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How to Generate Test Data with matlab and excel

Generating test data with all possible combinations of attribute values

Related matlab and excel VBA scripts can be downloaded at:
http://finaquant.com/download

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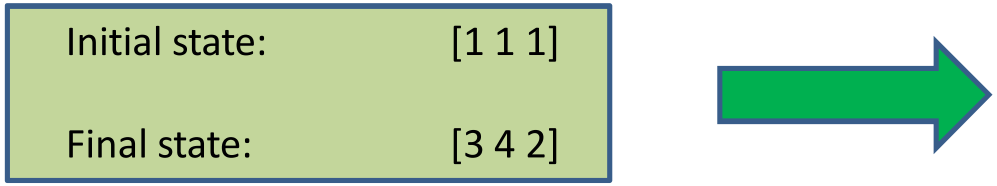
Multi-dimensional counter

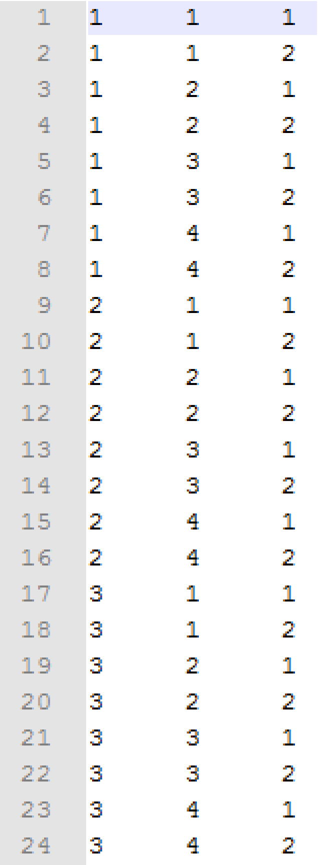
Å Test data as all possible combination of attribute values can be generated by using a multi-dimensional (or multi-register) counter.

Å You set the initial and final states; multi-dimensional counter generates all possible integer combinations between the final and end states. An example below:



Initial state: [1 1 1]

Final state: [3 4 2]



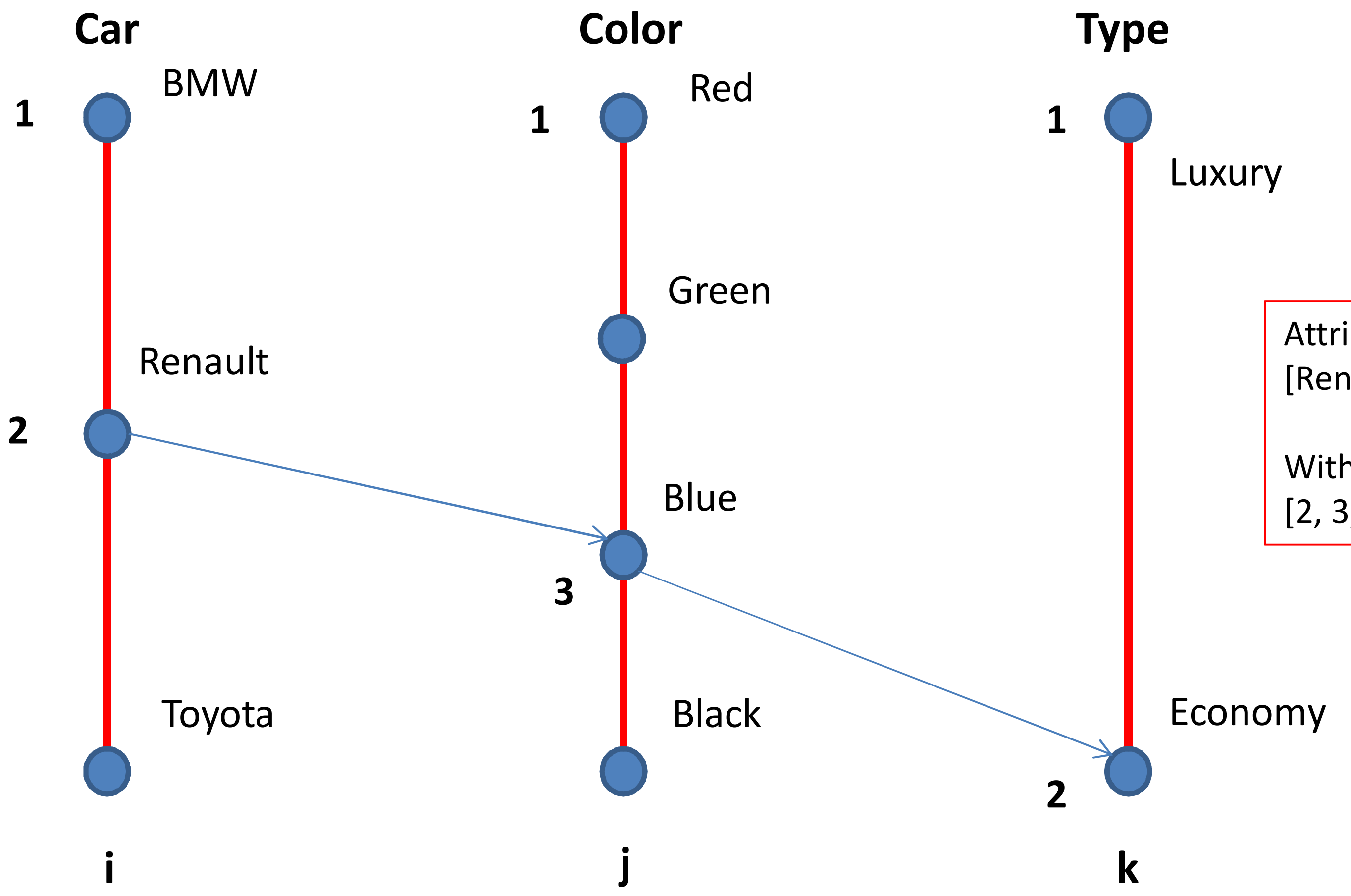
1	1	1	1
2	1	1	2
3	1	2	1
4	1	2	2
5	1	3	1
6	1	3	2
7	1	4	1
8	1	4	2
9	2	1	1
10	2	1	2
11	2	2	1
12	2	2	2
13	2	3	1
14	2	3	2
15	2	4	1
16	2	4	2
17	3	1	1
18	3	1	2
19	3	2	1
20	3	2	2
21	3	3	1
22	3	3	2
23	3	4	1
24	3	4	2

These integer combinations can be used as indices for arrays that contain attribute values in order to generate all possible combinations of attribute values.

You can download matlab and excel VBA scripts for multi-dimensional counter from http://finaquant.com/download

Combination of independent attributes

Å We assume here that all car brands can have all possible colors and types listed below. That is, any combination of car, color and type is a valid combiation.



Attribute combination:
[Renault, Blue, Economy]

With indices:
[2, 3, 2]

Algorithm for independent attributes

Algorithm for obtaining all possible combinations of independent attribute values

- Initiate vectors that contain the attribute values; a seperate vector for each attribute. For example:

Car = [‘BMW’, ‘Toyota’, ‘Mercedes’, ‘Renault’]
Color = [‘Blue’, ‘Red’, ‘Black’]

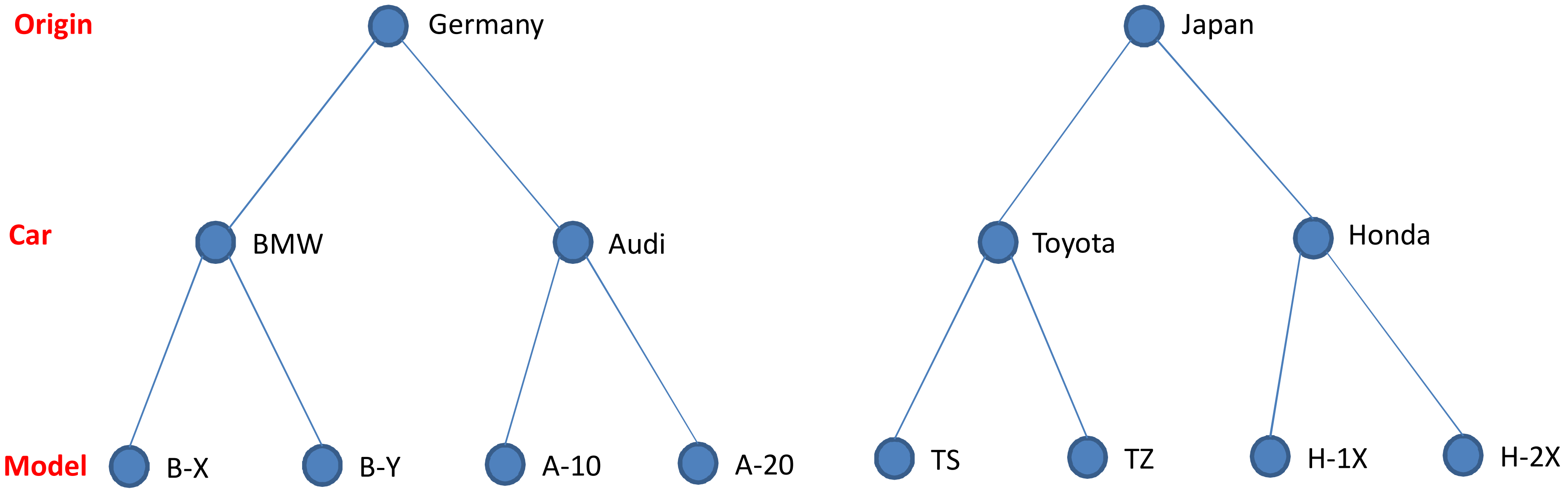
- Set the initial and final states of the multi-dimensional counter. The counter has as many digits (i.e. dimensions) as the number of attributes. The initial state for each digit is 1; the final state is the number of attribute values in corresponding attribute vector.

For example, for the vector Car above, the final state of corresponding digit is 4. That is, initial state = [1 1], final state = [4 3] for the attributes Car and Color.

- Start from the initial state (like [1 1] above) and increment counter in iterations until the final state is reached. At each iteration add a new row to the resultant test data.

For example, at the 3rd iteration: Counter = [1 3] → add [‘BMW’, ‘Black’] to resultant test data.

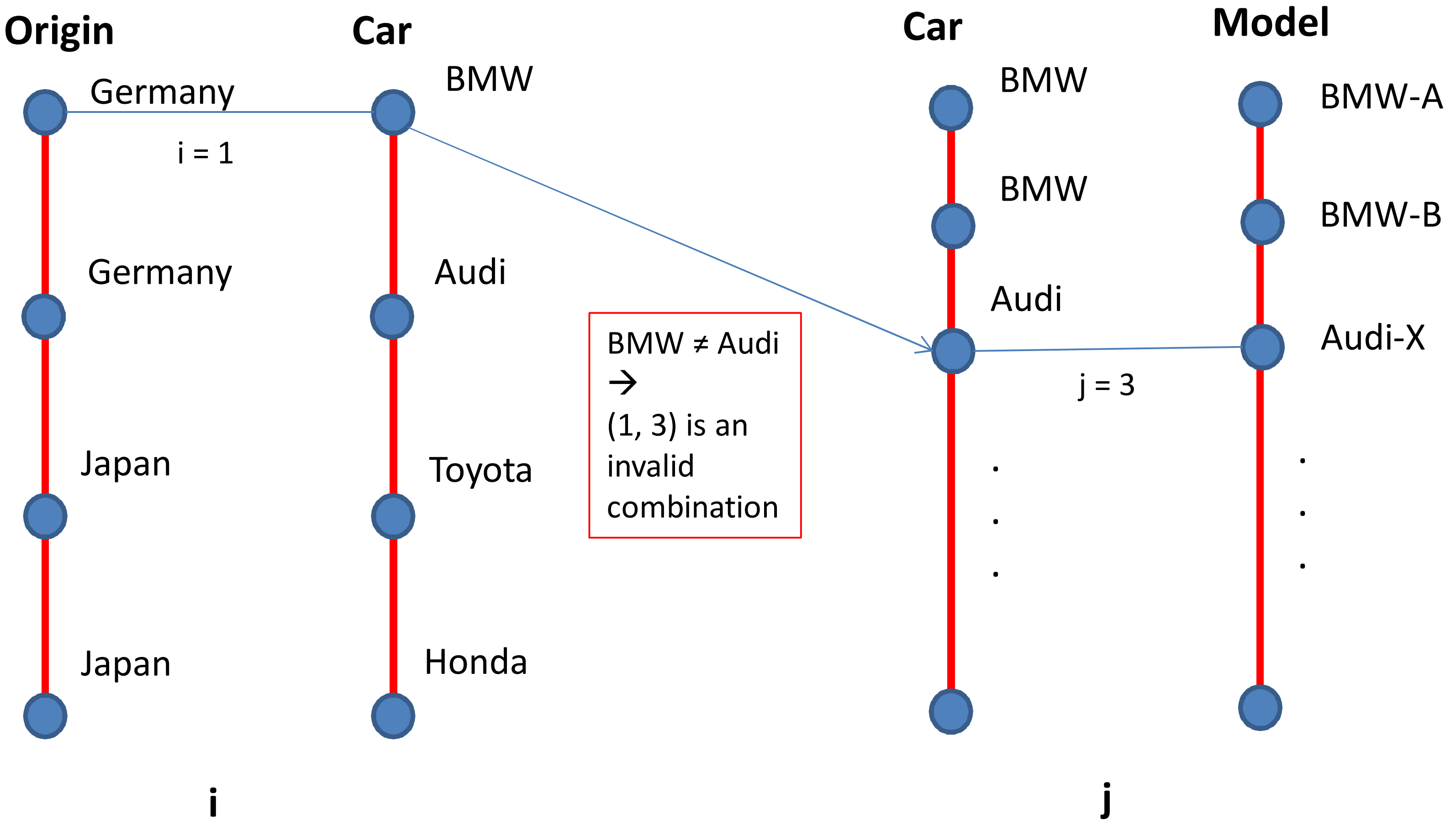
Tree structure of a hierarchy



- Real hierarchy → 1-N relationship between parent and child attributes. For example, a *Car* (parent) can have multiple *Models* (child), but a *Model* can belong only to a single *Car* brand.
- There can be only a single path from a leaf (lowest) node to a root (topmost) node in the hierarchical three structure → The total number of possible paths from root to leaf nodes is equal to the total number of leaf nodes.
- Each path from a root node to a leaf node represents a possible attribute value combination.

Combination of dependent attributes from a hierarchy

Å Hierarchical relations are given by attribute pairs. For example origin and car as parent and child attributes, from the hierarchy origin-car-model. Not all combinations are valid!



BMW ≠ Audi → (1, 3) is an invalid combination

Algorithm for depentent attributes from a hierarchy

Algorithm for obtaining all possible combinations of dependent attribute values from a hierarchy.

- Define the whole hierarchy with vector pairs of attribute values, from the topmost to lowest attribute in the hierarchy. For example:

Attribute pair 1:
Origin = [‘Germany’, ‘Germany’, ‘Japan’]
Car = [‘BMW’, ‘Mercedes’, ‘Toyota’]
Attribute pair 2:
Car = [‘BMW’, ‘BMW’, ‘Mercedes’, ‘Mercedes’, ‘Toyota’, ‘Toyota’]
Model = [‘B10’, ‘B20’, ‘MX’, ‘MZ’, ‘T1’, ‘T5’]

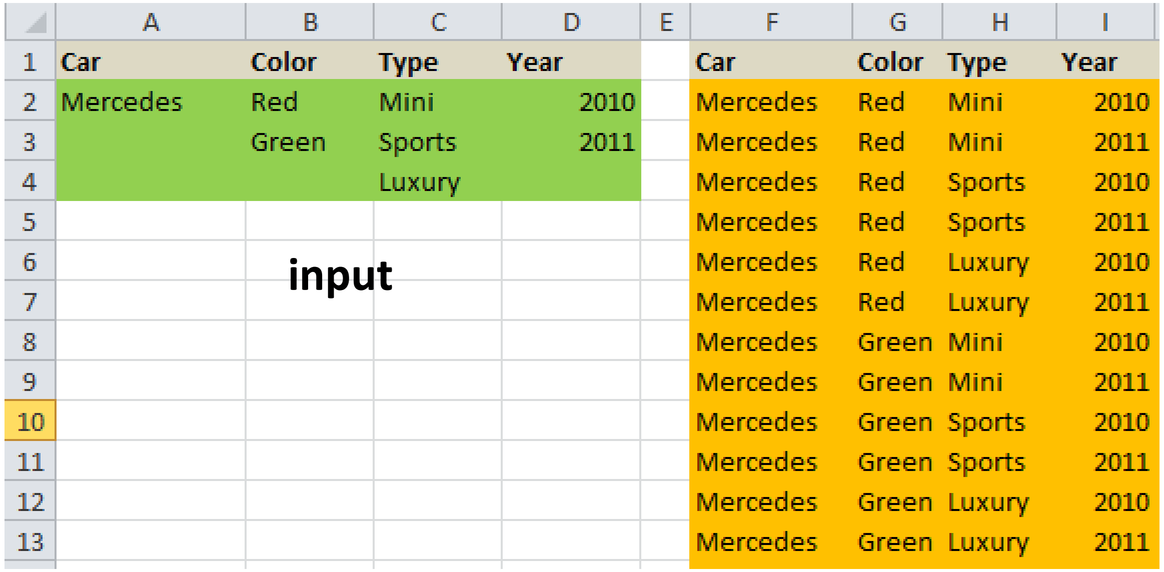
- Set the initial and final states of the multi-dimensional counter. The counter has as many digits (i.e. dimensions) as the number of attribute pairs. The initial state for each digit is 1; the final state is the number of attribute values in corresponding pair of attribute vectors.

For example, for the initial state is [1 1], and the final state is [3 6] for the vector pairs above.

- Start from the initial state (like [1 1] above) and increment counter in iterations until the final state is reached. At each iteration add a new row to the resultant test data only if the combination is valid.

Validity check: For all neigbouring attribute pairs, the second attribute (value) of the previous pair must be equal to the first attribute of the next pair. For example, the attribute combination corresponding to counter state [3 1] is not valid (Japan, Toyota – (BMW), B10) because Toyota ≠ BMW.

Excel VBA scripts (makro) for generating test data

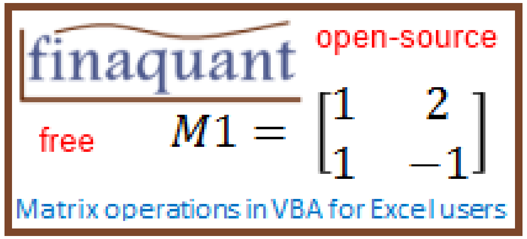


	A	B	C	D	E	F	G	H	I
1	**Car**	**Color**	**Type**	**Year**		**Car**	**Color**	**Type**	**Year**
2	Mercedes	Red	Mini	2010		Mercedes	Red	Mini	2010
3		Green	Sports	2011		Mercedes	Red	Mini	2011
4			Luxury			Mercedes	Red	Sports	2010
5						Mercedes	Red	Sports	2011
6						Mercedes	Red	Luxury	2010
7						Mercedes	Red	Luxury	2011
8						Mercedes	Green	Mini	2010
9						Mercedes	Green	Mini	2011
10						Mercedes	Green	Sports	2010
11						Mercedes	Green	Sports	2011
12						Mercedes	Green	Luxury	2010
13						Mercedes	Green	Luxury	2011

input

output

Excel VBA makros to generate test data:
Å FQS_generate_test_data()
Å FQS_generate_test_data_multiple_range()
Å FQS_generate_hierarchy_table()
... can be downloaded from
http://finaquant.com/download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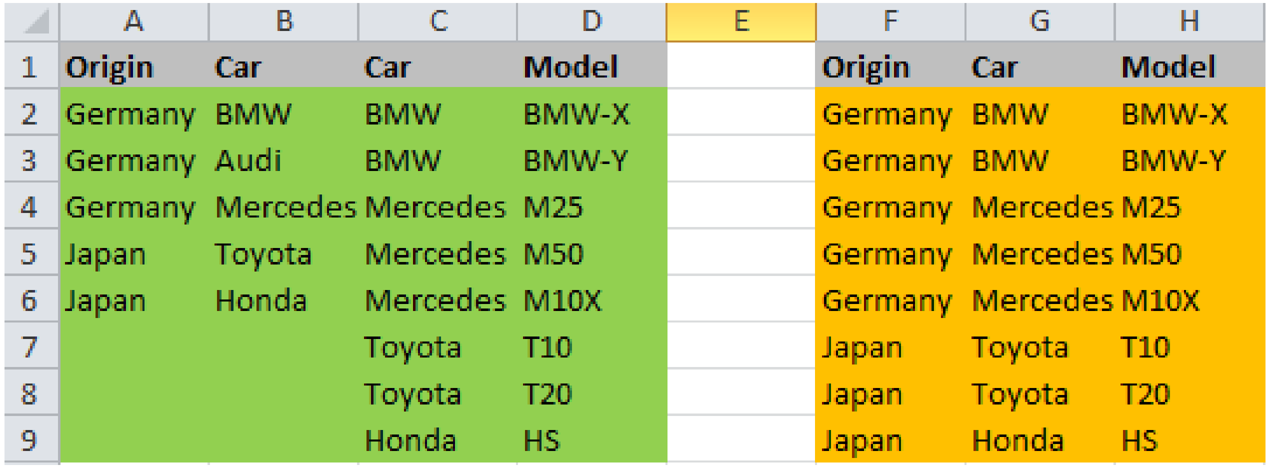
free
$M1 = \begin{bmatrix} 1 & 2 \\ 1 & -1 \end{bmatrix}$
Matrix operations in VBA for Excel users

These VBA makros use matrix and vector functions which can be downloaded from:
http://finaquant.com/download/matrixvectorvba

Generating a complete hierarchy table in excel



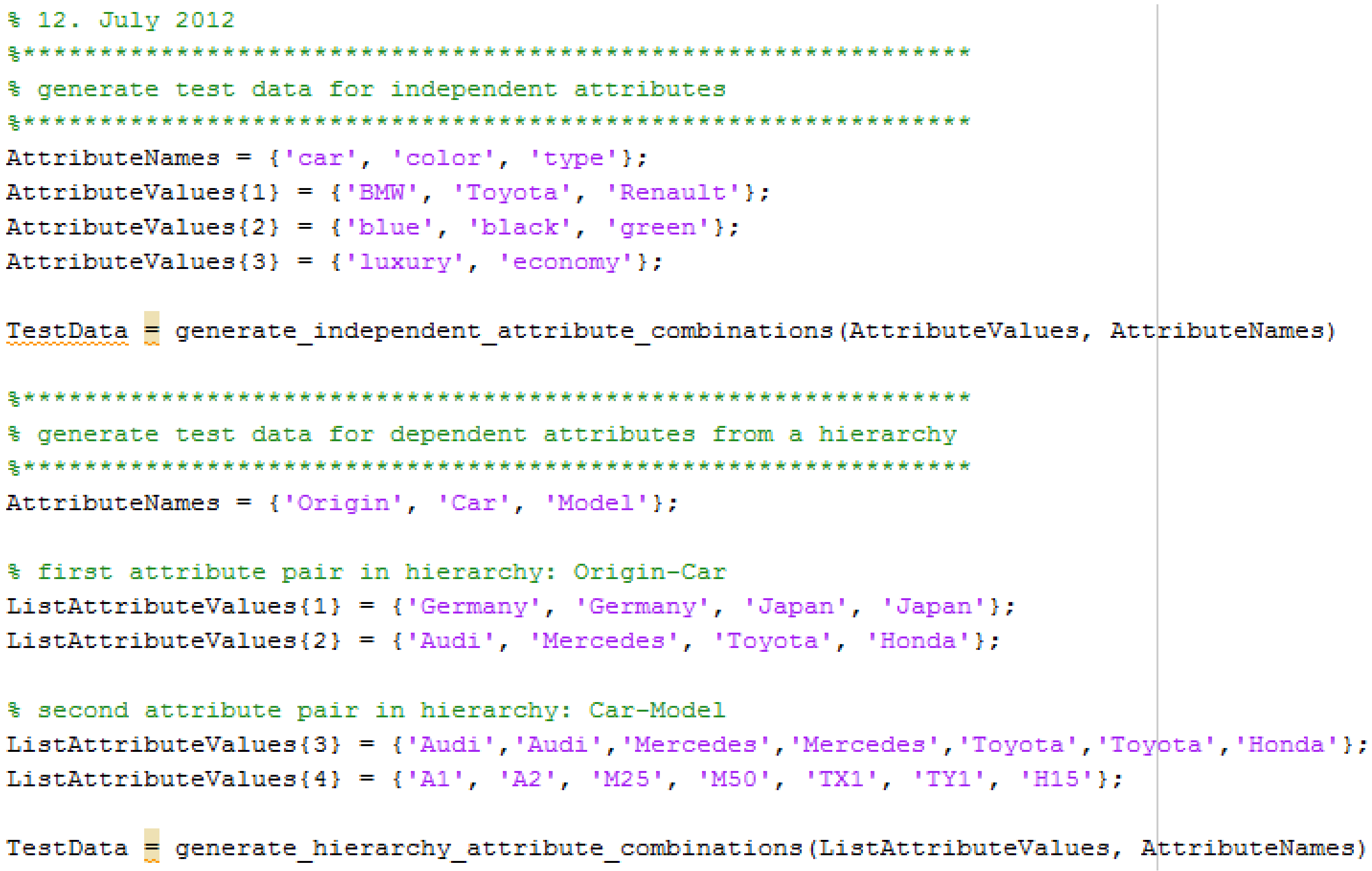
	A	B	C	D	E	F	G	H
1	Origin	Car	Car	Model		Origin	Car	Model
2	Germany	BMW	BMW	BMW-X		Germany	BMW	BMW-X
3	Germany	Audi	BMW	BMW-Y		Germany	BMW	BMW-Y
4	Germany	Mercedes	Mercedes	M25		Germany	Mercedes	M25
5	Japan	Toyota	Mercedes	M50		Germany	Mercedes	M50
6	Japan	Honda	Mercedes	M10X		Germany	Mercedes	M10X
7			Toyota	T10		Japan	Toyota	T10
8			Toyota	T20		Japan	Toyota	T20
9			Honda	HS		Japan	Honda	HS

input **output**

Makro: FQS_generate_hierarchy_table()

Excel VBA scripts can be downloaded from: http://finaquant.com/download

Matlab functions and scripts for generating test data



```
% 12. July 2012
%**************************************************************
% generate test data for independent attributes
%**************************************************************
AttributeNames = {'car', 'color', 'type'};
AttributeValues{1} = {'BMW', 'Toyota', 'Renault'};
AttributeValues{2} = {'blue', 'black', 'green'};
AttributeValues{3} = {'luxury', 'economy'};

TestData = generate_independent_attribute_combinations(AttributeValues, AttributeNames)

%**************************************************************
% generate test data for dependent attributes from a hierarchy
%**************************************************************
AttributeNames = {'Origin', 'Car', 'Model'};

% first attribute pair in hierarchy: Origin-Car
ListAttributeValues{1} = {'Germany', 'Germany', 'Japan', 'Japan'};
ListAttributeValues{2} = {'Audi', 'Mercedes', 'Toyota', 'Honda'};

% second attribute pair in hierarchy: Car-Model
ListAttributeValues{3} = {'Audi','Audi','Mercedes','Mercedes','Toyota','Toyota','Honda'};
ListAttributeValues{4} = {'A1', 'A2', 'M25', 'M50', 'TX1', 'TY1', 'H15'};

TestData = generate_hierarchy_attribute_combinations(ListAttributeValues, AttributeNames)
```

Matlab functions and scripts can be downloaded from: http://finaquant.com/download

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Å Analytical marketing
Å Fee and price calculations
Å Investment performance

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Contact: contactfq@finaquant.com