The Research on Meeting Arrangement

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Abstract. With the progress of modern society, the meeting plays a very important role in communicating information, exploring the latest development in a certain field and discussing the solution of the problem, and it is a popular hope to arrange meetings by computer instead of person. This paper introduces the research on the establishment of decision algorithm for automatic meeting arrangement system. The meeting organizer should not only consider meeting time and venue, but also consider representatives’ satisfaction, which includes two aspects: the first is the room cost, and the second is whether or not to meet the reservation requirements. Considering these factors, a linear programming model is given in this paper. With this model, the reasonable allocation of rooms and the optimal allocation of vehicles can be realized. On the other hand, the appropriate meeting time and venue can also be determined.

1. Introduction

With the progress of modern society, competition and cooperation become more frequent, and the role of meeting is becoming more and more important. But the different schedules, how to coordinate meeting schedules is an important work. If the meeting organizer first determines the meeting time and then invites each participant, this meeting arrangement will lead to the fact that some of participants cannot attend the meeting because of the time schedule, which will greatly reduce the meeting effectiveness.[1] Obviously, meeting arrangement is a very tedious and important task. Firstly, choosing a meeting time is a key step. The meeting organizer needs to draw up a time, get in touch with each participant, ask them if the meeting time is appropriate, and wait for their answers. As long as the time is not suitable for a participant, it is necessary to choose another time and repeat the above work. Secondly, a venue should be chosen for the meeting. Evidently, it is impossible that two meetings are held in the same place at the same time. Finally, the meeting organizer should make arrangements for the safeguard work. Once the time and venue of the meeting is fixed, it is vital that the meeting organizer decide the points on the agenda immediately. In order to ensure the smooth development of various activities, the meeting organizer needs to inform all the information to everyone, arrange transportation routes and allocate vehicles reasonably. Before the advent of the Internet, the meeting organizer contacts the participants by telephone, letter and so on to coordinate the agenda. It is not only time-consuming, but also inefficient. Today, it is a popular hope to arrange meetings by computers. An automatic meeting arrangement system must have a strong decision function.[2] According to the user's meeting application, the system determines whether the meeting is in conflict with other meetings of a participant. If there is a conflict, it will also give advice on the time to hold another meeting. For the meeting organizer, the two parties are indispensable to ensure that key participants are present and a suitable place can be used for the meeting, otherwise, the meeting will not be organized.
A meeting service company in a city is responsible for a national meeting in a professional field. The meeting organizer will reserve hotel rooms, lease meeting rooms and hire cars for transporting participants. Because the size of the participants is expected to be large, and the number of hotel rooms and meeting rooms of several hotels suitable for the meeting is all insufficient individually, the participants can only be dispersed to a number of hotels. For simple administration, in addition to meeting the needs of the representatives in terms of price and so on, the number of hotels should be as few as possible and close to each other. After investigation, the meeting organizer selected 10 hotels as alternative hotels. The names of them are expressed as symbol $I$ to 10, Their relative positions are shown in figure 1 (Where, the number is the distance between two hotels). The specifications, quantity and price of the rooms and meeting rooms can be obtained from the web site (http://www.mcm.edu.cn).

![Figure 1. The relative positions of 10 hotels.](image)

From the previous sessions, there are some representatives of the participants who do not submit the return receipt but attend the meeting. At the same time, some representatives do not submit the return receipt in advance. The relevant data and the information on reserving accommodation which issued by the participants' receipt can be obtained from the web site too. These data can be used as reference for reservation of participants. Attention please, although the room charge is paid by the representatives, but if the number of reservations is greater than the actual number of rooms, the meeting organizer will pay a day's room charge, and if the number of reservations is insufficient, it will cause the dissatisfaction for the representatives. During the meeting, six panel discussions are arranged every morning and afternoon a day, and the meeting organizer should lease meeting rooms of several hotels where representatives have been staying. Because there is no way to know which representatives are going to participate in the panel discussion, the meeting organizer should hire cars for transporting participants from the car rental company. There are three types of cars which number of seats is 45, 36, and 33, respectively, and the rent is 800, 700 and 600 per half day (unit:yuan). Considering the factors of economy, convenience and representative satisfaction, a reasonable plan for reserving hotel rooms, leasing meeting rooms and hiring cars should be made for the meeting organizer by mathematical model.

2. Establishment of model

2.1 Symbol explanation

1) Assume that the alternative hotels can accommodate all representatives;
2) In accordance with the accommodation requirements of the representatives, the hotel rooms are divided into six categories, including sharing 1, sharing 2, sharing 3, living alone 1, living alone 2, and living alone 3. Where, sharing represents that two persons live in one room, living alone represents that one person lives alone. Symbol 1, 2 and 3 refer to three kinds of the hotel room prices of 120~160, 161~200 and 201~300 each day (unit:yuan). \( x_{ij} \) represents the number of category \( j \) rooms reserved by the meeting organizer to hotel \( i \);

3) According to the data and figure 1, the hotel 7 and hotel 8 are located in the center of the region, the rental of the meeting rooms is relatively cheap and the number can meet the meeting needs. So we assume that the meeting rooms are reserved in the hotel 7 and hotel 8.

4) Except for those living in hotel 7 or hotel 8, the rest need to ride in the car.

5) \( a_{ij} \) represents the category \( j \) room price in the hotel \( j \), \( b_{ij} \) represents the cost of car rental for the representatives who live in the hotel \( i \) category \( j \) room.

6) Assume that the predetermined conference rooms can meet the requirements of panel discussions.

2.2 Analysis and results

There will be attendees who do not submit the return receipts, and there will be representatives who submit the return receipts but do not attend the meeting. Obviously, this is a common phenomenon for every meeting. According to the relevant data of the previous meetings on the number of return receipts, we can establish the following regression analysis models.[3]

\[
y_1 = 0.2995x + 0.4592
\]

(1)

This model reflects the relationship between the number of return receipts and the number of representatives who submit the return receipts but do not attend the meeting.

\[
y_2 = 0.1091x + 27.4214
\]

(2)

This model reflects the relationship between the number of return receipts and the number of representatives who do not submit the return receipts but attend the meeting.

Where, \( x \) represents the number of return receipts, \( y_1 \) represents the number of representatives who submit the return receipts but do not attend the meeting, and \( y_2 \) represents the number of representatives who do not submit the return receipts but attend the meeting.

The number of return receipts of the forthcoming meeting is 755. Using the above regression analysis models, we can predict that the number of representatives who submit the returned receipts but do not attend the meeting is 227, and the number of representatives who do not submit the return receipts but attend the meeting is 110. Therefore, it can be predicted that the number of representatives for the forthcoming meeting will be 755-227+110=638, as shown in figure 2.
Figure 2. The prediction results.

In the above figure, the abscissa axis represents $x$, and the vertical axis represents $y_1$ or $y_2$. Where, * represents the number of representatives who submit the return receipts but do not attend the meeting, o represents the number of representatives who do not submit the return receipts but attend the meeting. According to the previous meetings, it is assumed that the representatives' accommodation requirements are consistent.[4] Thus, information on the representatives' accommodation requirements can be predicted, as shown in table 1.

Table 1. The information on representatives' accommodation requirements.
(Unit: quantity of people)

|        | sharing 1 | sharing 2 | sharing 3 | living alone 1 | living alone 2 | living alone 3 |
|--------|-----------|-----------|-----------|----------------|----------------|----------------|
| male   | 130       | 88        | 27        | 90             | 57             | 35             |
| female | 66        | 41        | 14        | 50             | 24             | 16             |
| total  | 196       | 129       | 41        | 140            | 81             | 51             |

After sorting out the data on the specification, quantity and room price in the alternative hotels, we can get the quantity and price of all kinds of rooms, as shown in table 2.

Table 2. The quantity and price of all kinds of rooms.
(Unit: yuan or quantity of room)

| hotel code | sharing 1 | sharing 2 | sharing 3 | living alone 1 | living alone 2 | living alone 3 |
|------------|-----------|-----------|-----------|----------------|----------------|----------------|
| 1          | 50        | 180       | 30        | 220            | 30             | 180            |
| 2          | 85        | 150       | 30        | 220            | 30             | 180            |
| 3          | 50        | 150       | 24        | 180            | 27             | 150            |
| 4          | 50        | 140       | 45        | 200            |                |                |
| 5          | 70        | 150       | 40        | 200            |                |                |
| 6          | 50        | 170       | 40        | 160            | 30             | 180            |
| 7          | 50        | 150       | 40        | 160            | 30             | 180            |
| 8          | 40        | 160       | 40        | 180            | 45             | 180            |
| 9          | 60        | 270       | 60        | 270            |                |                |
| 10         | 100       | 270       | 60        | 270            |                |                |
Meeting the requirement of convenience management means that the number of hotels should be chosen as few as possible. Therefore, it is stipulated that the number of rooms reserved in one hotel is larger than half of the total number in this hotel. Considering all the factors, we establish the following linear programming model.\[5\]

\[
\begin{align*}
\text{Min } P &= \sum_{i=1}^{10} \sum_{j=1}^{6} (a_{ij} + b_{ij}) x_{ij} \\
\sum_{i=1}^{10} x_{ij} &> h_j \\
\sum_{j=1}^{6} x_{ij} &< d_j \\
0 < x_{ij} < e_{ij} (i = 1,2,...10; j = 1,2,...6), \quad x_{ij} \in N \\
2 \sum_{i=1}^{10} \sum_{j=1}^{3} x_{ij} + \sum_{i=1}^{10} \sum_{j=4}^{6} x_{ij} &\geq 638
\end{align*}
\]

Where, \(c_j\) represents total number of the category \(j\) rooms, \(d_i\) represents total number of rooms in the hotel \(i\), \(e_{ij}\) represents the number of the category \(j\) rooms in the hotel \(i\), \(h_j\) represents total number of the category \(j\) rooms reserved.\[6\] According to the linear programming model, we can have the results shown in table 3.

Table 3. Hotel occupancy and the number of vehicles needed.
(Unit: quantity of room)

| Hotel code | sharing 1 | sharing 2 | sharing 3 | living alone 1 | living alone 2 | living alone 3 | vehicles needed |
|------------|-----------|-----------|-----------|----------------|----------------|----------------|----------------|
| 1          | 37 (living alone) | 21 (sharing) |          | 30 (living alone) | 30 (living alone) |                | 3 cars with 45 seats 1 car with 33 seats. |
| 3          | 8 (sharing) | 42 (living alone) | 24 (sharing) | 27 (living alone) |                |                | 3 cars with 45 seats |
| 7          | 50 (sharing) |          |          | 40 (living alone) |                | 12 (living alone) |                |
| 8          | 40 (sharing) | 40 (sharing) |          |                | 45 (living alone) |                |                |

3. Conclusion
For the meeting organizer, not only the cost of meeting preparatory should be considered, but also the satisfaction of the representatives should be considered, and the satisfaction is reflected in two aspects: one is the room cost, and the second is the reservation of the room that meets representatives’ requirements. According to the data of the previous meetings, the number of attendees is predicted. Meanwhile, by using the linear programming model, we can obtain the following results.

When the meeting organizer reserves the rooms from hotel 1, hotel 3, hotel 7 and hotel 8, the total cost of reserving rooms and hiring cars are the least, they are 73730 and 5400 yuan respectively. If the
meeting rooms are leased in hotel 7 and hotel 8, the representatives living in hotel 1 and hotel 3 need to ride in the car, they only need to hire 6 cars with 45 seats and 1 car with 33 seats.

References
[1] Jin C Q, Chen D R 2002 Computer Engineering and Application 17 p 235-237
[2] Gao Y, Gao H K, Wang H M 1995 Computer Engineering 21 Supplement 1 p 336-339
[3] Frank R G, Maurice D W and William P F 2005 A First Course in Mathematical Modeling (Beijing :China Machine Press) p 43-91
[4] Vladimir A Z 2006 Mathematical Analysis I (Beijing: World Publishing Corporation) p 411-540
[5] Alfred V A, John E H and Jeffrey D U 2006 The Design and Analysis of Computer Algorithms (Beijing: China Machine Press) p 2-4
[6] Zhu H J, Xiao Y C and Qiu C 2004 MATLAB Language and Practice Course (Beijing: Tsinghua University Press) p 51-83