Viewpoints on obtaining aggregated value sets

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Abstract: - In many economic analyses, situations occur when we need to obtain aggregated values. For *n* fields (used for grouping) from a database, we can obtain 2^n aggregation types - the maximal set possible. For economic reasons, some from these aggregation types are important, other, probably are not. In this paper we are focused on presenting algorithms with which the user can obtain any subsets of aggregation types from the maximal set. The selection of aggregation types is made according to the economic problem.

Key-Words: aggregated value sets, economic analyses, relational databases, programming environment

1 Introduction

Data analysis is used in more departments or sectors like finance departments, marketing departments, the manufacturing sector, sales departments etc. Data analysis applications typically aggregate data across many dimensions (n>=0). Many analyses can be very complex and can concern a considerable number of aggregation types.

In order to illustrate the importance of this subject and its practical applicability, in this paper we consider as example data corresponding to the Monoprix supermarket network. For analysis, we use information from the web site www.monoprix.fr. The database structure corresponding to the supermarkets network is presented in *Figure 1*.

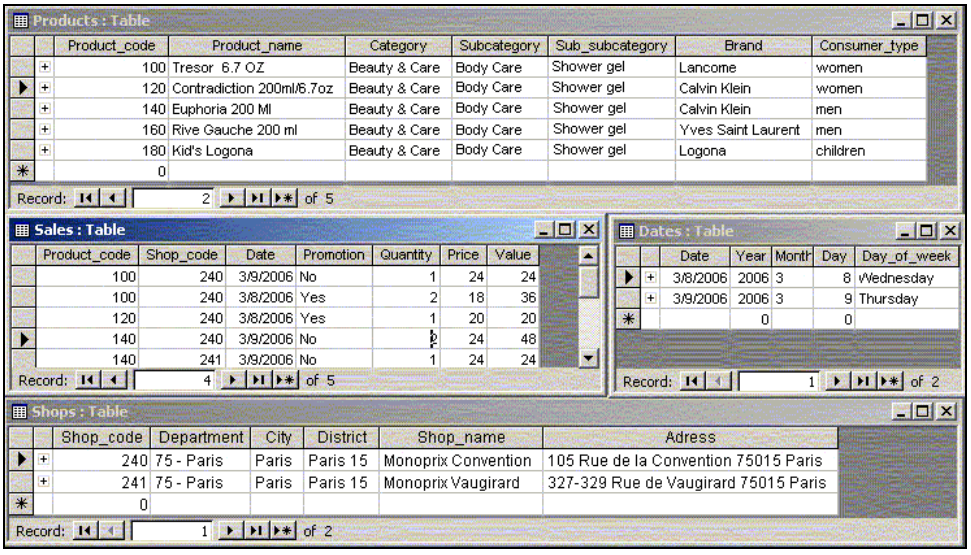

Fig. 1: Database structure, for a supermarket network

In the Monoprix supermarkets network we find the following product categories: *Mode & Accessories* (subcategories: Skirts, Shirts, Tops, Accessories, Uenderwear, T-Shirt, Dress, Trousers, Jacket/Waistcoat &Winter coat); *Beauty & Care* (subcategories: Body Care, Face Care, Make-up); *House & Leisure* (subcategories: Pieces of furniture, Decoration Accessories, Kitchen Materials, Stationery); *Food/Maintenance* (subcategories: Soft drinks, Bread- pastry, Maintenance, Fruits, Vegetables, Breakfast, Cooked dishes, Fish, dairy product, Dry Products, Frozen, Meat, Alcoholic drinks, ice cream, sausages).

Starting from the database presented in *Figure 1*, we can make many analyses concerning the product sales. These analyses can concern the sales at country, department, city, district or shop level, etc. In order to simplify the presentation, we present a possible analysis type at shop level.

2 Aggregation types and their specification

2.1. Problem presentation

Now, we consider the following situation:

We fix the values for the following fields *Shop_name, Category, Subcategory* and *year.* This implies an analysis at the shop level for a certain subcategory of products and for a certain year.

We consider as maximal set for grouping the following fields *Sub_subcategory, Brand, Consumer_type, Product_name, Promotion, Date, Month, Day, Day_of_week* and we want to calculate the total Euro value for corresponding sales.

We have nine fields which can be used for grouping. All result tables will have the same header. We can use any subset of this set of fields, and this means 2^9 = 512 possibilities for grouping. However, from this maximal set with 512 aggregation types, only a part has economic significance (see *Subsection 2.3.*). For each aggregation type, this means obtaining the same result as in the case of *SQL* statement with the following form:

SELECT subset_of_fields_used_for_grouping, SUM(value) as Total_value FROM Shops INNER JOIN (Products INNER JOIN (Dates INNER JOIN Sales ON Dates.Date = Sales.Date) ON Products.Product_code = Sales.Product_code) ON Shops.Shop_code = Sales.Shop_code WHERE Year = value_of_year and Shop_name =value_of_shop_name and Category = value_of_category and Subcategory = value_of _subcategory GROUP BY subset_of_fields_used_for_grouping

2.2. A method used to specify the aggregation types

In *Subsection 2.3.* we present a way in which we can make very complex analyses concerning the sales, but before that we recall how we want to refer to the sets of aggregation types (see [6] and [7]). In order to specify the aggregation types, we propose that the user make specifications, which contain combinations of "*m*" and/or "*f*" and/or "*u*", where:

f – means one field used for grouping,

u – means one field not used for grouping,

m – means zero, one or more fields not used for grouping.

Now, we consider the table presented in *Figure. 2.* Here, the fields *field1, field2, field3, field4, field5* form the maximal set used for grouping and the field *fvalue* is used for aggregation.

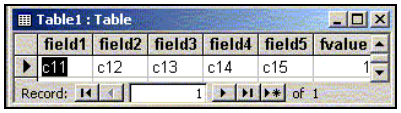

Fig. 2 An initial table

The specification *m f m* produces the results presented in *Figure 3* (which correspond to five aggregation types).

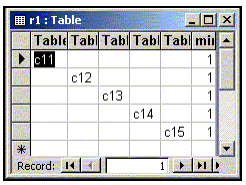

Fig. 3 The result for *m f m*

The specification *m f u f m* produces the results presented in *Figure 4* (which correspond to three aggregation types).

The specification *f m f m* produces the results presented in *Figure 5* (which correspond to four aggregation types).

In such specifications we can also eliminate some fields for a certain *f*.

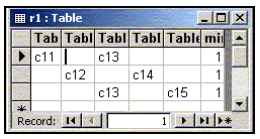

Fig. 4 The result for *m f u f m*

The user must specify the *n* fields used for grouping. Using specifications, which are composed of "*f*" or/and "*m*" or/and "*u*", the user can obtain any wanted subsets of aggregation types for the *n* specified fields.

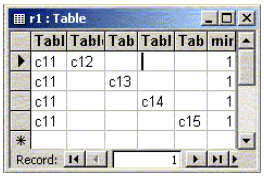

Fig. 5 The result for *f m f m*

2.3. Sales analysis – aggregation types and their specification

In all our cases, the result tables will have the following header: *Sub_subcategory, Brand, Consumer_type, Product_name, Promotion, Date, Month, Day, Day_of_week, Total_value*.

In *Sub_subcategory* we have a general name for a product. *Consumer_type* can be a value like *women*, *men*, *children* or *all*. *Product_name* refers to the name with all necessary details in order to classify the different products, corresponding to the same sub-subcategory. The field *Promotion* is used to find out the sales differences in the case of consumer sales promotions.

The fields *Date* and *Month* are used to observe the days and months of a year in which considerable differences in sales can be noticed (eg. Holidays, the seasons, etc.).
The field *Day*, which refers to a particular date of each month, is used to observe if there is an increase in sales during a certain period of the month.
The field *Day_of_week*, which refers to the days of the week, is used in order to observe if the consumers have a preference for shopping at a particular time during the week. This can be important especially for perishable products.
According to the position of fields in the header, we will construct our specifications of aggregation types. Now we present possible types of aggregations using different numbers of fields for grouping.

Case 1 – *one field used for grouping – 9 aggregation types*	
Sub_subcategory; Brand; Consumer_type; Product_name; Promotion; Date; Month; Day; Day_of_week	
Case 2 – *two fields used for grouping – 30 aggregation types*	
Case 2.1. Sub_subcategory, Brand Sub_subcategory, Consumer_type Sub_subcategory, Product_name Sub_subcategory, Promotion Sub_subcategory, Date Sub_subcategory, Month Sub_subcategory, Day Sub_subcategory, Day_of_week	**Case 2.2.** Brand, Consumer_type Brand, Product_name Brand, Promotion Brand, Date Brand, Month Brand, Day Brand, Day_of_week
Case 2.3. Consumer_type, Product_name Consumer_type, Promotion Consumer_type, Date Consumer_type, Month Consumer_type, Day Consumer_type, Day_of_week	**Case 2.4.** Product_name, Promotion Product_name, Date Product_name, Month Product_name, Day Product_name, Day_of_week
Case 2.5. Promotion, Date Promotion, Month Promotion, Day Promotion, Day_of_week	
Case 3 – *three fields used for grouping – 50 aggregation types*	
Case 3.1. Sub_subcategory, Brand, Consumer_type Sub_subcategory, Brand, Product_name Sub_subcategory, Brand, Promotion Sub_subcategory, Brand, Date Sub_subcategory, Brand, Month Sub_subcategory, Brand, Day Sub_subcategory, Brand, Day_of_week	
Case 3.2. Sub_subcategory, Consumer_type, Product_name Sub_subcategory, Consumer_type, Promotion Sub_subcategory, Consumer_type, Date Sub_subcategory, Consumer_type, Month Sub_subcategory, Consumer_type, Day Sub_subcategory, Consumer_type, Day_of_week	
Case 3.3. Sub_subcategory, Product_name, Promotion Sub_subcategory, Product_name, Date Sub_subcategory, Product_name, Month Sub_subcategory, Product_name, Day Sub_subcategory, Product_name, Day_of_week	
Case 3.4. Sub_subcategory, Promotion, Date Sub_subcategory, Promotion, Month Sub_subcategory, Promotion, Day Sub_subcategory, Promotion, Day_of_week	
Case 3.5. Brand, Consumer_type, Product_name Brand, Consumer_type, Promotion Brand, Consumer_type, Date Brand, Consumer_type, Month Brand, Consumer_type, Day Brand, Consumer_type, Day_of_week	
Case 3.6. Brand, Product_name, Promotion Brand, Product_name, Date Brand, Product_name, Month Brand, Product_name, Day Brand, Product_name, Day_of_week	
Case 3.7. Brand, Promotion, Date Brand, Promotion, Month Brand, Promotion, Day Brand, Promotion, Day_of_week	
Case 3.8. Consumer_type, Product_name, Promotion Consumer_type, Product_name, Date Consumer_type, Product_name, Month Consumer_type, Product_name, Day Consumer_type, Product_name, Day_of_week	
Case 3.9. Consumer_type, Promotion, Date Consumer_type, Promotion, Month Consumer_type, Promotion, Day Consumer_type, Promotion, Day_of_week	
Case 3.10. Product_name, Promotion, Date Product_name, Promotion, Month Product_name, Promotion, Day Product_name, Promotion, Day_of_week	
Case 4– *four fields used for grouping – 45 aggregation types*	
Case 4.1. Sub_subcategory, Brand, Consumer_type, Product_name Sub_subcategory, Brand, Consumer_type, Promotion Sub_subcategory, Brand, Consumer_type, Date Sub_subcategory, Brand, Consumer_type, Month Sub_subcategory, Brand, Consumer_type, Day Sub_subcategory, Brand, Consumer_type, Day_of_week	
Case 4.2. Sub_subcategory, Brand, Product_name, Promotion Sub_subcategory, Brand, Product_name, Date Sub_subcategory, Brand, Product_name, Month Sub_subcategory, Brand, Product_name, Day Sub_subcategory, Brand, Product_name, Day_of_week	
Case 4.3. Sub_subcategory, Brand, Promotion, Date Sub_subcategory, Brand, Promotion, Month Sub_subcategory, Brand, Promotion, Day Sub_subcategory, Brand, Promotion, Day_of_week	
Case 4.4. Sub_subcategory, Consumer_type, Product_name, Promotion Sub_subcategory, Consumer_type, Product_name, Date Sub_subcategory, Consumer_type, Product_name, Month Sub_subcategory, Consumer_type, Product_name, Day Sub_subcategory, Consumer_type, Product_name, Day_of_week	
Case 4.5. Sub_subcategory, Consumer_type, Promotion, Date Sub_subcategory, Consumer_type, Promotion, Month Sub_subcategory, Consumer_type, Promotion, Day Sub_subcategory, Consumer_type, Promotion, Day_of_week	
Case 4.6. Sub_subcategory, Product_name, Promotion, Date Sub_subcategory, Product_name, Promotion, Month Sub_subcategory, Product_name, Promotion, Day Sub_subcategory, Product_name, Promotion, Day_of_week	
Case 4.7.	

Brand, Consumer_type, Product_name, Promotion Brand, Consumer_type, Product_name, Date Brand, Consumer_type, Product_name, Month Brand, Consumer_type, Product_name, Day Brand, Consumer_type, Product_name, Day_of_week
Case 4.8. Brand, Consumer_type, Promotion, Date Brand, Consumer_type, Promotion, Month Brand, Consumer_type, Promotion, Day Brand, Consumer_type, Promotion, Day_of_week
Case 4.9. Brand, Product_name, Promotion, Date Brand, Product_name, Promotion, Month Brand, Product_name, Promotion, Day Brand, Product_name, Promotion, Day_of_week
Case 4.10. Consumer_type, Product_name, Promotion, Date Consumer_type, Product_name, Promotion, Month Consumer_type, Product_name, Promotion, Day Consumer_type, Product_name, Promotion, Day_of_week
Case 5– *five fields used for grouping – 21 aggregation types*
Case 5.1. Sub_subcategory, Brand, Consumer_type, Product_name, Promotion Sub_subcategory, Brand, Consumer_type, Product_name, Date Sub_subcategory, Brand, Consumer_type, Product_name, Month Sub_subcategory, Brand, Consumer_type, Product_name, Day Sub_subcategory, Brand, Consumer_type, Product_name, Day_of_week
Case 5.2. Sub_subcategory, Brand, Consumer_type, Promotion, Date Sub_subcategory, Brand, Consumer_type, Promotion, Month Sub_subcategory, Brand, Consumer_type, Promotion, Day Sub_subcategory, Brand, Consumer_type, Promotion, Day_of_week
Case 5.3. Sub_subcategory, Brand, Product_name, Promotion, Date Sub_subcategory, Brand, Product_name, Promotion, Month Sub_subcategory, Brand, Product_name, Promotion, Day Sub_subcategory, Brand, Product_name, Promotion, Day_of_week
Case 5.4. Sub_subcategory, Consumer_type, Product_name, Promotion, Date Sub_subcategory, Consumer_type, Product_name, Promotion, Month Sub_subcategory, Consumer_type, Product_name, Promotion, Day Sub_subcategory, Consumer_type, Product_name, Promotion, Day_of_week
Case 5.5. Brand, Consumer_type, Product_name, Promotion, Date Brand, Consumer_type, Product_name, Promotion, Month Brand, Consumer_type, Product_name, Promotion, Day Brand, Consumer_type, Product_name, Promotion, Day_of_week
Case 6– *six fields used for grouping – 4 aggregation types*
Sub_subcategory, Brand, Consumer_type, Product_name, Promotion, Date Sub_subcategory, Brand, Consumer_type, Product_name, Promotion, Month Sub_subcategory, Brand, Consumer_type, Product_name, Promotion, Day Sub_subcategory, Brand, Consumer_type, Product_name, Promotion, Day_of_week

In the *cases 1-6* we have 159 aggregation types from 512 possible using the nine fields (*Sub_subcategory, Brand, Consumer_type, Product_name, Promotion, Date, Month, Day, Day_of_week*). In our analysis we can use any subset of aggregation types from the set presented above.

Now, starting from the model proposed in *Subsection 2.2.*, we present ways in which we can specify aggregation types, using our notations "f", "u" and "m". If we want to use only one specification for each presented case, we can use the following forms of specifications:

Case 1 - m f m; Case 2.1. - f m f m; Case 2.2. - u f m f m; Case 2.3. - u u f m f m; Case 2.4. - u u u f m f m; Case 2.5. - u u u u f m f m; Case 3.1. - f f m f m; Case 3.2. - f u f m f m; Case 3.3. - f u u f m f m; Case 3.4. - f u u u f m f m; Case 3.5. - u f f m f m; Case 3.6. - u f u f m f m; Case 3.7. - u f u u f m f m; Case 3.8. - u u f f m f m; Case 3.9.- u u f u f m f m; Case 3.10. - u u u f f m f m; Case 4.1. - f f f m f m; Case 4.2. - f f u f m f m; Case 4.3. - f f u u f m f m; Case 4.4. - f u f f m f m; Case 4.5. - f u f u f m f m; Case 4.6.-f u u f f m f m ; Case 4.7. - u f f f m f m; Case 4.8. - u f f u f m f m; Case 4.9. - u f u f f m f m; Case 4.10. -u u f f f m f m; Case 5.1. - f f f f m f m; Case 5.2. - f f f u f m f m; Case 5.3. - f f u f f m f m; Case 5.4. - f u f f f m f m; Case 5.5. - u f f f f m f m ; Case 6 – f f f f f m f m.

We can formulate other specifications concerning the presented types of aggregation. For example, if we want only one specification for the *Cases 2.2 and 2.3* we can use the specification *m f m f m*, where for the first *f* we use only the fields *Brand* and *Consumer_type*.

The *Cases 1 – 6* concern distinct possible aggregation types, but we can use many other formulations for the same header of result tables. For example we consider the following case

Sub_subcategory, Promotion
Brand, Promotion
Consumer_type, Promotion
Product_name, Promotion
Promotion, Date
Promotion, Month
Promotion, Day
Promotion, Day_of_week

which is a combination of sub-cases of *Case 2*. For this new case we can use two specifications: *m f m f m* – where the last f is the field *Promotion* and *m f m f m* – where the first field is *Promotion*.

The formulation of specification, generally, is not unique. For example, for this last new case, we can use other two specifications, like in the following way: *m f m f u u u u* – where the last *f* automatically means the field *Promotion*, because to the right (in the header) we have four fields which will not be used for grouping and *u u u u f m f m* - where the first *f* automatically means the field *Promotion*, because to the left (in the header) we have four fields which will not be used for grouping.

3 Implementation and results

3.1. Problem presentation

In order to easily observe the implementation of this algorithm and the results tables we fix the values for the following fields: *Shop_name* (eg. Monoprix Convention), *Category* (eg. Beauty&Care),

Subcategory (Body_Care) and *year* (eg. 2006). In this case we can consider for grouping, only the fields *Sub_subcategory, Brand, Consumer_type, Product_name, Promotion, Date, Month.* Now we present the types of aggregations and their specifications.

Case 2.1. - f f m Sub_subcategory, Brand
Case 3.1. - f f m f m Sub_subcategory, Brand, Consumer_type Sub_subcategory, Brand, Product_name Sub_subcategory, Brand, Promotion Sub_subcategory, Brand, Date Sub_subcategory, Brand, Month
Case 4.1. - f f f m f m Sub_subcategory, Brand, Consumer_type, Product_name Sub_subcategory, Brand, Consumer_type, Promotion Sub_subcategory, Brand, Consumer_type, Date Sub_subcategory, Brand, Consumer_type, Month
Case 4.2. - f f u f m f m Sub_subcategory, Brand, Product_name, Promotion Sub_subcategory, Brand, Product_name, Date Sub_subcategory, Brand, Product_name, Month
Case 4.3. - f f u u f m f m Sub_subcategory, Brand, Promotion, Date Sub_subcategory, Brand, Promotion, Month
Case 5.1. - f f f f m f m Sub_subcategory, Brand, Consumer_type, Product_name, Promotion Sub_subcategory, Brand, Consumer_type, Product_name, Date Sub_subcategory, Brand, Consumer_type, Product_name, Month
Case 5.2. - f f f u f m f m Sub_subcategory, Brand, Consumer_type, Promotion, Date Sub_subcategory, Brand, Consumer_type, Promotion, Month
Case 5.3. - f f u f f m f m Sub_subcategory, Brand, Product_name, Promotion, Date Sub_subcategory, Brand, Product_name, Promotion, Month
Case 6 - f f f f f m f m Sub_subcategory, Brand, Consumer_type, Product_name, Promotion, Date Sub_subcategory, Brand, Consumer_type, Product_name, Promotion, Month

3.2. Implementation presentation

We select the tables and the fields, we specify the relationships, criteria and the aggregation functions like in *Figure 6*.

We specify the aggregation types and for each *f* we confirm the fields which will be used for grouping like in *Figure 7*.

For obtaining result tables we can select all specifications of aggregation types or only some of them, like in *Figure 8*.

In the case in which we select all specifications of aggregation types, we will obtain the result presented in *Figure 10*. If we select only the two first specifications of aggregation types (like in *Figure 8*), we will obtain the results presented in *Figure 9*. In both result tables (see *Figures 9* and *10*) the result presentation is affected by the order in which we introduce the specifications of aggregation types (see *Figures 8*). According to the situation, we can choose the intended order of specifications.

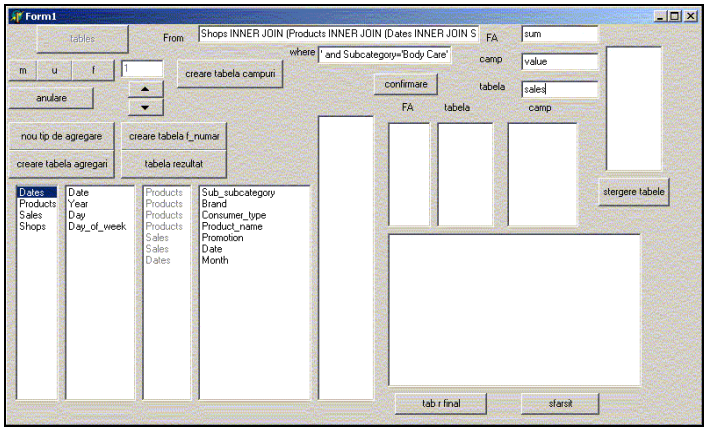

Fig. 6 Tables, fields, aggregation functions

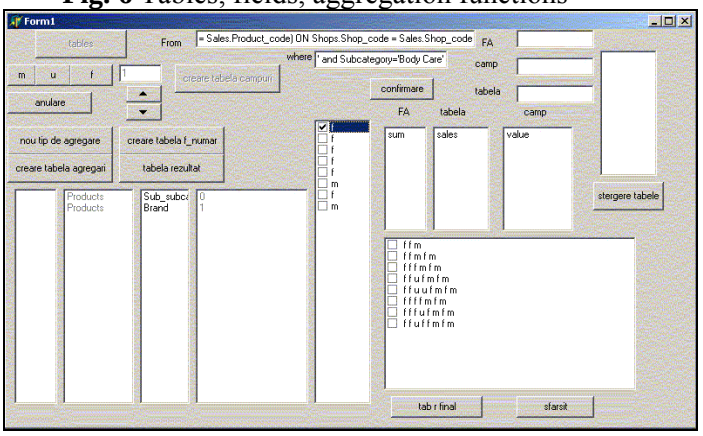

Fig. 7 Specification of aggregation types

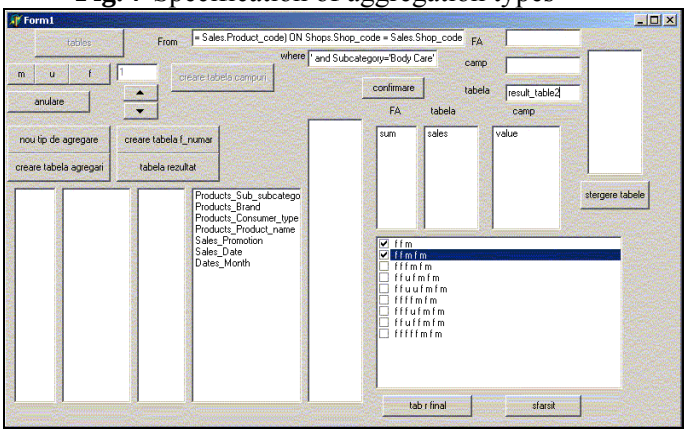

Fig. 8 Final confirmation for result tables

result_table2 : Table

Sub_subcategory	Brand	Consumer_type	Product_name	Promotion	Date	Month	Total_value
Shower gel	Calvin Klein						68
Shower gel	Lancome						60
Shower gel	Calvin Klein	men					48
Shower gel	Calvin Klein	women					20
Shower gel	Lancome	women					60
Shower gel	Calvin Klein		Contradiction 200				20
Shower gel	Calvin Klein		Euphoria 200 Ml				48
Shower gel	Lancome		Tresor 6.7 OZ				60
Shower gel	Calvin Klein			No			48
Shower gel	Calvin Klein			Yes			20
Shower gel	Lancome			No			24
Shower gel	Lancome			Yes			36
Shower gel	Calvin Klein				3/8/2006		20
Shower gel	Calvin Klein				3/9/2006		48
Shower gel	Lancome				3/8/2006		36
Shower gel	Lancome				3/9/2006		24
Shower gel	Calvin Klein					3	68
Shower gel	Lancome					3	60

Record: 1 of 18

Fig. 9 Result table corresponding to the specifications *f f m* and *f f m f m*

result_table1 : Table

Sub_subcategory	Brand	Consumer_type	Product_name	Promotion	Date	Month	Total_value
Shower gel	Calvin Klein						68
Shower gel	Lancome						60
Shower gel	Calvin Klein	men					48
Shower gel	Calvin Klein	women					20
Shower gel	Lancome	women					60
Shower gel	Calvin Klein		Contradiction 20				20
Shower gel	Calvin Klein		Euphoria 200 Ml				48
Shower gel	Lancome		Tresor 6.7 OZ				60
Shower gel	Calvin Klein			No			48
Shower gel	Calvin Klein			Yes			20
Shower gel	Lancome			No			24
Shower gel	Lancome			Yes			36
Shower gel	Calvin Klein				3/8/2006		20
Shower gel	Calvin Klein				3/9/2006		48
Shower gel	Lancome				3/8/2006		36
Shower gel	Lancome				3/9/2006		24
Shower gel	Calvin Klein					3	68
Shower gel	Lancome					3	60
Shower gel	Calvin Klein	men	Euphoria 200 Ml				48
Shower gel	Calvin Klein	women	Contradiction 20				20
Shower gel	Lancome	women	Tresor 6.7 OZ				60
Shower gel	Calvin Klein	men		No			48
Shower gel	Calvin Klein	women		Yes			20
Shower gel	Lancome	women		No			24
Shower gel	Lancome	women		Yes			36
Shower gel	Calvin Klein	men			3/9/2006		48
Shower gel	Calvin Klein	women			3/8/2006		20
Shower gel	Lancome	women			3/8/2006		36
Shower gel	Lancome	women			3/9/2006		24
Shower gel	Calvin Klein	men				3	48
Shower gel	Calvin Klein	women				3	20
Shower gel	Lancome	women				3	60
Shower gel	Calvin Klein		Contradiction 20	Yes			20
Shower gel	Calvin Klein		Euphoria 200 Ml	No			48
Shower gel	Lancome		Tresor 6.7 OZ	No			24
Shower gel	Lancome		Tresor 6.7 OZ	Yes			36
Shower gel	Calvin Klein		Contradiction 20		3/8/2006		20
Shower gel	Calvin Klein		Euphoria 200 Ml		3/9/2006		48
Shower gel	Lancome		Tresor 6.7 OZ		3/8/2006		36
Shower gel	Lancome		Tresor 6.7 OZ		3/9/2006		24
Shower gel	Calvin Klein		Contradiction 20			3	20
Shower gel	Calvin Klein		Euphoria 200 Ml			3	48
Shower gel	Lancome		Tresor 6.7 OZ			3	60
Shower gel	Calvin Klein			No	3/9/2006		48
Shower gel	Calvin Klein			Yes	3/8/2006		20
Shower gel	Lancome			No	3/9/2006		24
Shower gel	Lancome			Yes	3/8/2006		36
Shower gel	Calvin Klein			No		3	48
Shower gel	Calvin Klein			Yes		3	20
Shower gel	Lancome			No		3	24
Shower gel	Lancome			Yes		3	36
Shower gel	Calvin Klein	men	Euphoria 200 Ml	No			48
Shower gel	Calvin Klein	women	Contradiction 20	Yes			20
Shower gel	Lancome	women	Tresor 6.7 OZ	No			24
Shower gel	Lancome	women	Tresor 6.7 OZ	Yes			36
Shower gel	Calvin Klein	men	Euphoria 200 Ml		3/9/2006		48
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Shower gel	Lancome	women	Tresor 6.7 OZ		3/9/2006		24
Shower gel	Calvin Klein	men	Euphoria 200 Ml			3	48
Shower gel	Calvin Klein	women	Contradiction 20			3	20
Shower gel	Lancome	women	Tresor 6.7 OZ			3	60
Shower gel	Calvin Klein	men		No	3/9/2006		48
Shower gel	Calvin Klein	women		Yes	3/8/2006		20
Shower gel	Lancome	women		No	3/9/2006		24
Shower gel	Lancome	women		Yes	3/8/2006		36
Shower gel	Calvin Klein	men		No		3	48
Shower gel	Calvin Klein	women		Yes		3	20
Shower gel	Lancome	women		No		3	24
Shower gel	Lancome	women		Yes		3	36
Shower gel	Calvin Klein		Contradiction 20	Yes	3/8/2006		20
Shower gel	Calvin Klein		Euphoria 200 Ml	No	3/9/2006		48
Shower gel	Lancome		Tresor 6.7 OZ	No	3/9/2006		24
Shower gel	Lancome		Tresor 6.7 OZ	Yes	3/8/2006		36
Shower gel	Calvin Klein		Contradiction 20	Yes		3	20
Shower gel	Calvin Klein		Contradiction 20	Yes		3	20
Shower gel	Calvin Klein		Euphoria 200 Ml	No		3	48
Shower gel	Lancome		Tresor 6.7 OZ	No		3	24
Shower gel	Lancome		Tresor 6.7 OZ	Yes		3	36
Shower gel	Calvin Klein	men	Euphoria 200 Ml	No	3/9/2006		48
Shower gel	Calvin Klein	women	Contradiction 20	Yes	3/8/2006		20
Shower gel	Lancome	women	Tresor 6.7 OZ	No	3/9/2006		24
Shower gel	Lancome	women	Tresor 6.7 OZ	Yes	3/8/2006		36
Shower gel	Calvin Klein	men	Euphoria 200 Ml	No		3	48
Shower gel	Calvin Klein	women	Contradiction 20	Yes		3	20
Shower gel	Lancome	women	Tresor 6.7 OZ	No		3	24
Shower gel	Lancome	women	Tresor 6.7 OZ	Yes		3	36

Record: 75 of 86

Fig. 10 Result table corresponding to all specification of aggregation types

4 Conclusions

This algorithm can be used for any type of relational databases. In the programming environment we use *SQL* statements to exploit the database. Here we have worked with databases from *Access*. We have presented the implementation in *Delphi*, but the implementation can also be made in other programming environments.

For *n* fields (used for grouping) from a database, we can obtain 2^n aggregation types. With our algorithms, we can obtain any subsets of aggregation types. We can specify any set of aggregation types, we can choose the presentation order in the result tables and for a set of specifications of aggregation types we can also obtain result tables corresponding to the subsets of specifications (see *Figures 9* and *10*).

Our algorithm can be used in many other economic situations, as well. We have presented a situation at shop level but the analysis can be used in more departments or sectors such as finance departments, marketing departments, manufacturing sector, tourism etc.

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