Excel Workshop for Actuarial Science

MTSU Student Actuarial Club

MTSU Student Actuarial Club

16 April 2025

Table of contents

Overview

This workshop provides comprehensive training on Excel techniques essential for actuarial work. It covers:

1. Basic and Advanced Excel Functions
2. Data Analysis Tools
3. Model Building Best Practices
4. Life Insurance and Reserving Examples

1 Excel Fundamentals

1.1 Essential Functions

> **Note**
>
> These foundational functions are critical for actuarial work.

Function	Syntax Example	Description
IF	`=IF(A1>0, "Positive", "Negative")`	Returns one value if TRUE, another if FALSE
AND	`=AND(A1>0, B1<10)`	TRUE if all conditions are TRUE
OR	`=OR(A1>0, B1<10)`	TRUE if any condition is TRUE
NOT	`=NOT(A1>0)`	Reverses TRUE/FALSE
COUNT	`=COUNT(A1:A10)`	Counts numeric entries
COUNTA	`=COUNTA(A1:A10)`	Counts non-empty cells
SUM	`=SUM(A1:A10)`	Adds up values
AVERAGE	`=AVERAGE(A1:A10)`	Mean of values
MIN, MAX	`=MIN(A1:A10), =MAX(A1:A10)`	Min or Max value
LARGE, SMALL	`=LARGE(A1:A10, 2)`	Kth largest/smallest value
ROUND	`=ROUND(123.456, 2)`	Rounds to 2 decimals
ROUNDUP, ROUNDDOWN	`=ROUNDUP(123.456, 2)`	Round up/down
ABS	`=ABS(A1)`	Absolute value
INT	`=INT(3.7)`	Integer part (floor)
RAND()	`=RAND()`	Random number between 0 and 1
RANDBETWEEN	`=RANDBETWEEN(1,6)`	Random integer in range
VLOOKUP	`=VLOOKUP(lookup, table, col, FALSE)`	Vertical lookup
HLOOKUP	`=HLOOKUP(lookup, table, row, FALSE)`	Horizontal lookup
OFFSET	`=OFFSET(A1, 1, 2)`	Returns value offset by rows and cols
SUMIF	`=SUMIF(A1:A10, ">10")`	Sum if condition met
COUNTIF	`=COUNTIF(A1:A10, "Male")`	Count if condition met
AVERAGEIF	`=AVERAGEIF(A1:A10, ">5")`	Average if condition met
SUMPRODUCT	`=SUMPRODUCT(A1:A10, B1:B10)`	$(Ai \times Bi)$
CORREL	`=CORREL(A1:A10, B1:B10)`	Correlation coefficient

2 Advanced Excel Features

2.1 Financial Analysis Tools

Function	Syntax Example	Actuarial Use Case
NPV	`=NPV(rate, cashflows)`	Present value of future cash flows
XNPV	`=XNPV(rate, cashflows, dates)`	NPV with specific dates
IRR	`=IRR(cashflows)`	Internal rate of return
XIRR	`=XIRR(cashflows, dates)`	IRR with irregular periods
PMT	`=PMT(rate, nper, pv, [fv], [type])`	Calculate premium payments
PPMT	`=PPMT(rate, per, nper, pv)`	Principal portion of payment
IPMT	`=IPMT(rate, per, nper, pv)`	Interest portion of payment
FV	`=FV(rate, nper, pmt, [pv], [type])`	Future value calculation
RATE	`=RATE(nper, pmt, pv, [fv])`	Interest rate calculation

2.2 Statistical Analysis

Function	Syntax Example	Actuarial Use Case
NORMDIST	`=NORMDIST(x, mean, sd, TRUE)`	Normal distribution probability
NORMINV	`=NORMINV(prob, mean, sd)`	Normal distribution quantiles
CONFIDENCE	`=CONFIDENCE(alpha, sd, n)`	Confidence interval calculation
PERCENTILE	`=PERCENTILE(array, k)`	Risk metrics (VaR)
FORECAST	`=FORECAST(x, known_y, known_x)`	Linear prediction

3 Model Building

3.1 Best Practices

1. Use clear, descriptive names for ranges and variables.
2. Document all assumptions and sources.
3. Break complex formulas into smaller, manageable steps.
4. Use consistent formatting and color coding.

3.2 Data Tables and Scenario Analysis

Data Tables are powerful tools for sensitivity analysis and scenario testing.

Path: Data > What-If Analysis > Data Table

3.2.1 Types of Data Tables

1. One-Variable Data Table

- Varies one input
- Shows impact on multiple outputs

2. Two-Variable Data Table
    - Varies two inputs
    - Shows impact on single output

3.2.2 Example: Premium Sensitivity Analysis

```
Input Variables:
- Row Input: Interest_Rate
- Column Input: Lapse_Rate
Output Formula: =Calculate_Premium()
```

4 Practical Applications

4.1 Life Insurance Pricing

4.1.1 Premium Calculations

```
=PMT(rate, nper, pv, [fv], [type])
```

4.1.2 Reserving Methods

```
=SUMPRODUCT(triangle_array, development_factors_array)
```

5 Workshop Exercises

5.1 Practice Files

The following files contain hands-on exercises:

1. `Excel Workshop Material/MTSU Excel Workshop.xlsm`
2. `BackUp/Reserving Exercise.xlsm`

6 References

> **Note**
>
> For more detailed information about Excel functions in actuarial work, refer to:
>
> - **?**] "Best Practices in Actuarial Spreadsheet Design"
> - **?**] "Casualty Actuarial Society Excel Best Practices"

- **?**] “Modern Excel Techniques in Actuarial Practice”

References