

INSTITUTE OF ACTUARIES OF INDIA

EXAMINATIONS

24th March 2021

Subject CP2A – Actuarial Modelling (Paper A)

Time allowed: 3 Hour 30 Minutes (09.30 – 13.00 Hours)

Total Marks: 100

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 guidance material.

- 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 different stage of calculations.
 - i) Validate the given data and amend any corrupt or missing data. (2)
 - ii) Generate summary statistics for the corrected data (1)
 - iii) Using the information in the background:
 - a) Estimate the total retirement benefits liability as on the valuation date (17)
 - b) Calculate the total accrued liability as on the valuation date (5)
 - iv) Repeat part (iii) for the request given in Scenario 2. (3)
 - v) Repeat part (iii) for the request given in Scenario 3. (3)
 - vi) Produce a suitable chart showing the total liability and accrued liability across the three scenarios. (2)
- 3) Modelling technique and practice

Demonstration of good modelling technique and practice (7)

Other (non-data) checks (7)

[47]
- 4) 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

Adventure Ltd. was incorporated on 1st July 2011. On the first day of the company, there were total 5 employees. Over the years, the company has grown substantially and the total employee strength has gone up to 25. The current retirement age at Adventure Ltd. is 60 years.

The Central Government of the country requires all the companies with minimum 25 employees to provide retirement benefit. Adventure Ltd. is required to provide retirement benefits for the first time since inception and is required to account for retirement benefit liability in the financial statements. You work for an actuarial consultancy firm specialised in the employee benefit valuation. Adventure Ltd. has approached your firm for the determination of the retirement benefit liability to be booked in the financial statements for the year ended 31/December/2020. Your manager has asked you to work on the valuation of the retirement benefits.

The retirement benefit is payable on earlier of the following events:

- Attainment of retirement age; or
- Termination of the employment due to employee leaving the company after completion of five years of service with the same employer; or
- Death of the employee

The Employer may relax any of the above conditions of benefit eligibility.

As per the regulation, employers need not pay benefit amount in excess of INR 10,00,000. However, the employer may provide benefit amount in excess of INR 10,00,000.

Benefit payable depends on two factors:

- Last drawn salary; and
- Completed years of service

To calculate the benefit amount payable, there is a formula. The formula is 50% of last drawn monthly salary *times* completed years of service.

To calculate the liability of Adventure Ltd., you have been provided the seriatim employee data and below assumptions.

- Discount rate 5.5% p.a.
- Salary escalation rate 6% p.a.
- Employees usually leave the company at the end of the calendar year and the year of resignation is considered as a full years of service
- No new employees are added to the company

Base Scenario

It is assumed that no employee leaves the company before retirement, there is no minimum service period requirement and the maximum cap on the benefit is Rs. 10 lacs.

Scenario 1

The finance director does not agree to this statement that no employee would leave before retirement and asks you to assume 10% of the employees leave the work force (attrition) on yearly basis. It is also assumed that no new employee joins the company.

Scenario 2

Contrary to his belief, having introduced the withdrawal rates actually increases the liability of the company. The Finance Director is then suggested to introduce the minimum service (vesting) period of 5 years for an employee to receive this benefit to discourage employees leaving the company early. This change will have an impact on the attrition rate assumption; you are asked to use a rate of 2% p.a. It is also assumed that no new employee joins the company.

Additional Guidance:

Accrued liability:

50% of last drawn monthly salary times completed years of service

Retirement benefits liability:

- For a given model point, you will need to project the year wise retirement benefit from attained age on valuation date to the retirement age.
- For each year you will need to calculate the benefit amount and multiply by the probability of event leading to benefit payment

- Calculate the present value and total the expected outgo
- You might use Data-Table function to estimate the expected outgo for all the employees from the model point cashflow

Data Table Function guide: One variable data table should be good for this project

Assume you own a book store and have 100 books in storage. You sell a certain % for the highest price of \$50 and a certain % for the lower price of \$20. If you sell 60% for the highest price, cell D10 below calculates a total profit of $60 * \$50 + 40 * \$20 = \$3800$.

One Variable Data Table

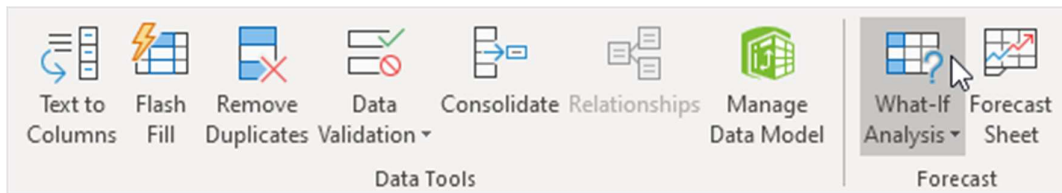
To create a one variable data table, execute the following steps.

1. Select cell B12 and type =D10 (refer to the total profit cell).
2. Type the different percentages in column A.
3. Select the range A12:B17.

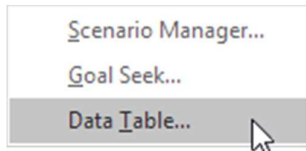
We are going to calculate the total profit if you sell 60% for the highest price, 70% for the highest price, etc.

6R x 2C			

4. On the Data tab, in the Forecast group, click What-If Analysis.

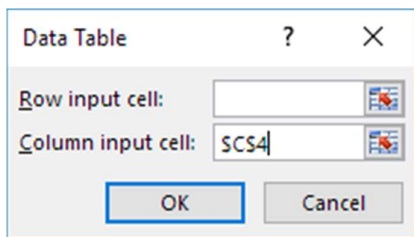


5. Click Data Table.



6. Click in the 'Column input cell' box (the percentages are in a column) and select cell C4.

We select cell C4 because the percentages refer to cell C4 (% sold for the highest price). Together with the formula in cell B12, Excel now knows that it should replace cell C4 with 60% to calculate the total profit, replace cell C4 with 70% to calculate the total profit, etc.



Note: this is a one variable data table so we leave the Row input cell blank.

7. Click OK.

8. You would be required to refresh the results:

Go to the Formulas tab, in the Calculation group, click Calculations Options.
