in planning to enter into a strategic tie-up with an insurance company to provide insurance coverage along with the loan wherein the Sum Assured (SA) of insurance will be same as initial loan amount. As part of the tie-up, the bank would receive commission income at the end of the first year for customers who have availed the insurance. The age wise premium rate for male customers has been provided. The expected cost of the bank involved in providing the insurance, like additional staff and incentives etc, will be 5% of commission income. It is expected that the premium rate will increase with increase in age. The premium rate for female customer till the age of 20 years will be equivalent to premium rate for male customer at the age of 18 years and thereafter it will be equivalent to premium rate for male customer younger by 3 years. The commission rate as percentage of premium is provided below:
40% of premium if premium is less than 30,000
37.5% of premium if premium is more than or equal to 30,000 but less than 60,000
35% of premium if premium is more than or equal to 60,000 but less than 90,000
32.5% of premium if premium is more than or equal to 90,000 but less than 1,20,000
30% of premium is premium is more than or equal to 1,20,000
There are no other income or expenses for the bank and the bank will have to create a provision of 25% of expected loan default amount for secured loans and 40% of expected loan default amount for unsecured loans. The interest payment will be received for all the loans at the end of the first year and the defaults, if any, is expected to occur at the end of the first year after the payment of interest by customer.
The regulator is concerned about the rise in unsecured loans in the country and lower provisioning in case of secured loans in the recent years. As a result, the regulator has proposed the following:
Increase in the proportion levied on unsecured loans by 1.5 times while calculating the required capital

Introduce a minimum flooring of 3% and 1.5% for probability of default for unsecured and secured loans respectively resulting in increase in expected loan default amount and provisions.
Note: All the cashflows except initial investment, sanction of loan and receipt of deposit can be assumed to take place at the end of the year.
Additional Guidance:

Interest rate on loan:

The interest rate on loan will be dependent on base interest rate, type of loan, loan amount and bank staff. The calculation of interest rate on loan is as follows:

Base Interest Rate of 7%

Increase in interest rate by 4%, 6%, 8% and 10% in case of Home Loan, Vehicle Loan, Education Loan and Personal Loan respectively

Discount in interest rate of 0.50% for loan amount more than INR 0.90 Crores but less than or equal to INR 1 Crores with additive increase in discount of 0.10% for every increase in loan amount by INR 0.10 Crores thereafter

Discount in interest rate for bank staff by 4%

Expected loan default amount:

The expected loan default amount will be calculated as initial loan amount multiplied by probability of default. You have been provided with 400 random numbers generated from Normal (0,1) distribution pertaining to each customer. The probability of default can be determined as:

$0.02y + 0.01x$

where,

y is 1 for unsecured loan and 0.5 for secured loan

x is

random number if random number is greater than or equal to 0 and

random number if random number is less than 0

Probability of availing insurance:

The bank is expected to hire 2 sales support staff, Staff A and Staff B, to promote the insurance coverage and the customers are allotted to either of these staff with equal probability. The probability of customer availing the insurance if promoted by Staff A and Staff B is 75% and 60% respectively.

Net Assets for Bank:

The net assets for the bank is defined as the total assets less total liabilities of the bank. In this case at the end of the first year, the loans provided by the bank is equal to the total deposits, so net assets will be initial investment plus expected profit at the end of first year.