# Romanian Black Sea Resorts. Study on the Summer Offers 

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#### Abstract

In Romania, the Black Sea seaside is one of the most popular places for the summer holidays. In this paper we present a database model including information about resorts, hotels, hotel star classifications, hotel room types, room amenities, hotel facilities, the holiday time period, the number of days for a holiday stay, meal types, rates for accommodation, etc. We built this database model based on data presented in travel agencies' catalogues. To explore the database data, we apply algorithms of aggregation. Our study is focused on detecting the best rates (depending on tourist preferences) for the summer holiday according to some other features.


Key-Words: - tourism, seaside summer offer, database, algorithms.

## 1 Introduction

In this paper we propose an algorithm used to explore information on the rates for summer offers at Romanian Black Sea resorts.

Starting from the 2009 summer catalogues of two famous travel agencies from Romania (Mareea and Eximtur), we build a database with data, which will be exploited in our study.

In the Section 2 we present information on the data from these catalogues. This information refers to: resorts, hotels, star classification, hotel facilities, room types, room amenities, children facilities and pet access in hotels. The room rates are influenced by all these factors, by the number of nights for a stay and by meal types (breakfast, lunch and dinner).

In Section 3, firstly, we build a database with the information presented in Section 2; we recall an algorithm (see also [13]) which can be used in the case of the summer offer study and in the last part of the Section 3 we apply this algorithm to our database.
These studies can help the tourist in order to quickly find an offer which is more suitable to his preference. At the same time he can estimate the suitable rate for himself. But in the same manner, these studies can help people who work in different tourism activity areas.

## 2 Data presentation

We have offers for 10 resorts: Mamaia, Eforie Nord, Eforie Sud, Costineşti, Olimp, Neptun, Jupiter, Cap Aurora, Venus and Saturn. One travel agency (Mareea) has offers for the Mangalia town. The present offer consists of 100 hotels for the first travel agency and of 130 hotels for the second one. 74 hotels are being offered by both agencies.

We are now presenting the number of hotels for each resort, offered by both catalogues of the agencies above: Mamaia - 47 hotels, Eforie Nord-26 hotels, Neptun-18 hotels, Costineşti-14 hotels, Venus-12 hotels, Jupiter-11 hotels, Saturn-10 hotels, Olimp-9 hotels, Eforie Sud-6 hotels, Cap Aurora-3 hotels and Mangalia-2 hotels.

We have 158 different hotels. Depending on the number of stars, we find: two 5 -star hotels, twenty one 4 -star hotels, sixty three 3 - star hotels, seventy one 2 star hotels and one 1 -star hotel. At the same time we would like to mention that: on the Romanian seaside, there are hotels with a 12 months full activity. For these hotels, the rates depend on the seasons and also on the week days (Fridays, Saturdays and Mondays are more expensive than the other nights). In this study we are exclusively focused on the summer offers. In these offers, the day of week is not significant for the stay rate, but the time period of the whole stay is.

In Table 1 we present, for each resort, the number of hotels depending on the star classification. We find 36 hotel facilities. Now, we enumerate these facilities and the number of hotels where we can find them: restaurant - 150 hotels; parking-112 hotels; bar-101 hotels; terrace-74 hotels; safe-59 hotels; conference rooms-50 hotels; outdoor swimming pool-47 hotels; Internet-45 hotels; children playground or elevator-34 hotels; luggage room-31 hotels; fitness or laundry-21 hotels; garden or beauty salon-19 hotels; massage-15 hotels; sauna- 14 hotels; drying room-13 hotels; Jacuzzi, billiards or medical treatments-9 hotels; shop-8 hotels; table tennis or tennis court-7 hotels; spa-6 hotels; football-5 hotels; volleyball or confectionary-4 hotels; disco-2 hotels; church, medical center, pharmacy, park, basketball court or track bowling-1 hotel. We use these
information exclusive from the travel agency catalogues.

| Resort | $\begin{gathered} \text { No } \\ \text { hotels } \end{gathered}$ | Stars | Resort | $\begin{gathered} \text { No } \\ \text { hotels } \end{gathered}$ | Stars | Resort | $\begin{gathered} \text { No } \\ \text { hotels } \end{gathered}$ | Stars |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Mamaia | 1 | 5 | Costinesti | 3 | 4 | Jupiter | 6 | 3 |
| Mamaia | 10 | 4 | Costinesti | 4 | 3 | Jupiter | 5 | 2 |
| Mamaia | 14 | 3 | Costinesți | 7 | 2 | Cap Aurora | 2 | 3 |
| Mamaia | 22 | 2 | Olimp | 3 | 4 | Cap Aurora | 1 | 2 |
| Mangalia | 2 | 3 | Olimp | 2 | 3 | Venus | 2 | 4 |
| Eforie <br> Nord | 1 | 4 | Olimp | 4 | 2 | Venus | 4 | 3 |
| Eforie <br> Nord | 16 | 3 | Neptun | 1 | 4 | Venus | 6 | 2 |
| Eforie Nord Efone | 9 | 2 | Neptun | 7 | 3 | Satum | 1 | 5 |
| Sud <br> Eforie | 1 | 3 | Neptun | 9 | 2 | Satum | 1 | 4 |
| Sud | 5 | 2 | Neptun | 1 | 1 | Satum <br> Saturn | 5 3 | 3 <br> 2 |

Table 1 Resorts and hotel stars


Figure 1 Number of facilities for 2, 3 and 4-star hotels
We find that a hotel has between 1 and 18 from the 36 hotel facilities enumerated above. In Table 2 we present, in a decreasing order by number of facilities, the corresponding number of hotels. In Table 2 we consider all hotels from all resorts in the studied
catalogues. In this way, we can observe that most hotels have less than 10 facilities.

| Number <br> of <br> facilities <br> 18 | Number <br> of <br> hotels | 1 | Number <br> of <br> facilities |
| :---: | :---: | :---: | :---: | | Number |
| :---: |
| of |
| hotels |
| 17 |

Table 2: Number of hotels corresponding to different numbers of facilities

| Hotel <br> Star | Minimum <br> number <br> of facilities | Maximum <br> number <br> of facilities |
| :--- | :--- | :--- |
| 5 | 12 | 16 |
| 4 | 2 | 15 |
| 3 | 1 | 18 |
| 2 | 1 | 9 |
| 1 | 6 | 6 |

Table 3: Minimum and maximum number of facilities per no star hotels

In Table 3 we present the minimum and the maximum number of hotel facilities, depending on the number of stars.

| Resort | Stars | min_no_f | max_no_f | Resort | Stars | min_no_f | max_no_f |
| :--- | ---: | ---: | ---: | :--- | ---: | ---: | ---: |
| Mamaia | 5 | 16 | 16 | Neptun | 3 | 3 | 8 |
| Mamaia | 4 | 6 | 12 | Neptun | 2 | 2 | 8 |
| Mamaia | 3 | 2 | 17 | Neptun | 1 | 6 | 6 |
| Mamaia | 2 | 2 | 8 | Jupiter | 3 | 5 | 18 |
| Eforie |  |  |  |  |  |  |  |
| Nord | 4 | 6 | 6 | Jupiter | 2 | 1 | 9 |
| Eforie |  |  |  |  |  |  |  |
| Nord | 3 | 1 |  |  |  |  |  |
| Eforie |  |  |  |  | Cap Aurora |  | 2 |

Table 4 Minimum and maximum number of facilities per no star hotels for each resort

In Figure 1, we have a chart for the number of hotel facilities for 2, 3 and 4-star hotels. In all of these cases
we can observe that the interval of values between the minimum and maximum value has no blanks.

In Table 4 we can view the minimum and maximum number of hotel facilities, according to the number of stars and the resort.

We find the following room types: apartments in 12 hotels, double rooms in 156 hotels, double attic rooms in 3 hotels, superior double rooms in 12 hotels, studio in 4 hotels, matrimonial rooms in 3 hotels and triple rooms in 1 hotel. In this section we present only the amenities for double rooms.

| Amenity | Number <br> of hotels |
| :--- | :--- |
| shower | 150 |
| TV | 145 |
| balcony | 123 |
| air conditioning | 98 |
| Mini-bar | 88 |
| phone | 70 |
| refrigerator | 54 |
| hair dryer | 29 |
| safe | 14 |
| room service | 5 |
| long chair | 3 |
| kitchen | 1 |
| Jacuzzi | 1 |

Table 5 Room amenities and the number of hotels, which provide them

For double rooms, we find the following amenities: air conditioning, balcony, shower, refrigerator, minibar, TV, phone, safe, hair dryer, Jacuzzi, room -service, long chair and kitchen. In Table 5 we present the number of hotels which provide the amenities mentioned above.

In Table 6 we present the number of hotels which provide different room amenities depending on star classification.

The value from the column on the right represents the number of hotels with the number of stars presented in the first column. We write this value only in the first line of each star number.

156 hotels have discount for children. In Table 7 we present, in the case of each facility, the minimum and maximum extra charge and the corresponding maximum interval of children ages. There have been found 147 of different cases, but we have extracted in Table 7 only those which represent the extremes for each child facility. Even if the extra charge for children facilities covers 147 cases, there is a good picture of these values given by Tables 7 and 8. The percentage on the columns refers to the percentage of the adult rate.

| Stars | Amenity | No h | Stars | Amenity | No h |  |
| ---: | :--- | ---: | ---: | :--- | ---: | :--- |
| 5 | hair dryer | 2 | 2 | 3 | shower | 63 |
| 5 | Mini-bar | 2 | 3 | TV | 58 |  |
| 5 | TV | 2 | 3 | air |  |  |
|  | air |  |  |  | 55 |  |
| 5 | conditioning | 2 | 3 | balcony | 51 |  |
| 5 | balcony | 1 | 3 | Mini-bar | 37 |  |
| 5 | Jacuzzi | 1 | 3 | phone | 35 |  |
| 5 | long chair | 1 | 3 | refrigerator | 24 |  |
| 5 | phone | 2 | 3 | hair dryer | 14 |  |
| 5 | safe | 2 | 3 | safe | 9 |  |
| 5 | shower | 2 | 3 | room service | 3 |  |
| 4 | TV | 21 | 21 | 3 | long chair | 2 |
|  | air |  |  |  |  |  |
| 4 | conditioning | 21 | 2 | shower | 69 | 71 |
| 4 | shower | 21 | 2 | TV | 65 |  |
| 4 | phone | 18 | 2 | balcony | 55 |  |
| 4 | Mini-bar | 18 | 2 | Mini-bar | 31 |  |
| 4 | balcony | 16 | 2 | refrigerator | 29 |  |
| 4 | hair dryer | 10 | 2 | air |  |  |
| 4 | safe | 4 | 2 | phone | 21 |  |
| 4 | kitchen | 1 | 2 | hair dryer | 3 |  |
| 4 | refrigerator | 1 | 2 | room service | 1 | 1 |
| 4 | room service | 1 | 1 | shower | 1 |  |

Table 6: Room amenities and the number of hotels which provide them, depending on the number of hotel stars

| Facility | Min age | Max age | Extra <br> charge |
| :--- | :--- | :--- | :--- |
| all inclusive | 0 | 5 | $0 \%$ |
| all inclusive | 12 | 18 | $75 \%$ |
| breakfast | 0 | 12 | $0 \%$ |
| breakfast | 7 | 12 | $75 \%$ |
| extra bed | 0 | 18 | $10 \%$ |
| extra bed | 12 | 18 | $80 \%$ |
| no bed | 0 | 18 | $0 \%$ |
| no bed | 12 | 14 | $40 \%$ |

Table 7 Children facilities and extra charges
156 hotels have discount for children. In Table 7 we present, in the case of each facility, the minimum and maximum extra charge and the corresponding maximum interval of children ages. There have been found 147 of different cases, but we have extracted in Table 7 only those which represent the extremes for each child facility.

Even if the extra charge for children facilities covers 147 cases, there is a good picture of these values given by Tables 7 and 8 . The percentage on the columns refers to the percentage of the adult rate.

Pets are allowed only in 18 hotels. The extra charge for pets is between 0 and $50 \%$ of the adult rate, or 60 RON in just one case.

We have 32411 different rates. The start date of a stay is between April $19^{\text {th }}$ and October $4^{\text {th }}$. We find that a
hotel has between 11 and 79 start dates for stays. These values are presented in Table 10.

| Stars | Facility | Min extra <br> charge | Max extra <br> charge |
| :--- | :--- | ---: | ---: |
| 5 | all inclusive | $0 \%$ | $50 \%$ |
| 5 | breakfast | $0 \%$ | $0 \%$ |
| 5 | extra bed | $50 \%$ | $50 \%$ |
| 5 | no bed | $0 \%$ | $0 \%$ |
| 4 | all inclusive | $0 \%$ | $75 \%$ |
| 4 | breakfast | $0 \%$ | $10 \%$ |
| 4 | extra bed | $30 \%$ | $80 \%$ |
| 4 | no bed | $0 \%$ | $0 \%$ |
| 3 | all inclusive | $0 \%$ | $70 \%$ |
| 3 | breakfast | $0 \%$ | $75 \%$ |
| 3 | extra bed | $10 \%$ | $75 \%$ |
| 3 | no bed | $0 \%$ | $25 \%$ |
| 2 | breakfast | $0 \%$ | $75 \%$ |
| 2 | extra bed | $10 \%$ | $75 \%$ |
| 2 | no bed | $0 \%$ | $40 \%$ |
| 1 | extra bed | $50 \%$ | $50 \%$ |

Table 8 Children extra charge according to star hotels

| Stars | Observation | Extra <br> charge | No <br> hotels |
| :--- | :--- | ---: | ---: |
| 4 | rate | 60 | 1 |
| 4 | percent | $20 \%$ | 2 |
| 4 | percent | $10 \%$ | 1 |
| 4 |  | $0 \%$ | 1 |
| 3 | percent | $50 \%$ | 1 |
| 3 | percent | $30 \%$ | 2 |
| 3 | percent | $20 \%$ | 2 |
| 3 |  | $0 \%$ | 1 |
| 2 | percent | $30 \%$ | 3 |
| 2 | percent | $20 \%$ | 4 |

Table 9 Extra charges for pets

| Stars | Minimum <br> number of start <br> dates | Maximum <br> number of start <br> dates |
| :--- | :--- | :--- |
| 5 | 21 | 50 |
| 4 | 13 | 57 |
| 3 | 13 | 79 |
| 2 | 11 | 58 |
| 1 | 14 | 14 |

Table 10 Number of different stays at a hotel during the summer offers

Table 11 provides information about the last date for starting the summer stays (which is $19^{\text {th }}$ of June) and the first date of the last stay (which is $24^{\text {th }}$ of August). This means that during the period between June $19^{\text {th }}$
and August $24^{\text {th }}$, all the hotels provide summer offers. For 2, 3 and 4 star hotels, in Figure 2, we present charts with these first and the last dates.


Figure 2 Interval of time for a summer stay

| Stars | Minimum <br> for the first <br> date | Maximum <br> for the first <br> date | Minimum for the <br> last date | Maximum for the <br> last date |
| :---: | :---: | :---: | ---: | ---: |
| 5 | 07 -May-09 | 07 -June-09 | 15-September-09 | 22-September-09 |
| 4 | 19-April-09 | 13-June-09 | 28-August-09 | 04 -October-09 |
| 3 | 28-April-09 | 20-June-09 | 24-August-09 | 02 -October-09 |
| 2 | 01 -May-09 | 19-June-09 | 26-August-09 | 24-September-09 |
| 1 | 05 -June-09 | 05-June-09 | 04-September-09 | 04-September-09 |

Table 11 Interval of stay dates, according to the star classification

Table 12 presents information about the duration of a stay, which can start from 5 nights up to 10 nights. The duration of a stay, usually increases for the 2 star hotels or the 3 star ones.

The offers include all possibilities, depending on the number of meals, as it follows: 1-no meals; 2-breakfast; 3-lunch; 4-dinner; 5-breakfast and lunch; 6-breakfast
and dinner; 7-lunch and dinner; 8-breakfast, lunch and dinner. In Table 13, we present, for each case of meals, the corresponding number of offers.

| Stars | No nights | No hotels |
| :--- | :--- | :--- |
| 5 | 7 | 1 |
| 5 | 6 | 1 |
| 5 | 5 | 2 |
| 4 | 7 | 17 |
| 4 | 6 | 6 |
| 4 | 5 | 10 |
| 3 | 10 | 8 |
| 3 | 8 | 8 |
| 3 | 7 | 51 |
| 3 | 6 | 27 |
| 3 | 5 | 30 |
| 2 | 10 | 10 |
| 2 | 8 | 20 |
| 2 | 7 | 44 |
| 2 | 6 | 33 |
| 2 | 5 | 29 |
| 1 | 7 | 1 |

Table 12 Number of nights for a stay
54 hotels offer 8 possibilities for the number of meals and 6 hotels offer 5 possibilities.

86 hotels offer 4 possibilities which are: 2, 5, 6 and 8, mentioned above.

3 hotels offer 3 possibilities for the number of meals, while 5 hotels offer just one possibility.

| Meals | No of offers |
| :--- | :--- |
| 1 | 2478 |
| 2 | 6074 |
| 3 | 1763 |
| 4 | 1763 |
| 5 | 6784 |
| 6 | 6669 |
| 7 | 1822 |
| 8 | 6858 |

Table 13 Type of meals and number of offers
Now, we present some rate results. Table 14 reveals the minimum and the maximum rate, depending on different periods of time. The rates refer to one person per night. As it shows, the table mentions 21 RON for a minimum rate and 566 RON for a maximum one. All rates are in RON.

All the hotels with all their meal offers have been considered in Table 14. This is the reason why the differences between rates are that significant. It is our intention to develop combinations of offers, depending on certain periods of time, which are supported by all types of budgets.

Lowest rates usually do not imply best conditions, while the highest rates do not imply bad conditions.

Based on these facts, it is advisable that everyone interested in these offers should consider a proper interval of rates for their own interest. However, it is also a common situation when the rates for the 4 star hotels are more affordable than the ones for the 3 star hotels.

| Interval | Date of start between |  | Min RON/night | Max RON/night |
| ---: | :--- | ---: | ---: | ---: |
| 1 | 14.04 .2009 | 23.04 .2009 | 91 | 205 |
| 2 | 24.04 .2009 | 03.05 .2009 | 38 | 230 |
| 3 | 04.05 .2009 | 13.05 .2009 | 23 | 230 |
| 4 | 14.05 .2009 | 23.05 .2009 | 23 | 282 |
| 5 | 24.05 .2009 | 02.06 .2009 | 21 | 288 |
| 6 | 03.06 .2009 | 12.06 .2009 | 24 | 298 |
| 7 | 13.06 .2009 | 22.06 .2009 | 24 | 347 |
| 8 | 23.06 .2009 | 02.07 .2009 | 30 | 533 |
| 9 | 03.07 .2009 | 12.07 .2009 | 34 | 533 |
| 10 | 13.07 .2009 | 22.07 .2009 | 39 | 556 |
| 11 | 23.07 .2009 | 01.08 .2009 | 44 | 541 |
| 12 | 02.08 .2009 | 11.08 .2009 | 53 | 556 |
| 13 | 12.08 .2009 | 21.08 .2009 | 37 | 541 |
| 14 | 22.08 .2009 | 31.08 .2009 | 28 | 556 |
| 15 | 01.09 .2009 | 10.09 .2009 | 23 | 347 |
| 16 | 11.09 .2009 | 20.09 .2009 | 24 | 313 |
| 17 | 21.09 .2009 | 30.09 .2009 | 25 | 230 |
| 18 | 01.10 .2009 | 10.10 .2009 | 81 | 205 |

Table 14 Minimum and maximum rate for different time intervals

In Table 15, we present these rates depending on the star classification of hotels.

The top image in Figure 3 presents the difference between the maximum rate and the minimum rate for each hotel, during summer. The maximum difference is 369 RON. We would like to mention that we are taking into consideration the difference in the rates of the same hotels, but we are not taking into consideration the influence of meals.

| Stars | Interval | Min | Max | Stars | Interval | Min | Max | Stars | Interval | Min | Max |
| ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| 5 | 3 | 98 | 213 | 4 | 12 | 85 | 458 | 2 | 4 | 28 | 161 |
| 5 | 4 | 98 | 213 | 4 | 13 | 71 | 458 | 2 | 5 | 21 | 190 |
| 5 | 5 | 98 | 230 | 4 | 14 | 57 | 389 | 2 | 6 | 24 | 190 |
| 5 | 6 | 115 | 298 | 4 | 15 | 46 | 347 | 2 | 7 | 24 | 207 |
| 5 | 7 | 115 | 313 | 4 | 16 | 52 | 278 | 2 | 8 | 30 | 236 |
| 5 | 8 | 115 | 533 | 4 | 17 | 91 | 205 | 2 | 9 | 35 | 247 |
| 5 | 9 | 253 | 533 | 4 | 18 | 91 | 205 | 2 | 10 | 46 | 318 |
| 5 | 10 | 300 | 556 | 3 | 2 | 69 | 230 | 2 | 11 | 53 | 318 |
| 5 | 11 | 300 | 541 | 3 | 3 | 23 | 230 | 2 | 12 | 53 | 318 |
| 5 | 12 | 300 | 556 | 3 | 4 | 23 | 230 | 2 | 13 | 37 | 282 |
| 5 | 13 | 264 | 541 | 3 | 5 | 27 | 264 | 2 | 14 | 28 | 258 |
| 5 | 14 | 192 | 556 | 3 | 6 | 29 | 264 | 2 | 15 | 23 | 207 |
| 5 | 15 | 115 | 313 | 3 | 7 | 38 | 273 | 2 | 16 | 24 | 192 |
| 5 | 16 | 98 | 313 | 3 | 8 | 41 | 334 | 2 | 17 | 34 | 132 |
| 5 | 17 | 98 | 213 | 3 | 9 | 48 | 384 | 1 | 6 | 26 | 107 |
| 4 | 1 | 91 | 205 | 3 | 10 | 66 | 384 | 1 | 7 | 26 | 107 |
| 4 | 2 | 69 | 218 | 3 | 11 | 78 | 384 | 1 | 8 | 31 | 111 |
| 4 | 3 | 52 | 219 | 3 | 12 | 84 | 384 | 1 | 9 | 34 | 132 |
| 4 | 4 | 52 | 282 | 3 | 13 | 53 | 384 | 1 | 10 | 48 | 132 |
| 4 | 5 | 52 | 288 | 3 | 14 | 42 | 312 | 1 | 11 | 54 | 138 |
| 4 | 6 | 58 | 293 | 3 | 15 | 27 | 273 | 1 | 12 | 54 | 138 |
| 4 | 7 | 65 | 347 | 3 | 16 | 25 | 230 | 1 | 13 | 37 | 138 |
| 4 | 8 | 78 | 362 | 3 | 17 | 25 | 230 | 1 | 14 | 30 | 111 |
| 4 | 9 | 82 | 397 | 3 | 18 | 81 | 161 | 1 | 15 | 26 | 107 |
| 4 | 10 | 82 | 450 | 2 | 2 | 38 | 154 |  |  |  |  |
| 4 | 11 | 85 | 458 | 2 | 3 | 29 | 161 |  |  |  | 2 |

Table 15 Rates for summer offers
In fact, the type of meals strongly influences the rate, not only the time period of a stay.

In Figure 3, in the image at the bottom, we present a percentage corresponding to the part of the minimum rate according to the maximum rate for each hotel.


Figure 3 Rate difference

From both images in Figure 3, we can observe that these differences are very important and they must be taken into consideration.

## 3 Database presentation

In order to highlight the best rates (according to tourist preferences) for the summer holidays in Romanian Black Sea resorts, we have built a database model containing information about the resort hotels. The information refers to resorts, star classification, room types, hotel facilities, room amenities, time period and duration of the stays, etc. In this subsection we describe all the database tables and the significance of their fields. Starting from the data presented in the travel agency catalogues or websites, we build the database presented in Figure 4. Now, we present the database tables.

In the Resorts table, we have the following fields: ID_resort, Resort and Description. In the Description field we save some information about each resort. The Hotels table has the fields: ID_hotel, ID_resort, Hotel, Phone, Fax, Stars (this field refers to the hotel star classification), Address, Web_address, E_mail and Beach_description (in this field we save information about the beach near the hotel).

In the Area_ Information table, we save information about the hotel location inside the resort (restaurants,
spa treatments, churches, mosques, theatre, etc).
All the possible facilities are saved in the Facility field, in the Hotel_facility_types table. In the Hotel_facilities table we specify all the facilities per hotel. For each facility, in the No field, we save their corresponding number. For example, if a hotel has two Outdoor Swimming Pools, then in the No field we have the value 2. The Extra_charge field contains number values. These values are 0 in the case in which the facility rate is included in the holiday series rate. In the Description field, we save a detailed description of each facility.

In the Hotel_rooms table we save information on the rooms of the hotels, including their corresponding number. Data about the room amenities are saved in the Room_amenity_types table. In the Rooms_amenities table, in the case of each hotel, we save the corresponding amenities for each room type. The No, Extra_charge and Description fields have the same significance as in the Hotel_facilities table.

In the Hotel_policies table, we have information on the policies of all hotels. The most common policies are the following: Check-In, Check-Out, Cancellation, Accepted credit cards, etc.

In the Photos (Movies) table we save the path of the image (video) files. These images (videos) refer to hotels, rooms, facilities, etc.

In the Children table we save all children facility types, specifying the extra charge, according with the child age.

In the Pets table we have information if pets are allowed in hotel and the corresponding extra charge in the affirmative case.

In the Travel_agencies table we have data about travel agencies.

The payment is made either at the hotel, or at different travel agencies. Travel agencies offer different duration of stays for hotels.

The rates are different from one agency to another (we find situations where the rates are significantly different). Generally, the highest rates are applied if you pay directly at the hotel.
In the Rate field, for each agency and for each type of hotel room, we save the following information: the rate for one person per night, depending on the number of meals (including or not breakfast, lunch or dinner); the start date of the stay and number of nights per stay.

### 3.1 Algorithm for obtaining aggregated values sets

Data analysis is used in many departments or sectors such as finance departments, marketing departments, manufacturing sector, sales departments etc. Data analysis applications typically aggregate data across
many dimensions ( $n>=0$ ). For aggregations, many tools are known. We recall some from these:

An $S Q L$ aggregate function $(A F)$ produces one answer:
Select AF (attribute_value) from table which corresponds to one aggregation type.

An $S Q L$ aggregate function $(A F)$ and the Group by operator also yield one answer:
Select attribute_1,...,attribute_n, AF (attribute_value) from table group by attribute_1,...,attribute_n which corresponds to one aggregation type.


Figure 4 Database for studying summer offers

The Rollup operator (from Oracle) - corresponds to $n+1$ aggregation types.

The Cube operator - corresponds to $2^{n}$ aggregation types (the maximal set possible).

In the case in which $n$ is not small, $2^{n}$ is a considerable value. In the case in which the user wants to obtain (in the same result table) other subsets of aggregated values than the sets given by the known tools, we propose the following algorithm.

In the beginning, we recall how we want to refer to the sets of aggregation types (see [10]). In order to specify the aggregation types, we propose that the user make specifications, which contain combinations of " $m$ " and/or " $f$ " and/or " "", 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 5. Here, the fields field1, field2, field3, field4, field5 form the maximal set used for grouping and the field fvalue is used for aggregation.

The specification $m f m$ produces the results presented in Figure 6 (which correspond to five aggregation types).

The specification $m f u f m$ produces the results presented in Figure 7 (which correspond to three aggregation types).


Figure 5: An initial table


Figure 6: The result for $m f m$
The specification $f m f m$ produces the results presented in Figure 8 (which correspond to four aggregation types). In such specifications we can also eliminate some fields for a certain $f$.


Figure 7: 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.

The implementation is presented in [13], using a programming environment (the current demonstration has been developed in Delphi) and a database (any relational database, here it is used an Access database).


Figure 8: The result for $f m f m$
For grouping and for aggregation, we can use fields from one or more tables. Also, we can build new tables with fields, regarding the criteria on the fields from the initial tables, like in the following examples.

### 3.2 Examples of aggregation used in the study of the rates per stay

Example 1 We present an example for studying the hotel room rates according to the resorts, the hotel star classification, room type and meal type.

We now present a situation in which for grouping we use fields from the tables presented in Figure 4.


Figure 9: Tables, fields, relationships and aggregated function

We assume that in the result tables we want to have the following header: Resort, Stars, Number_of_nights, Room_type, Observation, Breakfast, Lunch, Dinner, Number_of_offers, Minimum_Rate, Maximum_Rate.
Here, for grouping we use the following fields: Resort (from the Resorts table), Stars (from the Hotels table), Number_of_nights (from the Rates table), Room_type
(from the Hotel_rooms table), Observation, Breakfast, Lunch, Dinner (from the Rates table).

For aggregation we use the count, $\min$ and $\max$ functions on the Rate field (from the Rates table). We recall that the Rates field refers to the rate per person per night.


Figure 10: The specification of aggregation types
We have 8 fields used for grouping and this means that we have $2^{8}=256$ different possibilities of aggregation. We can formulate specifications of aggregation types, in the following way:

We specify the fields used for grouping and the fields used for aggregation with the corresponding aggregation function, like in Figure 9.
In Figure 10, we present the way in which we formulate the aggregation types.
We can obtain the aggregated values in the same result table or we can obtain different result tables corresponding to the selected aggregation type, like in Figure 11.

Now, we present some specification of aggregation types:


Figure 11: Result tables
c1.fmfmuu - which means that for grouping we use the following fields: Resort Stars // Resort Number_of_nights // Resort Room_type// Resort Observation.

From the 8 possible fields (Resort, Stars, Number_of_nights, Room_type, Observation, Breakfast, Lunch, Dinner - used in the header of the result table), in the case $c 1$, we use only 2 fields for grouping: the first field - Resort and any other field, with the exception of
the following three fields - Breakfast, Lunch and Dinner. In this way, we use 4 aggregation types which correspond to the number of 1 -combination from a set of 4 elements.


Table 16: Results for specification $f f f f f f f f$ (the Mamaia resort)

| Resort | S N | B | L | D | O | Min Max |  | Resort | S | N B | L | D | O | Min Max |
| ---: | :--- | :--- | :--- | :--- | :--- | ---: | ---: | ---: | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

Table 17: Results for specification $f m f m f f f$ (the Mamaia resort)
c2. fmfmfmuu $\mathbf{f}$ - which means that for grouping we use the following fields: Resort Stars Number_of_nights // Resort Stars Room_type // Resort Stars Observation // Resort Number_of_nights Room_type // Resort Number_of_nights Observation // Resort Room_type Observation.
From the 8 possible fields, in the case $c 2$, we use only 3 fields for grouping: the first field - Resort and any other 2 fields, with the exception of the following three fields - Breakfast, Lunch and Dinner. In this way, we use 6 aggregation types which correspond to the number of 2-combinations from a set of 4 elements.
c 3. $\mathbf{f m} \mathbf{f m} \mathbf{f m} \mathbf{f m u u}$ - which means that for grouping we use the following fields: Resort Stars Number_of_nights Room_type // Resort Stars Number_of_nights Observation // Resort Stars Room_type Observation // Resort Number_of_nights Room_type Observation.
In the case $c 3$, we use 4 fields for grouping: the first field - Resort and any other 3 fields, with the exception of the following three fields - Breakfast, Lunch and Dinner. In this way, we use 4 aggregation types which correspond to the number of 3 -combinations from a set of 4 elements.
c 4.fffffuuc- which means that for grouping we use the following fields: Resort Stars Number_of_nights Room_type Observation.
c5.fmfmfff which means that for grouping we use the following fields: Resort Stars Breakfast Lunch Dinner // Resort Number_of_nights Breakfast Lunch Dinner // Resort Room_type Breakfast Lunch Dinner // Resort Observation Breakfast Lunch Dinner.

| Resort | S | N | B L D | O | Min | Max |
| ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| 1 Mamaia | 2 | 5 |  | 2169 | 32 | 306 |
| 2 Mamaia | 2 | 6 |  | 1019 | 38 | 208 |
| 3 Mamaia | 2 | 7 |  | 2939 | 29 | 318 |
| 4 Mamaia | 2 | 8 |  | 379 | 38 | 216 |
| 5 Mamaia | 2 | 10 |  | 148 | 38 | 204 |
| 6 Mamaia | 3 | 5 | 847 | 46 | 366 |  |
| 7 Mamaia | 3 | 6 |  | 681 | 46 | 384 |
| 8 Mamaia | 3 | 7 | 1740 | 46 | 384 |  |
| 9 Mamaia | 3 | 8 | 278 | 46 | 234 |  |
| 10 Mamaia | 3 | 10 | 294 | 46 | 264 |  |
| 11 Mamaia | 4 | 5 | 809 | 69 | 458 |  |
| 12 Mamaia | 4 | 6 | 56 | 129 | 285 |  |
| 13 Mamaia | 4 | 7 | 863 | 69 | 389 |  |
| 14 Mamaia | 5 | 5 | 21 | 283 | 556 |  |

Table 18: Results for specification $f f f f f$ и и и (the Mamaia resort)

From the 8 possible fields (Resort, Stars, Number_of_nights, Room_type, Observation, Breakfast, Lunch, Dinner - used in the header of the result table), in the case $c 5$, we use only 5 fields for grouping:
the first field - Resort, the last three fields (Breakfast, Lunch, Dinner) and any other field. In this way, we use 4 aggregation types which correspond to the number of 1combination from a set of 4 elements.
c 6.fmfmfmfffewhich means that for grouping we use the following fields: Resort Stars Number_of_nights Breakfast Lunch Dinner // Resort Stars Room_type Breakfast Lunch Dinner // Resort Stars Observation Breakfast Lunch Dinner // Resort Number_of_nights Room_type Breakfast Lunch Dinner // Resort Number_of_nights Observation Breakfast Lunch Dinner // Resort Room_type Observation Breakfast Lunch Dinner.
From the 8 possible fields, in the case $c 6$, we use 6 fields for grouping: the first field - Resort, the last three fields (Breakfast, Lunch, Dinner) and any other 2 fields. In this way, we use 6 aggregation types which correspond to the number of 2 - combinations from a set of 4 elements.
c 7.fmfmfmfmfff-which means that for grouping we use the following fields: Resort Stars Number_of_nights Room_type Breakfast Lunch Dinner // Resort Stars Number_of_nights Observation Breakfast Lunch Dinner // Resort Stars Room_type Observation Breakfast Lunch Dinner // Resort Number_of_nights Room_type Observation Breakfast Lunch Dinner.
From the 8 possible fields, in the case $c 7$, we use 7 fields for grouping: the first field - Resort, the last three fields (Breakfast, Lunch, Dinner) and any other 3 fields. Here, we use 4 aggregation types which correspond to the number of 3 - combinations from a set of 4 elements.
c 8.ffffffff-which means that for grouping we use the following fields: Resort Stars Number_of_nights Room_type Observation Breakfast Lunch Dinner.

| Resort | S N B L D | O | Min |  | Max |
| :--- | :--- | :--- | ---: | ---: | ---: |
| 1 Mamaia | 2 |  | 6654 | 29 | 318 |
| 2 Mamaia | 3 |  | 3840 | 46 | 384 |
| 3 Mamaia | 4 |  | 1728 | 69 | 458 |
| 4 Mamaia | 5 |  | 21 | 283 | 556 |
| 5 Mamaia | 5 | 3846 | 32 | 556 |  |
| 6 Mamaia | 6 | 1756 | 38 | 384 |  |
| 7 Mamaia | 7 | 5542 | 29 | 389 |  |
| 8 Mamaia | 8 | 657 | 38 | 234 |  |
| 9 Mamaia | 10 | 442 | 38 | 264 |  |

Table 19: Results for specification $f m f m и и и$ (the Mamaia resort)
The difference between the group of cases c1-c4 and the group of cases $c 5-c 8$ is that, in the last group, the results depend on the meal type (the Breakfast, Lunch and Dinner fields). In the cases c1-c8 we have 30 aggregation types out of all 256 . We can use all these specifications of aggregation types (this means obtaining all the results in the same table) or only some of them, for different result tables.

We apply this example of our database with real data. For the Observation field from the Rates table we have in all cases the Catalogue Rate value. For the Room_type field we have the value double. In order to have an image on these results, we present (for some cases presented above) the result values corresponding to the Mamaia resort. In Tables 16-19 we present only the following fields: Resort, Star (S), Number_of_nights (N), Breakfast (B), Number_of_offers (O), Minimum_Rat (Min) and Maximum_Rate (Max).

Example 2 In this example, we are interested on the stays that have the start date between August $1^{\text {th }}$ and August $8^{\text {th }}$. We present an example for studying the hotel room rates depending on the resorts, the hotel star classification, number of nights and meal type.
In the result tables we want to have the following header: Resort, Stars, Number_of_nights, Breakfast, Lunch, Dinner, Number_of_offers Minimum_Rate, Maximum_Rate. Here, for grouping we use the following fields: Resort (from the Resorts table), Stars (from the Hotels table), Number_of_nights (from the Rates table), Breakfast, Lunch and Dinner (from the Rates table). For aggregation we use the count, $\min$ and max functions on the Rate field (from the Rates table). We have 6 fields used for grouping and this means that we have $2^{6}=64$ different possibilities of aggregation. For exemplification, we can use the following specifications of 14 aggregation types (for two cases, we present results in Tables 21 and 22).:

|  | Resort | $\mathbf{S}$ | $\mathbf{N}$ | $\mathbf{B}$ | $\mathbf{L}$ | $\mathbf{D}$ | $\mathbf{O}$ | Min | Max |
| ---: | :--- | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| 1 | Cap Aurora | 2 |  |  |  |  | 44 | 78 | 161 |
| 2 | Cap Aurora | 3 |  |  |  | 24 | 132 | 228 |  |
| 3 | Costinesti | 2 |  |  |  | 126 | 66 | 224 |  |
| 4 | Costinesti | 3 |  |  |  | 52 | 84 | 216 |  |
| 5 | Costinesti | 4 |  |  |  | 28 | 106 | 306 |  |
| 6 | Eforie Nord | 2 |  |  |  | 113 | 78 | 240 |  |
| 7 | Eforie Nord | 3 |  |  |  | 157 | 102 | 332 |  |
| 8 | Eforie Sud | 2 |  |  |  | 40 | 60 | 176 |  |
| 9 | Eforie Sud | 3 |  |  |  | 4 | 122 | 230 |  |
| 10 | Jupiter | 2 |  |  |  | 90 | 72 | 216 |  |
| 11 | Jupiter | 3 |  |  |  | 104 | 90 | 300 |  |
| 12 | Mamaia | 2 |  |  |  | 458 | 72 | 318 |  |
| 13 | Mamaia | 3 |  |  |  | 198 | 114 | 384 |  |
| 14 | Mamaia | 4 |  |  |  | 97 | 149 | 458 |  |
| 15 | Mamaia | 5 |  |  |  | 2 | 525 | 556 |  |
| 16 | Mangalia | 3 |  |  |  | 11 | 144 | 241 |  |
| 17 | Neptun | 1 |  |  |  | 8 | 54 | 138 |  |
| 18 | Neptun | 2 |  |  | 162 | 53 | 192 |  |  |
| 19 | Neptun | 3 |  |  | 126 | 102 | 300 |  |  |
| 20 | Neptun | 4 |  |  | 4 | 210 | 270 |  |  |
| 21 | Olimp | 2 |  |  | 62 | 96 | 216 |  |  |
| 22 | Olimp | 3 |  |  | 5 | 168 | 252 |  |  |
| 23 | Olimp | 4 |  |  | 21 | 186 | 324 |  |  |
| 24 | Saturn | 2 |  |  | 22 | 67 | 153 |  |  |
| 25 | Saturn | 3 |  |  |  | 91 | 160 | 311 |  |
|  | 2 |  |  |  |  |  |  |  |  |

Table 21: Results for specification $m f m f m и и и-I$

|  | Resort | S | N | B | L | D | O | Min | Max |
| :--- | :--- | :--- | :--- | :--- | :--- | ---: | ---: | ---: | ---: |
| 26 | Saturn | 4 |  |  |  |  | 14 | 85 | 260 |
| 27 | Saturn | 5 |  |  |  |  | 3 | 300 | 300 |
| 28 | Venus | 2 |  |  |  |  | 126 | 64 | 161 |
| 29 | Venus | 3 |  |  |  |  | 47 | 84 | 251 |
| 30 | Venus | 4 |  |  |  |  | 11 | 156 | 357 |
| 31 | Cap Aurora |  | 5 |  |  | 8 | 132 | 222 |  |
| 32 | Cap Aurora | 6 |  |  | 36 | 78 | 228 |  |  |
| 33 | Cap Aurora | 7 |  |  | 4 | 132 | 222 |  |  |
| 34 | Cap Aurora |  | 8 |  |  | 12 | 78 | 228 |  |
| 35 | Cap Aurora | 10 |  |  | 8 | 78 | 143 |  |  |
| 36 | Costinesti |  | 5 |  |  | 26 | 126 | 261 |  |
| 37 | Costinesti | 6 |  | 126 | 66 | 261 |  |  |  |
| 38 | Costinesti | 7 |  |  | 54 | 84 | 306 |  |  |
| 39 | Eforie Nord | 5 |  |  | 73 | 78 | 252 |  |  |
| 40 | Eforie Nord | 6 |  |  | 56 | 90 | 332 |  |  |
| 41 | Eforie Nord | 7 |  |  | 88 | 78 | 252 |  |  |
| 42 | Eforie Nord | 8 |  |  | 33 | 78 | 240 |  |  |
| 43 | Eforie Nord | 10 |  |  | 20 | 90 | 168 |  |  |
| 44 | Eforie Sud | 5 |  |  | 11 | 60 | 153 |  |  |
| 45 | Eforie Sud | 6 |  |  | 6 | 121 | 153 |  |  |
| 46 | Eforie Sud | 7 |  | 27 | 67 | 230 |  |  |  |
| 47 | Jupiter | 5 |  | 67 | 90 | 300 |  |  |  |
| 48 | Jupiter | 6 |  | 17 | 84 | 186 |  |  |  |
| 49 | Jupiter | 7 |  | 85 | 73 | 264 |  |  |  |
| 50 | Jupiter | 8 |  | 25 | 72 | 186 |  |  |  |

Table 20: Results for specification $m f m u u u$
c1. $\mathbf{m} \mathbf{f m u u}$ - which means that for grouping we use the following fields: Resort // Stars // Number_of_nights. We use 3 aggregation types which correspond to the number of 1 - combinations from a set of 3 elements (see Table 20).

|  | Resort | S | N |  | L | D | 0 | Min | Max |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Cap Aurora |  |  |  |  |  | 68 | 78 | 228 |
| 2 | Costinesti |  |  |  |  |  | 206 | 66 | 306 |
| 3 | Eforie Nord |  |  |  |  |  | 270 | 78 | 332 |
| 4 | Eforie Sud |  |  |  |  |  | 44 | 60 | 230 |
| 5 | Jupiter |  |  |  |  |  | 194 | 72 | 300 |
| 6 | Mamaia |  |  |  |  |  | 755 | 72 | 556 |
| 7 | Mangalia |  |  |  |  |  | 11 | 144 | 241 |
| 8 | Neptun |  |  |  |  |  | 300 | 53 | 300 |
| 9 | Olimp |  |  |  |  |  | 88 | 96 | 324 |
| 10 | Saturn |  |  |  |  |  | 130 | 67 | 311 |
| 11 | Venus |  |  |  |  |  | 184 | 64 | 357 |
| 12 |  | 1 |  |  |  |  | 8 | 54 | 138 |
| 13 |  | 2 |  |  |  |  | 1243 | 53 | 318 |
| 14 |  | 3 |  |  |  |  | 819 | 84 | 384 |
| 15 |  | 4 |  |  |  |  | 175 | 85 | 458 |
| 16 |  | 5 |  |  |  |  | 5 | 300 | 556 |
| 17 |  |  |  | 5 |  |  | 625 | 60 | 556 |
| 18 |  |  |  | 6 |  |  | 546 | 64 | 384 |
| 19 |  |  |  | 7 |  |  | 814 | 53 | 389 |
| 20 |  |  |  | 8 |  |  | 198 | 61 | 240 |
| 21 |  |  | 10 |  |  |  | 67 | 78 | 264 |

[^0]

|  | Resort | S | N | B | L | D | 0 | Min | Max |  | Resort | S | N | B | L | D | 0 | Min | Max |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 51 | Mamaia |  | 5 |  |  |  | 247 | 84 | 556 | 72 | Venus |  | 6 |  |  |  | 30 | 64 | 252 |
| 52 | Mamaia |  | 6 |  |  |  | 117 | 84 | 384 | 73 | Venus |  | 7 |  |  |  | 55 | 66 | 357 |
| 53 | Mamaia |  | 7 |  |  |  | 312 | 72 | 389 | 74 | Venus |  | 8 |  |  |  | 27 | 64 | 204 |
| 54 | Mamaia |  | 8 |  |  |  | 49 | 84 | 234 | 75 | Venus |  | 10 |  |  |  | 3 | 181 | 226 |
| 55 | Mamaia |  | 10 |  |  |  | 30 | 84 | 264 | 76 |  | 1 | 7 |  |  |  | 8 | 54 | 138 |
| 56 | Mangalia |  | 6 |  |  |  | 8 | 144 | 228 | 77 |  | 2 | 5 |  |  |  | 286 | 60 | 306 |
| 57 | Mangalia |  | 7 |  |  |  | 3 | 193 | 241 | 78 |  | 2 | 6 |  |  |  | 344 | 64 | 240 |
| 58 | Neptun |  | 5 |  |  |  | 75 | 76 | 252 | 79 |  | 2 | 7 |  |  |  | 420 | 53 | 318 |
| 59 | Neptun |  | 6 |  |  |  | 72 | 72 | 270 | 80 |  | 2 | 8 |  |  |  | 151 | 61 | 240 |
| 60 | Neptun |  | 7 |  |  |  | 116 | 53 | 300 | 81 |  | 2 | 10 |  |  |  | 42 | 78 | 204 |
| 61 | Neptun |  | 8 |  |  |  | 37 | 61 | 188 | 82 |  | 3 | 5 |  |  |  | 270 | 90 | 366 |
| 62 | Olimp |  | 5 |  |  |  | 10 | 118 | 264 | 83 |  | 3 | 6 |  |  |  | 178 | 84 | 384 |
| 63 | Olimp |  | 6 |  |  |  | 36 | 96 | 324 | 84 |  | 3 | 7 |  |  |  | 299 | 84 | 384 |
| 64 | Olimp |  | 7 |  |  |  | 38 | 96 | 324 | 85 |  | 3 | 8 |  |  |  | 47 | 84 | 234 |
| 65 | Olimp |  | 8 |  |  |  | 4 | 118 | 190 | 86 |  | 3 | 10 |  |  |  | 25 | 114 | 264 |
| 66 | Saturn |  | 5 |  |  |  | 39 | 85 | 311 | 87 |  | 4 | 5 |  |  |  | 66 | 85 | 458 |
| 67 | Saturn |  | 6 |  |  |  | 42 | 121 | 300 | 88 |  | 4 | 6 |  |  |  | 23 | 156 | 324 |
| 68 | Saturn |  | 7 |  |  |  | 32 | 67 | 300 | 89 |  | 4 | 7 |  |  |  | 86 | 106 | 389 |
| 69 | Saturn |  | 8 |  |  |  | 11 | 160 | 226 | 90 |  | 5 | 5 |  |  |  | 3 | 300 | 556 |
| 70 | Saturn |  | 10 |  |  |  | 6 | 181 | 226 | 91 |  | 5 | 6 |  |  |  | 1 | 300 | 300 |
| 71 | Venus |  | 5 |  |  |  | 69 | 66 | 251 | 92 |  | 5 | 7 |  |  |  | 1 | 300 | 300 |

Table 22: Results for specification $m f m f m u u u$-II
c2. $m \mathbf{f m} \mathbf{f m u} \mathbf{u}$ - which means that for grouping we use the following fields: Resort Stars // Resort Number_of_nights// Stars Number_of_nights. We use 3 aggregation types which correspond to the number of 2 - combinations from a set of 3 elements (see Tables 20 22).
c3. $\mathbf{f f f m u u}$ - which means that for grouping we use the following fields: Resort Stars Number_of_nights. We use 1 aggregation type which corresponds to the number of 3 - combinations from a set of 3 elements.
c4. $\mathbf{m f m} \mathbf{f f} \mathbf{f}$ - which means that for grouping we use the following fields: Resort Breakfast Lunch Dinner // Stars Breakfast Lunch Dinner// Number_of_nights Breakfast Lunch Dinner. We use 3 aggregation types which correspond to the number of 1 - combinations from a set of 3 elements.
c5. mfmfmfff - which means that for grouping we use the following fields: Resort Stars Breakfast Lunch Dinner// Resort Number_of_nights Breakfast Lunch Dinner// Stars Number_of_nights Breakfast Lunch Dinner.
We use 3 aggregation types which correspond to the number of 2 - combinations from a set of 3 elements.
c6. fffmuuu - which means that for grouping we use the following fields: Resort Stars Number_of_nights Breakfast Lunch Dinner. We use 1 aggregation type which corresponds to the number of 3 - combinations from a set of 3 elements.

Example 3 In the Examples 1 and 2 the stay rates are detected depending exclusively on the fields from the tables presented in Figure 4. If we want, with our algorithms, we can detect rates depending on values from tables. More clearly, in Section 2 we have presented the hotel facilities and room amenities, which are values in the database presented in Figure 4. In order to detect rates depending on hotel facilities and room amenities, we now consider the following situation:

We are interested in the offers that have the start date between August $1^{\text {th }}$ and August $8^{\text {th }}$, the resort is Mamaia, the number of hotel stars is 4 , the number of nights is 5 .

We suppose that we are interested in the offers where among the hotel facilities we find all the following values: restaurant, outdoor swimming pool and parking. Additionally, although it is not obligatory, we prefer to find the following facilities: bar, terrace, garden, luggage room, safe, children playground, Internet and elevator.

We suppose that we are interested in the offers where among the room amenities we find all the following values: air conditioning and shower. Additionally, although it is not obligatory, we prefer to find the following amenities: balcony, TV and mini-bar. In order to solve this problem, we create a result table with the offers that verify the following conditions: the start date between August $1^{\text {th }}$ and August $8^{\text {th }}$, the resort is Mamaia, the number of stars is 4 , the number of
nights is 5. This table has the following fields: Breakfast, Lunch, Dinner, Rate (from the Rates table presented in Figure 5.4), fl-fll and al-a5. We denote the hotel facilities with $f 1-f 11$, in the following way: restaurant-f1, outdoor swimming pool-f2, parking-f3, bar-f4, terrace-f5, garden-f6, luggage room-f7, safe-f8, children playground-f9, Internet-f10 and elevator-f11. We denote the room amenities with al-a5, in the following way: air conditioning-a1, shower-a2, balcony-a3, TV-a 4 and mini-bar - a5. In the fields f1f11 we have the value 1 if we find the facility at the corresponding hotel and the value 0 if we do not. In the fields a1-a 5 we have the value 1 if we find the facility at the corresponding hotel and the value 0 in the contrary case.

We present an example for studying the hotel room rates depending on meal type, hotel facilities and room amenities.
In the result tables we want to have the following header: Breakfast, Lunch, Dinner, $f 1, f 2, f 3, f 4, f 5, f 6, f 7$, f8, f9, f10, f11, a1, a2, a3, a4, a5 Number_of_offers, Minimum_Rate, Maximum_Rate.

For aggregation we use the count, $\min$ and max functions from the Rate field (from the Rates table).
We have 19 fields used for grouping and this means that we have $2^{19}=524288$ different possibilities of aggregation. We formulate the following specification of aggregation types:
c1. $\mathbf{f f f f f m f m f m f f m e m ~ - ~ w h i c h ~ m e a n s ~ t h a t ~ f o r ~}$ grouping we use the following fields: Breakfast Lunch Dinner f1 f2 f3 f4 f5 a1 a2 a3 // Breakfast Lunch Dinner f1 f2 f3 f4 f5 a1 a2 a4// c Breakfast Lunch Dinner f1 f2 $\mathrm{f} 3 \mathrm{f} 4 \mathrm{f5} \mathrm{a} 1 \mathrm{a} 2 \mathrm{a} / / /$ Breakfast Lunch Dinner f1 f2 f3 f4 f6 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f4 f6 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f4 f6 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f4 f7 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f4 f7 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f4 f7 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f4 f8 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f4 f8 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f4 f8 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f4 f9 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f4 f9 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f4 f9 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f4 f10 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f4 f10 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f4 f10 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f4 f11 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f4 f11 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f4 f11 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f5 f6 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f5 f6 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f5 f6 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f5 f7 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f5 f7 a1 a2 a4//

Breakfast Lunch Dinner f1 f2 f3 f5 f7 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f5 f8 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f5 f8 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f5 f8 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f5 f9 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f5 f9 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f5 f9 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f5 f10 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f5 f10 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f5 f10 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f5 f11 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f5 f11 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f5 f11 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f6 f7 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f6 f7 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f6 f7 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f6 f8 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f6 f8 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f6 f8 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f6 f9 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f6 f9 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f6 f9 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f6 f10 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f6 f10 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f6 f10 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f6 f11 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f6 f11 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f6 f11 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f7 f8 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f7 f8 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f7 f8 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f7 f9 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f7 f9 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f7 f9 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f7 f10 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f7 f10 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f7 f10 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f7 f11 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f7 f11 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f7 f11 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f8 f9 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f8 f9 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f8 f9 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f8 f10 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f8 f10 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f8 f10 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f8 f11 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f8 f11 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f8 f11 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f9 f10 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f9 f10 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f9 f10 a1 a2 a5// Breakfast Lunch Dinner f1 f2 f3 f9 f11 a1 a2 a3// Breakfast Lunch Dinner f1 f2 f3 f9 f11 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f9 f11 a1 a2 a5//

Breakfast Lunch Dinner f1 f2 f3 f10 f11 a1 a2 a3//
Breakfast Lunch Dinner f1 f2 f3 f10 f11 a1 a2 a4// Breakfast Lunch Dinner f1 f2 f3 f10 f11 a1 a2 a5.
We use 84 aggregation types which correspond to the number of 2 - combinations from a set of 8 elements (28-ffffffmfmfmffmfm) multiply by the number of 1 - combination from a set of 3 elements (3ffffffmimfmffmfm).

In order to generate the set of fields used for grouping, presented above, we can use the following program in Clips:
(deffacts f1
(c Breakfast Lunch Dinner f1 f2 f3 f4 f5 f6f7f8f9f10
f11 al a2 a3 a4 a5))
(defrule rl
(c ?b ?l ?d ?f1 ?f2 ?f3 \$? ?y \$? ?z \$? ?a1 \& al ?a2 \& a2 \$? ? $x$ \$?)
=>
(assert (c ?b ?l ?d ?f1 ?f2 ?f3 ?y ?z ?a1 ?a2 ?x)))
In this way, with a single specification of aggregation types, we obtain, in the same table, the results corresponding to 84 aggregation types (see Tables 23-26).

|  | 8 |  | D | ${ }^{1} 1$ |  | 12 f3 |  | 44 | $5 \mathrm{f6}$ | 167 |  | f8 | f9 f | 10 | $f 11$ | a1 | a 2 | a3 | 3 a | 4 as |  |  | Min | Max |  |  | 10 | f1 | $1{ }_{12}$ | $f$ | $\mathrm{fa}_{4}$ | f6 | $f 7$ | f8 | f9 | $f 10$ | f11 | a1 | a 2 | a3 | 34 |  | M |  | Max |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 1 y |  |  | 1 |  | 11 | 1 | 1 | 1 |  |  |  |  |  |  | 1 | 1 | 1 | 1 |  |  | 1 | 253 | 253 | 26 | V | $y$ | 1 | 1 | 1 | 1 |  |  | 1 |  |  |  | 1 | 1 | 1 |  |  | 30 |  | 37 |
|  | 2 y |  | v | 1 |  | 1. | 1 | 1 | 1 |  |  |  |  |  |  | 1 | 1 | 1 | 1 |  |  | 1 | 307 | 307 |  | y | $v$ | 1 | 1 |  | 1 |  |  | 1 |  |  |  | 1 | 1 | 1 |  |  | 30 |  | 37 |
|  | 3 y |  |  | 1 |  | 1. | 1 | 1 | 1 |  |  |  |  |  |  | 1 |  | 1 | 1 |  |  | 1 | 307 | 307 |  | y V | v y | 1 | 1 |  | 1 |  |  | 1 |  |  |  | 1 | 1 | 1 |  |  | 36 |  | 361 |
|  | 4 y | v |  | 1 |  | 1. | 1 | 1 | 1 |  |  |  |  |  |  | 1 | 1 | 1 | 1 |  |  | 1 | 361 | 361 | 29 |  |  |  | 1 |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | 1. |  | 19 |  | 53 |
|  | 5 y |  |  | 1 |  | 1. | 1 | 1 | 1 |  |  |  |  |  |  | 1 | 1 | 1 |  | 1 |  | 3 | 194 | 253 | 30 |  | y | 1 | 1 |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | 1 |  | 25 |  | 37 |
|  | 6 y |  | v | 1 |  | 1. | 1 | 1 | 1 |  |  |  |  |  |  | 1 | 1 | 1 |  | 1 |  | 3 | 254 | 307 | 31 | $y>$ | $y \mathrm{y}$ |  | 1 |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  |  | 1 | 31 |  | 361 |
|  | y |  |  | 1 |  | 1. | 1 | 1 | 1 |  |  |  |  |  |  | 1 | 1 | 1 |  | 1 |  | 3 | 255 | 307 |  | $y^{7}$ |  | 1 | 1 |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | 1 |  | 25 |  | 37 |
|  | 3 y | v |  | 1 |  | 1. | 1 | 1 | 1 |  |  |  |  |  |  | 1 | 1 | 1 |  | 1 |  | 3 | 315 | 361 | 33 | $\mathrm{y}_{\mathrm{y}}$ | y y | 1 | 1 |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | 1 |  | 31 |  | 31 |
|  | 9 |  |  | 1. |  | 1. | 1 | 1 | 1 |  |  |  |  |  |  |  | 1 | 1 |  |  |  | 3 | 194 | 253 | 34 |  |  |  | 1 |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  |  | 1 | 19 |  | 53 |
|  | y |  | v | 1 |  | 12 | 1 | 1 | 1 |  |  |  |  |  |  | 1 | 1 | 1 |  |  |  | 3 | 254 | 307 | 35 |  | $y$ | 1 | 1 |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  |  | 1 | 25 |  | 37 |
| 11 | 1 y | $v$ |  | 1 |  | 1 | 1 | 1 | 1 |  |  |  |  |  |  | 1 | 1 | 1 |  |  |  | 3 | 255 | 307 |  | $\mathrm{y}_{\mathrm{y}}$ |  |  | 1 |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  |  | 1 | 25 |  | 37 |
| 12 | 2 y | v |  | 1 |  | 11 | 1 | 1 | 1 |  |  |  |  |  |  | 1 | 1 | 1 |  |  |  | 3 | 315 | 361 |  | y | v y | 1 | 1 |  | 1 |  |  |  |  | 1 |  | 1 | 1 |  | 1 |  | 31 |  | 30 |
|  | 3 y | $v$ |  | 1. |  | 1. | 1 | 1 |  |  | 1 |  |  |  |  | 1. | 1 | 1 | 1 |  |  | 1 | 307 | 307 | 38 | V |  | 1 | 1 | 1 | 1 |  |  |  |  | 1 |  | 1 | 1 |  | 1 |  | 19 |  | 09 |
| 14 | 4 y | y |  | 1 |  | 1. |  | 1 |  |  | 1 |  |  |  |  | 1. |  |  | 1 |  |  | 1 | 361 | 361 | 39 | y | r |  | 1 |  | 1 |  |  |  |  | 1 |  | 1 | 1 |  | 1 |  | 25 |  | 269 |
| 15 | 5 |  |  | 1 |  | 12 | 1 | 1 |  |  | 1 |  |  |  |  | 1 | 1 | 1 |  | 1 |  | 1 | 253 | 253 |  | y |  | 1 | 1 |  | 1 |  |  |  |  | 1 |  | 1 | 1 |  | 1 |  | 25 |  | 270 |
| 16 | v |  | v | 1 |  | 1. | 1 | 1 |  |  | 1 |  |  |  |  | 1 | 1 | 1 |  | 1 |  | 1 | 307 | 307 | 41 | v |  | 1 | 1 | 1 | 1 |  |  |  |  | 1 |  | 1 | 1 |  |  | 1 | 19 |  | 209 |
| 17 | y | $v$ |  | 1 |  | 1 | 1 | 1 |  |  | 1 |  |  |  |  | 1 | 1 | 1 |  | 1 |  | 1 | 307 | 307 | 42 | v | $y$ | 1 | 1 |  | 1 |  |  |  |  | 1 |  | 1 | 1 |  |  | 12 | 25 |  | 69 |
| 18 | 8 y | v |  | 1 |  | 1. | 1 | 1 |  |  | 1 |  |  |  |  |  | 1 | 1 |  | 1 |  | 1 | 361 | 361 |  | $\mathrm{V}^{2}$ |  | 1 | 1 |  | 1 |  |  |  |  | 1 |  | 1 | 1 |  |  | 1 | 25 |  | 270 |
| 19 | V |  |  | 1. |  | 1.1 | 1 | 1 |  |  | 1 |  |  |  |  |  |  | 1 |  |  | 1. |  | 253 | 253 |  | 4 y | y y |  | 1 |  | 1 |  |  |  |  | 1 |  | 1 | 1 |  |  | 1 | 31 |  | 330 |
| 20 | y |  | v | 1 |  | 1. | 1 | 1 |  |  | 1 |  |  |  |  | 1 | 1 | 1 |  |  |  | 1 | 307 | 307 | 45 | y |  |  | 1 |  | 1 |  |  |  |  |  | 1 | 1 | 1 |  | 1. |  | 19 |  | 09 |
| 21 | 1 V | $v$ |  | 1 |  | 11 |  | 1 |  |  | 1 |  |  |  |  | 1 | 1 | 1 |  |  |  |  | 307 | 307 |  | $\mathrm{y}_{1}$ |  | 1 | 1 |  | 1 |  |  |  |  |  | 1 | 1 | 1 |  |  |  | 25 |  | 270 |
| 22 | 2 y | v |  | 1 |  | 1. | 1 | 1 |  |  | 1 |  |  |  |  | 1 | 1 | 1 |  |  | 1 |  | 361 | 361 | 47 | y y | v y | 1 | 1 | 1 | 1 |  |  |  |  |  | 1 | 1 | 1 |  |  | 1 | 31 |  | 30 |
| 23 | 3 y |  |  | 1 |  | 11 |  | 1 |  |  |  | 1 |  |  |  | 1 | 1 | 1 | 1 |  |  | 1 | 253 | 253 | 48 | V |  | 1 | 1 | 1 | 1 |  |  |  |  |  |  | 1 | 1 | 1 |  |  | 25 |  | 53 |
| 24 | 4 V |  |  | 1 |  |  |  | 1 |  |  | 1. |  |  |  |  |  |  |  | 1 |  |  | 1 | 253 | 253 | 49 | V | y |  | , |  | 1 |  |  |  |  |  |  | 1 | 1 | 1 |  | 1 | 30 |  | 37 |
| 25 | 5 y |  | $v$ | 1 | 1 | 1 | 1 | 1 |  |  | 1 |  |  |  |  | 1 | 1 | 1 | 1 |  |  | 1 | 307 | 307 | 50 | v | $y$ | 1 | 1 | 1 | 1 |  |  |  |  |  | 1 | 1 | 1 |  | 1 |  | 25 |  | 69 |

Table 23: Results for specification $f f f f f f m f m f m f f m f m-\mathrm{I}$


Table 24: Results for specification $f f f f f f m f m f m f f m f m$-II

|  |  | B 1. | D | f1 ${ }_{1}$ | $1 \mathrm{fz} \mathrm{f}^{\text {f }}$ |  | f4 | f5 | f6 f7 | f7 | f8 f9 | 69 f | $f 10$ | $f 11$ | a1 | a2 | a3 | 34 | as | 0 | Min |  | Max |  | B | 1 | D | $f 1$ | f2 | $f 3$ | $f 4$ | 65 | $f 6$ | f7 | 18 | f9 | $f 10$ | $f 11$ | a1 | a2 | a3 | 34 | as | 0 | Min | Max |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 101 | y | v |  | 1 | 1. | 1 |  | 1 |  |  |  |  |  |  | 1. | 1 | 1 | 1 |  | 1 | 253 |  | 253 | 126 | , |  | y | 1 | 1 | 1 |  |  |  | 1 |  |  |  |  | 1 | 1 | 1 |  | 1 | 1 | 307 | 307 |
| 102 | y | v | y | 1 | 1 | 1 |  | 1 |  |  |  |  |  |  | 1 | 1 | 1 | 1 |  | 1 | 307 |  | 307 | 127 | v | $\checkmark$ |  | 1 | 1 | 1 |  |  |  | 1 |  |  |  |  | 1 | 1 | 1 |  | 1 | 1 | 307 | 307 |
| 103 | v | y |  | 1 | 1 | 1 |  | 1 |  |  |  |  |  |  | 1 | 1 | 1 | 1 |  | 1 | 307 |  | 307 | 128 | y | y | y | 1 | 1 | 1 |  |  |  | 1 |  |  |  |  | 1 | 1 | 1 |  | 1 | 1 | 361 | 361 |
| 104 | y | y | y | 1 | 1 | 1 |  | 1 |  |  |  |  |  |  | 1 | 1 | 1 | 1 |  | 1 | 361 |  | 361 | 129 | y | $y$ |  | 1 | 1 | 1 |  |  |  |  | 1 |  | 1 |  | 1 | 1 |  | 1 |  | 2 | 255 | 270 |
| 105 | y |  |  | 1 | 1 | 1 |  | 1. |  |  |  |  |  |  | 1 | 1 | 1 |  | 1 | 1 | 253 |  | 253 | 130 | y | y | y | 1 | 1 | 1 |  |  |  |  | 1 |  | 1 |  | 1 | 1 |  | 1 |  | 2 | 315 | 330 |
| 106 | y | V | y | 1 | 1 | 1 |  | 1. |  |  |  |  |  |  | 1. | 1. | 1 |  | 1 | 11 | 307 |  | 307 | 131 | y |  |  | 1 | 1 | 1 |  |  |  |  | 1. |  | 1 |  | 1. | 1 |  |  | 1. | 2 | 194 | 209 |
| 107 | y | y |  | 1 | 1 | 1 |  | 1 |  |  |  |  |  |  | 1 | 1 | 1 |  | 1 | 1 | 307 |  | 307 | 132 | y |  | y | 1 | 1 | 1 |  |  |  |  | 1. |  | 1 |  | 1. | 1 |  |  | 1 | 2 | 254 | 269 |
| 108 | y | y | y | 1 | 1 | 1 |  | 1. |  |  |  |  |  |  | 1. | 1 | 1 |  |  | 11 | 361 |  | 361 | 133 | y |  |  | 1 | 1 | 1 |  |  |  |  | 1 |  | 1 |  | 1 | 1 |  | 1 |  | 2 | 194 | 209 |
| 109 | r |  |  | 1 | 1 | 1 |  |  |  | 1 | 1 |  |  |  | 1 | 1. | 1 |  |  | 1 | 253 |  | 253 | 134 | y |  | y | 1 | 1 | 1 |  |  |  |  | 1 |  | 1 |  | 1 | 1 |  | 1 |  | 2 | 254 | 269 |
| 110 | y | $v$ | y | 1 | 11 | 1 |  |  |  | 1 | 1 |  |  |  | 1 | 1 | 1 |  |  | 1 | 307 |  | 307 | 135 | y | $y$ |  | 1 | 1 | 1 |  |  |  |  | 1. |  | 1 |  | 1. | 1 |  |  | 1. | 2 | 255 | 270 |
| 111 | y | y |  | 1 | 1 | 1 |  |  |  | 1 | 1 |  |  |  | 1. | 1. | 1 |  |  | 1 | 307 |  | 307 | 136 | y | y | y | 1 | 1 | 1 |  |  |  |  | 1. |  | 1 |  | 1 | 1 |  |  | 1 | 2 | 315 | 330 |
| 112 | y | y | y | 1 | 1 | 1 |  |  |  | 1. | 1 |  |  |  | 1 | 1 |  | 1 |  | 1 | 361 |  | 361 | 137 | y |  |  | 1 | 1 | 1 |  |  |  |  | 1. |  |  | 1 | 1 | 1 |  | 1 |  | 2 | 194 | 209 |
| 113 | y | v |  | 1 | 1 | 1 |  |  |  | 1 | 1 |  |  |  | 1 | 1 |  |  |  | 11 | 253 |  | 253 | 138 | y |  | y | 1 | 1 | 1 |  |  |  |  | 1 |  |  | 1 | 1 | 1 |  | 1 |  | 2 | 254 | 269 |
| 114 | v | $\gamma$ | y | 1 | 1 | 1 |  |  |  | 1 | 1 |  |  |  | 1. | 1 |  |  | 1 | 1 | 307 |  | 307 | 139 | r | y |  | 1 | 1 | 1 |  |  |  |  | 1. |  |  | 1 | 1 | 1 |  | 1 |  | 2 | 255 | 270 |
| 115 | y | y |  | 1 | 1 | 1 |  |  |  | 1 | 1 |  |  |  | 1 | 1. |  |  | 1 | 11 | 307 |  | 307 | 140 | r | $y$ | y | 1 | 1 | 1 |  |  |  |  | 1 |  |  | 1 | 1 | 1 |  | 1 |  | 2 | 315 | 330 |
| 116 | y | y | y | 1 | 1 | 1 |  |  |  | 1 | 1 |  |  |  | 1 | 1 | 1 |  |  | 1 | 361 |  | 361 | 141 | y |  |  | 1 | 1 | 1 |  |  |  |  | 1 |  |  | 1 | 1 | 1 |  |  | 1. | 2 | 194 | 209 |
| 117 | y | v |  | 1 | 1 | 1 |  |  |  | 1 | 1 |  |  |  | 1 | 1 |  | 1 |  | 1 | 253 |  | 253 | 142 | y |  | y | 1 | 1 | 1 |  |  |  |  | 1 |  |  | 1 | 1 | 1 |  |  | 1. | 2 | 254 | 269 |
| 118 | y | v | y | 1 | 1 | 1 |  |  |  | 1. | 1 |  |  |  | 1 | 1 |  | 1 |  | 1 | 307 |  | 307 | 143 | y |  |  | 1 | 1 | 1 |  |  |  |  | 1 |  |  |  | 1 | 1 | 1 | 1 |  | 1 | 253 | 253 |
| 119 | y | y |  | 1 | 11 | 1 |  |  |  | 1 | 1 |  |  |  | 1 | 1 |  | 1 |  | 1 | 307 |  | 307 | 144 | y |  | y | 1 | 1 | 1 |  |  |  |  | 1 |  |  |  | 1 | 1 | 1 | 1 |  | 1 | 307 | 307 |
| 120 | y | y | y | 1 | 1 | 1 |  |  |  | 1. | 1 |  |  |  | 1. | 1. |  |  |  | 11 | 361 |  | 361 | 145 | y | y |  | 1 | 1 | 1 |  |  |  |  | 1. |  |  | 1 | 1 | 1 |  |  | 1. | 2 | 255 | 270 |
| 121 | y | 1 |  | 1 | 1 | 1 |  |  |  | 1. |  |  |  |  | 1. | 1 | 1 | 1 |  | 1 | 253 |  | 253 | 146 | y | $y$ | y | 1 | 1 | 1 |  |  |  |  | 1. |  |  | 1 | 1 | 1 |  |  | 1 | 2 | 315 | 330 |
| 122 | y | V | y | 1 | 12 | 1 |  |  |  | 1 |  |  |  |  | 1 | 1 | 1 | 1 |  | 1 | 307 |  | 307 | 147 | y | y |  | 1 | 1 | 1 |  |  |  |  | 1 |  |  |  | 1. | 1 | 1 | 1 |  | 1 | 307 | 307 |
| 123 | y | y |  | 1 | 1. | 1 |  |  |  | 1 |  |  |  |  | 1 | 1 | 1 | 1 |  | 1 | 307 |  | 307 | 148 | V | y | y | 1 | 1 | 1 |  |  |  |  | 1 |  |  |  | 1. | 1 | 1 | 1 |  | 1 | 361 | 361 |
| 124 | y | y | y | 1 | 1 | 1 |  |  |  | 1 |  |  |  |  | 1 | 1 | 1 | 1 |  | 1 | 361 |  | 361 | 149 | y |  |  | 1 | 1 | 1 |  |  |  |  | 1. |  |  |  | 1 | 1 | 1 |  | 1. | 1 | 253 | 253 |
| 125 |  |  |  | 1 | 11 | 1 |  |  |  | 1 |  |  |  |  | 1 | 1 | 1 |  |  | 11 | 253 |  | 253 | 150 | $y$ |  | y | 1 | 1 | 1 |  |  |  |  | 1 |  |  |  | 1 | 1 | 1 |  | 1 | 1 | 307 | 307 |

Table 25: Results for specification $f f f f f f m f m f m f f m f m$-III


Table 26: Results for specification $f f f f f f m f m f m f f$ $m f m$-IV

## 4 Conclusion

Using algorithms like the one presented in Section 3, we can perform different studies on the room rates in the resort hotels. This type of study can help the tourist to make a good choice for his holiday and also can help the hotel managers to develop their business. The case presented in this paper is just an example and we consider that it can be adapted to many other types of tourism from Romania and other countries.

## References.

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