

A MODERN APPROACH FOR CONSTRUCTING DECISION ANALYTIC MODELS IN MICROSOFT EXCEL

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SUMMARY

Recent versions of Microsoft Excel and Google Sheets support dynamic array functions and variable declaration.

This allows models to be built with fewer formulas, improving transparency and simplifying development and validation.

VARIABLE DECLARATION

The new LET function lets us declare variables and write code in Excel and Google Sheets, similar to Python or R.

```
numbers = [1, 2, 3, 4, 5]
squares = [x**2 for x in numbers]
total = sum(squares)
print(total)
```

```
numbers <- c(1, 2, 3, 4, 5)
squares <- numbers^2
total <- sum(squares)
print(total)
```

```
=LET(numbers, {1, 2, 3, 4, 5},
squares, numbers^2,
total, SUM(squares),
total)
```

```
=LET(numbers, {1, 2, 3, 4, 5},
squares, ARRAYFORMULA(numbers^2),
total, SUM(squares),
total)
```

OUTPUT AN ENTIRE MARKOV TRACE WITH 1 FORMULA IN A SINGLE CELL

```
=SCAN(v_init_dist, SEQUENCE(cycles), LAMBDA(v_dist, cycle, IF(cycle > 1, MMULT(v_dist, m_tm_A), v_dist)))
```

Markov Trace for Treatment A

Cycle	State			
	Asymptomatic	Mild	Severe	Dead
0	100.00%	0.00%	0.00%	0.00%
1	91.00%	5.00%	3.00%	1.00%
2	83.19%	8.80%	5.86%	2.16%
3	76.36%	11.64%	8.56%	3.44%
4	70.36%	13.71%	11.09%	4.84%
5	65.06%	15.17%	13.44%	6.33%
6	60.34%	16.15%	15.62%	7.90%
7	56.12%	16.74%	17.61%	9.53%

The new SCAN function in Google Sheets lets us calculate the proportion of a cohort in each state on each cycle, using just one formula in a single cell:

```
=SCAN(v_init_dist, SEQUENCE(cycles), LAMBDA(v_dist, cycle, IF(cycle>1, MMULT(v_dist, m_tm_A), v_dist)))
```

Equivalently, we can use the REDUCE function, which works in both Google Sheets and Microsoft Excel:

```
=REDUCE(v_init_dist, SEQUENCE(cycles), LAMBDA(m_dist, cycle, IF(cycle>1, VSTACK(m_dist, MMULT(INDEX(m_dist, cycle - 1, ), m_tm_A)), m_dist)))
```

This can be quickly and easily reused across models, reducing the complexity of model development.

Scan the QR code below to learn more.

USE 1 FORMULA TO CONDUCT MONTE CARLO SIMULATION OVER 1000s OF ITERATIONS

```
=ARRAYFORMULA(LET(
i, $B1069,
v_p, CHOOSECOLS(m_p_A, i),
v_c_inp, TRANSPOSE(CHOOSECOLS(m_c_inp_A, i)),
range, m_total_A,
```

Probabilistic Analysis for Treatment A

Iteration	Treatment A		
	Total Costs	Total QALYs	Total LYs
1	\$130,827	1.863	3.106
2	\$96,316	1.840	2.822
3	\$154,767	1.990	4.403

By combining the LET function with these dynamic array functions, we can conduct Monte Carlo simulation over thousands of iterations with just one formula in a single cell, outputting an array of results for each iteration.

These simulations also run faster than approaches that use macros, since Excel and Google Sheets can use CPU cores in parallel to speed up calculations.

Scan the QR code below to learn more.

