ISSN: 2664-9640

Distribution and analysis of logistics information based on data analysis

Zijie Huang [1], Keer Zhang [2,*] and Yufeng Yang [3]

[1] Logistics Engineering, School of Mechanical Engineering, University of Science and Technology Beijing, China;

[2] School of Data Science and Engineering, East China Normal University, China;

[3] School of Mathematics and Information Science, Hebei University, China;

* Corresponding Author: 19966422680@163.com

Abstract

Consider dispatching trucks to fulfill shipping orders.First of all, we consider how to arrange the truck to complete the task normally. Taking the order place as the consideration target, we complete the transportation task, do not split the order and the number of destinations of a freight bill of a capacity truck. We choose eight places in Xi 'an as the transfer stations.In order to facilitate us to write the constraint function and design the shipping order, we use multiple ordering to renumber the freight cars.Then an integer linear programming model with the minimum transportation cost as the objective function is established.Finally, the shortest path to each destination and the corresponding cost are selected through MATLAB software.

Keywords

Data analysis, Logistics, Information system, Multiple linear regression equations, Maximizing utility.

1. Introduction

With the rapid development of China's economy, logistics has become an important link in the social division of labor.The quality of logistics system also affects the operation efficiency and cost of business process.In this paper, we assume that the main business of a domestic logistics company is to transport N kinds of brand goods cars to 4S stores in many cities across the country from M OEMs.We design a set of logistics transportation optimization system for logistics companies, in order to improve the efficiency of logistics transportation, optimize operating costs.

We selected eight transfer stations in Shaanxi. No matter group transport or self-service transport, the route is an important link connecting the source and destination.Reasonable design of the line is conducive to the purposeful choice, arrangement of their own activities, avoid "overspread transport", and is conducive to the function of each point and the reasonable use of time, there are conducive to the planned control of expenses and so on.Firstly, the objective function is established for the mode of self-driving transportation, and people with different demands are considered separately. When the time is minimum, the objective function is

$$X = (x_1 \sim x_6)$$

When the cost is minimum, the objective function is

$$Z = a_1 x_1 + \cdots + a_6 x_6 = a'X$$

And then using the graph theory to station as the vertices in the graph, the transit traffic routes can be as a figure on the edge, the edge weights of representative from one station to another station distance, finally selected after the transit lines using the most short-circuit problem solving design problems, using the Matlab solution for each meal time and cost.

When time is small, generally in a week or so we have seven tourist attractions, we set up the branch and bound method model to study the most short circuit problem, with each element for the n order matrix D said the distance between the various attractions, there is no direction and the distance between the various attractions, so n order matrix D is a symmetric matrix, with the various elements in every row in the D minus the smallest non-zero elements in the bank, get the new matrix D_1. Similarly, subtract the smallest element from each column to get D_2. Then select the element whose element is zero between the starting point and a scenic spot and delete its column to get a new matrix D_3. Repeat the above steps until the matrix is $\begin{pmatrix} 0 & \infty \\ \infty & 0 \end{pmatrix}$.When all the scenic spots are included, and they only appear once, the operation stops, otherwise repeat the above steps. First, Floyd algorithm was used to calculate the distance between any two scenic spots, and a weighted undirected graph was constructed, as shown in Figure (1).

Note: the distance is magnified 10 times .

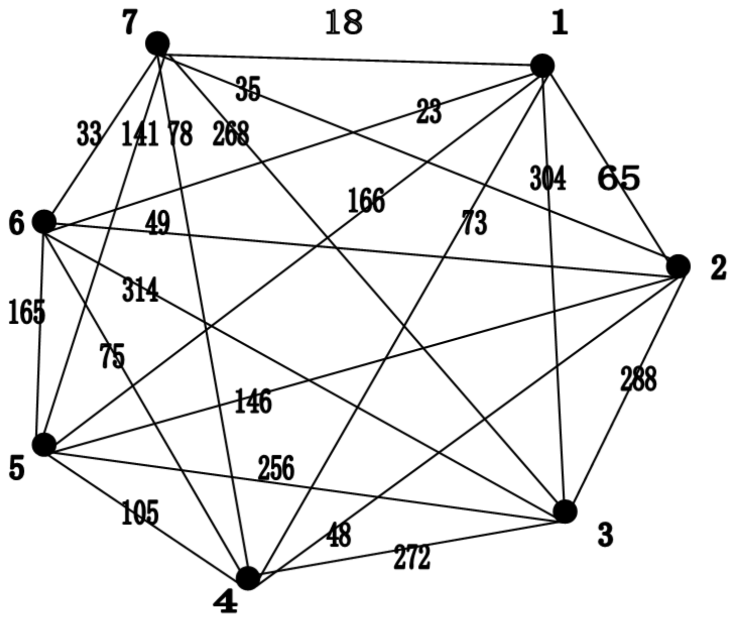

Figure 1: Weighted undirected graph of the distance between the stations

2. Simulation route optimization design

2.1. Optimal design of the line with unlimited cost and shortest time

Under the condition that the cost is not limited, the requirement takes in eight transit stations all transport, with the least time.The time spent in logistics transportation includes two parts, one is the time on the road, the other is the time spent in the transit station.Therefore, T2 is defined as the time spent by logistics transportation on the road, and T2 is the time that logistics transportation stays in the transit station. The total objective function is obtained as follows:

$$Min\ T = T_1 + T_2$$

ISSN: 2664-9640

Logistics transportation is required to inspect all the eight transfer stations, so the cost of logistics transportation on the way is:

$$T_1 = \sum_{i=0}^{8}\sum_{j=0}^{8} t_{ij} r_{ij}$$

The sum of the time that the logistics transportation stops at the eight transfer stations is $T_2 = 36$.

According to the above ideas, the following planning model is established:

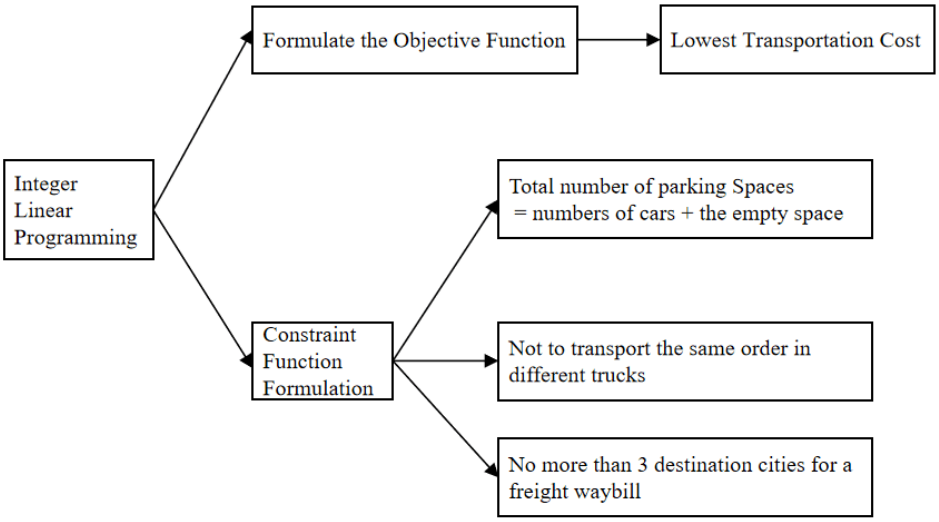

Figure 2: Schematic Diagram of Planning Model

Therefore, the final objective function is:

$$Min\ T = T_1 + T_2 = \sum_{i=0}^{8}\sum_{j=0}^{8} t_{ij} r_{ij} + 36$$

Constraint conditions:

$$\begin{cases} \sum_{i} r_{i0} = 1 \\ \sum_{j} r_{0j} = 1 \\ r_{ij} * r_{ji} = 0 \\ \sum_{t=0}^{8}\sum_{j=0}^{8} r_{ij} = 9 \\ \sum_{t=0}^{8} r_{ik} = \sum_{j=o}^{8} r_{kj} <= 1 (k = 1,2,3,4,5,\ldots 8) \end{cases}$$

2.2. Model solving

Using the graph theory method, the time matrix can be obtained:

$$A=\begin{bmatrix} 0 & 7.9 & 7 & \infty & 5.58 & \infty & \infty & \infty & 7 \\ 2.9 & 0 & 6.17 & \infty & 5.43 & \infty & \infty & \infty & 8.43 \\ 2 & 6.17 & 0 & \infty & 5.18 & \infty & \infty & \infty & 7.75 \\ \infty & \infty & \infty & 0 & 5.49 & 4.83 & \infty & \infty & \infty \\ 1.58 & 6.43 & 6.18 & 6.49 & 0 & \infty & \infty & \infty & 8.5 \\ \infty & \infty & \infty & 6.83 & \infty & 0 & \infty & 4.75 & \infty \\ \infty & \infty & \infty & \infty & \infty & \infty & 0 & 4.1 & 7 \\ \infty & \infty & \infty & \infty & \infty & 3.75 & 4.1 & 0 & \infty \\ 1 & 7.43 & 6.75 & \infty & 7.5 & \infty & 5 & \infty & 0 \end{bmatrix}$$

Then, the shortest time spent on solving the outlet by MATLAB is 76 hours. At this time, the best route is: Forest of Steles → Tomb of Yang Guifei → the Mausoleum of Emperor Qinshihuang → Qianling Mausoleum → Famen Temple → Louguantai → History museum → Da-Yan Tower → Cuihua Mountain.

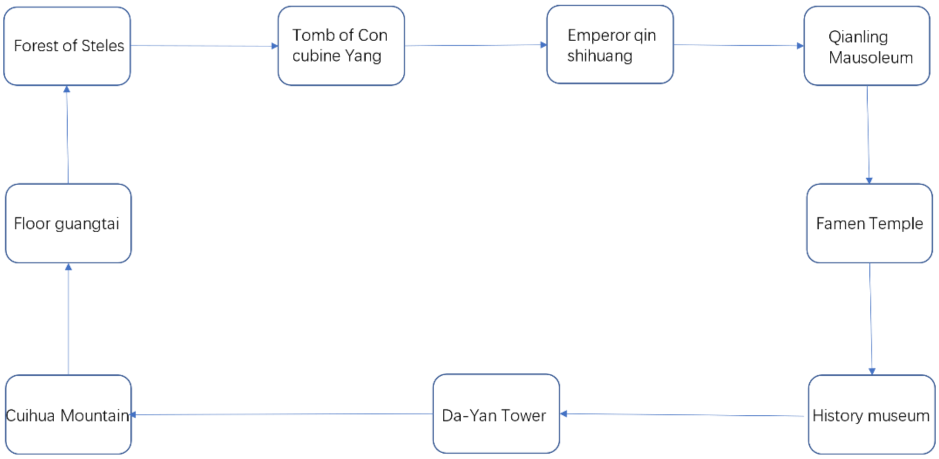

Figure 3:Diagram of the best route

2.3. Unlimited time, the least cost line optimization design

The total cost including the tolls, transportation, meals and lodging expenses, toll is certain, so the design of the route must make logistics transportation after eight station takes the sum of transportation, accommodation, meals and other expenses minimum, expressed in m1 accommodation, transportation, m2 said eating m3 said costs and other expenses, the m4 said admission.Therefore, the objective function is:

$$MinM = m_1 + m_2 + m_3 + m_4$$

m2 represents the transportation cost, rij is a variable from 0 to 1 to judge whether it can be from the i-th scenic spot to the j-th scenic spot, and cij represents the transportation cost of the logistics transportation from the i-th transfer station to the j-th transfer station. So the cost between transfer stations is:

$$m_2 = \sum_{i=0}^{8}\sum_{j=0}^{8} r_{ij} c_{ij}$$

m4 is the ticket fee, all eight transfer stations must be transported, so the total cost of the ticket:

$$m_4 = 100+122+30+45+70+50+50+81=548$$

After 10 hours of logistics and transportation in the day, we need to find a hotel accommodation, and the average accommodation fee is 100 yuan per day. T represents the total time, so the total cost of accommodation is:

$$m_1 = 100[\frac{T}{10}]$$

Since the average cost of eating every day is 100 yuan and T represents the total time, the cost of eating and other (such as shopping, etc.) is:

$$m_3 = 100\frac{T}{10} = 10T$$

To sum up, the final objective function is:

$$MinM = m_1 + m_2 + m_3 + m_4 = 100[\frac{T}{10}] + \sum_{i=0}^{8}\sum_{j=0}^{8} r_{ij}c_{ij} + 10T + 548$$

2.4. Restrictions

We propose the following constraints:

$$\begin{cases} \sum_{\mathrm{i}} \mathrm{r}_{\mathrm{i}0} = 1 \\ \sum_{j} r_{0j} = 1 \\ r_{ij} * r_{ji} = 0 \\ \sum_{\mathrm{t}=0}^{8}\sum_{j=0}^{8} \mathrm{r}_{ij} = 9 \\ \sum_{t=0}^{8} \mathrm{r}_{ik} = \sum_{j=o}^{8} r_{kj} <= 1(k = 1,2,3,4,5,\ldots 8) \end{cases}$$

And the constraint condition on the total time spent T is:

$$T = \sum_{\mathrm{i}=0}^{8}\sum_{j=0}^{8} t_{ij}\mathrm{r}_{ij} + 36$$

2.5. Model solution

Using graph theory methods, the cost matrix can be derived:

$$A = \begin{bmatrix} 0 & 179.4 & 174 & \infty & 83.9 & \infty & \infty & \infty & 105.6 \\ 79.4 & 0 & 152.2 & \infty & 83.96 & \infty & \infty & \infty & 182.3 \\ 57 & 125.2 & 0 & \infty & 75.6 & \infty & \infty & \infty & 159.44 \\ \infty & \infty & \infty & 0 & 76.8 & 114.4 & \infty & \infty & \infty \\ 38.9 & 138.96 & 152.6 & 601.8 & 0 & \infty & \infty & \infty & 140 \\ \infty & \infty & \infty & 74.4 & \infty & 0 & \infty & 68.7 & \infty \\ \infty & \infty & \infty & \infty & \infty & \infty & 0 & 51.14 & 104.64 \\ \infty & \infty & \infty & \infty & \infty & 88.7 & 51.14 & 0 & \infty \\ 24.6 & 101.3 & 108.44 & \infty & 104 & \infty & 73.64 & \infty & 0 \end{bmatrix}$$

Then using MATLAB to solve the minimum cost of 1872 yuan, the best route at this time is:

Forest of Steles→ Tomb of Concubine Yang → Emperor qinshihuang → Qianling Mausoleum → Famen Temple → History museum → Da-Yan Tower → Cuihua Mountain → Floor guangtai.

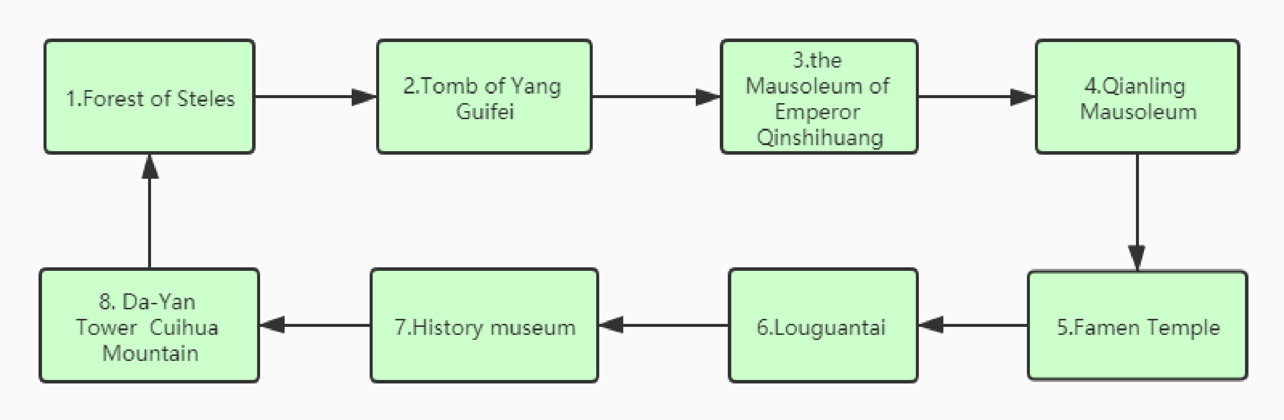

Figure 4: Schematic diagram of the shortest route

3. Evaluation and prospect of the model

The research of this paper enriches the research method of line optimization design, shows the application potential of the determinate analysis method in line optimization design, and reduces the cost of enterprises and enterprises.This paper discusses how to make the shortest distance, the least time and the lowest cost.The model is simple in construction and clear in thinking, which can solve practical problems well.The structure of the model is close to reality;In line with the market relationship;The model is easy to calculate without tedious calculation.The results obtained by the model are close to reality and accord with our common sense understanding.Of course, this paper also has some shortcomings, due to the limited time, so there is no sufficient consideration of the psychological flashins, satisfaction, etc.However, in practical problems, passenger satisfaction is also a factor that must be considered in the optimal design of travel routes, which can be further studied by APT model.

References

[1] Gao, huixuan, practical statistical methods and SAS system, Peking University press, 2001.

[2] Gu Jifa, Liu Baoding, Shi Quansheng.Operations Research, Beijing: Science Press, 2011.

[3] Chen Guangting, Qiu Zheyong.Mathematical Modeling, Beijing: Higher Education Press, 2010.

[4] Fang Dongyun, application of graph theory in route selection [J]. Journal of Changchun University of technology, 2009, Vol.20, No.5

[5] Wu Kai, Operational Research Problems in Route Optimization[D]. Dongbei Finance and Economics, 2003.

[6] Wang Haiying, Huang Qiang, Li Chuantao et al.Graph Theory Algorithm and MATLAB Implementation [M]. Beijing Aeronautics and Astronautics Press,2010.2.

[7] Bondy J A,Murty USA, Graph Theory and Its Applications [M].Translated by wu wangming et al. Beijing, science press,1984.

[8] Yang Yong, Autonomy and Mode Choice: A Utility - Based Economic Framework.2007.The Monthly, Volume 22.