The judges scoring, note	Team number： 20027	The judges scoring, note
The judges scoring, note	Problem： C	The judges scoring, note
Title：Family summer tour packages designed		

Abstract

Many parents bring their children to travel during the summer holiday. However, different families have different needs. Considering the route, cost, time and other important factors comprehensively, different tour packages should be designed for different families. Taking Beijing for example, 18 representative sites are selected which consider a combination of various factors about culture, learning, fun and landscape and others. Then the idea of clustering is used to combine the sight spots into a spot. The sight spots should have short distance from each other. Finally, the 14 spots are got. 14 spots are evaluated and sorted. Then the fit spot is selected and the route is planned. Linear regress is used for the distance and cost information by the software of MATLAB. A function about the relationship of distance and cost is got for calculating the total cost of tour package. About this problem, the following three conditions are discussed:

Aimed to the factor of time, the tour package can be divided into long-term and short-term course. Long-term is 5days and short-term is 2days.In the long-term, we have plenty of time to traverse 14 spots. The problem of calculating total cost is translated into the problem of getting shortest distance. We can use WinQSB to solved Hamilton optimal circuits. Then we calculate the cost based on the best circuits. In the short-term, time is limited to traverse 14 spots. We should make the tour package contains as more spots as possible in 2days. The fuzzy evaluation method was used to make the time have a relative large weight. Evaluating the spots based on the cost, scenic desirability and traffic conditions scenic so as to determine the five scenic spots. We can use WinQSB to solved Hamilton optimal circuits, and then we calculate the cost based on the best circuits.

Aimed to the factor of time, the constraint of 0-1 variables is used to make sure that each scenic spot is reached only once. Then evaluating and ranking the spots based on the cost. Five scenic spots are given as starting point, the number of scenic tours for optimal Hamiltonian circuit were 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and calculating the cost.

There are different needs of tour content for different families. Therefore, another four lines were developed .They are cultural lines, traveling and learning lines, landscape lines and interesting lines.

15 packages are given to be chosen for visiting Beijing in summer, as shown in

table 4.For the summer to visit Beijing, a total of 15 packages are given to choose from. In addition to choose suitable travelling route, paying attention to the weather and avoiding the peak of abortion.,

Key words： Clustering, WinQSB, Hamiltonian circuit, LINGO software, fuzzy evaluation, 0-1 constraints

Family summer tour packages designed

1 Problem restatement

With the summer vocation approaching, a family is planning a one-week travel to a city. The goal of this problem is to design a ‘comfortable’ travel plan for this family, with considerations of multiple effects on their trips. Select any city you are interested in as the example.

2 The model assumes

1 , all the sights , attractions are the nodes ;
2 , between each two tourist attractions in the same car as a transport , take the way without considering other costs other than transport costs and travel expenses from the same unit (both 0.50Yuan) ;
3 , only consider the connection between the different attractions roads , highways as paths between nodes ;
4 , continuous auto departure time , travel time is not calculated separately , without considering the traffic accidents;
5 , travelers will not be stranded in unexpected situations such as travel process ;
6 , each day, food and other consumer 100 Yuan / day ;

3 Symbol Conventions

sign	instruction
c	The all travel cost of everyone
t_i	The time they stay at the i sight of everyone
c_i	The all cost at the i sight of everyone
t_{ij}	The time we need from the i sight to the j sight
c_{ij}	The fare we spend from the i sight to the j sight
r_{ij}	$r_{ij}=\begin{cases}1 & from\ the\ i\ sight\ to\ j\ sight\ strightly \\ 0 & others\end{cases}$
d_{ij}	The distance between the i sight and the j sight
v	The average speed of bus
m	The average fare of by bus

4 Problem analyses

According to the present problems in the subject, the paper selected China's political, economic and cultural center -- Beijing, as the summer tourist destination. First of all, we consider in the absence of any constraint conditions, a choice of 18 well-known tourist resorts by statistical analysis, and the shortest route map that tourism. Then, we as main constraint condition in time, the optimal line drawn in different time. Then, the travel costs as the main constraint conditions, a number of attractions as a supplement, planning of the shortest tour. Finally, in order to meet the needs of different family, make travel plan, more features theme travel does not bring the same travel experience for all the family.

5 Establish and solve the model

5.1 Model preparation

We collected in the Beijing 18 spots of data, many of which are very close, so we will they are clustered according to geographical location, finally got 14 spots. Based on transportation costs and path length is proportional to the various attractions, accommodation costs are equal, driving on the highway and railway speed constant and other assumptions with the shortest distance between 14 sites in two two and set up the table, preparing for the establishment of model.

When not considering time, cost constraints, Hamilton overall optimal loop making 14 spots, the maximum to meet the unrestricted visitors, and visitors can quickly, with a minimum cost tour of the 14 spots. In order to solve the optimal Hamiltonian circuit, networking model module in WinQSB software was used for the dynamic programming on line, and get the optimal solution.

When time is limited, the course is divided into short and long term. Long-term initially set at seven days, short-term initially set at 2 days. Solving the results of the first case is long, not too much to repeat here. Short-term is fuzzy evaluation method 14 attractions based on a comprehensive evaluation of time and rank, to choose the five highest-ranked applications WinQSB Software Networking model module based on the data in Appendix 2 to get the optimal Hamiltonian circuit, and the optimal route.

When restricted fee, based on the understanding of the subject, we can know the total cost of travel, including travel expenses, accommodation expenses and costs of attractions to visit when, and in determining the number of attractions you want to visit, our goal is to satisfy all constraints in the case, find the minimum cost. In the design of suitable tourist routes, to make the least amount of money to spend as much sightseeing attractions within a very short time. Our approach here is to use the 0-1 variable constraint method that satisfies the various attractions in the corresponding constraints , first determine the number of sightseeing attractions , sights and then select the appropriate number of fuzzy evaluation method, then calculate in this case the minimum cost under .

Through the establishment of the model, we make the constraint:

$$
s.t.\begin{cases}
\sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij}\times t_{ij} + \frac{1}{2}\times\sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij}\times\left(t_i + t_j\right)\le 55.5 \\
\sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij} = n \qquad \left(n = 2,3,\cdots,14\right) \\
\sum_{i} r_{ij} = \sum_{j} r_{ij} \le 1 \qquad \left(i, j = 1,2,3,\cdots,14\right) \\
\sum_{i=1} r_{ij} = 1 \qquad \sum_{j=1} r_{ij} = 1 \\
r_{ij}\times r_{ji} = 0 \qquad \left(i, j = 2,3,\cdots,14\right)
\end{cases}
$$

Wherein, said article or article sites, respectively: (Qianmen Street, Tiananmen, the Imperial Palace, Zhongshan Park, the Summer Palace, Taoranting Park, Beihai), Old Summer Palace, Tiantan, the Great Wall, Xiangshan, zoo, (Houhai, Prince Gong House), sea world, Tsinghua University, north high, Happy Valley.

We use the software to carry on the various schemes to determine the number of spots obtained, browsing and distance, in the calculation of minimum cost and time consumption, for different family selection.

5.2 Toll model

In order to get a general relationship between vehicle distance and travel in Beijing city during the trip, we collected 10 sets of data, and carries on the linear regression using MATLAB, so that in the course of travel to take the relationship between vehicle distance and travel as shown in figure 1.

Table 1 walk toll diagram

Distance (x)	15.7	6.7	17.2	11.1	6.4	2	5.1	12.2	8.7	27.2
Fare(y)	7.2	2.9	8.1	5.0	2.5	0.9	2.3	5.7	4.9	13

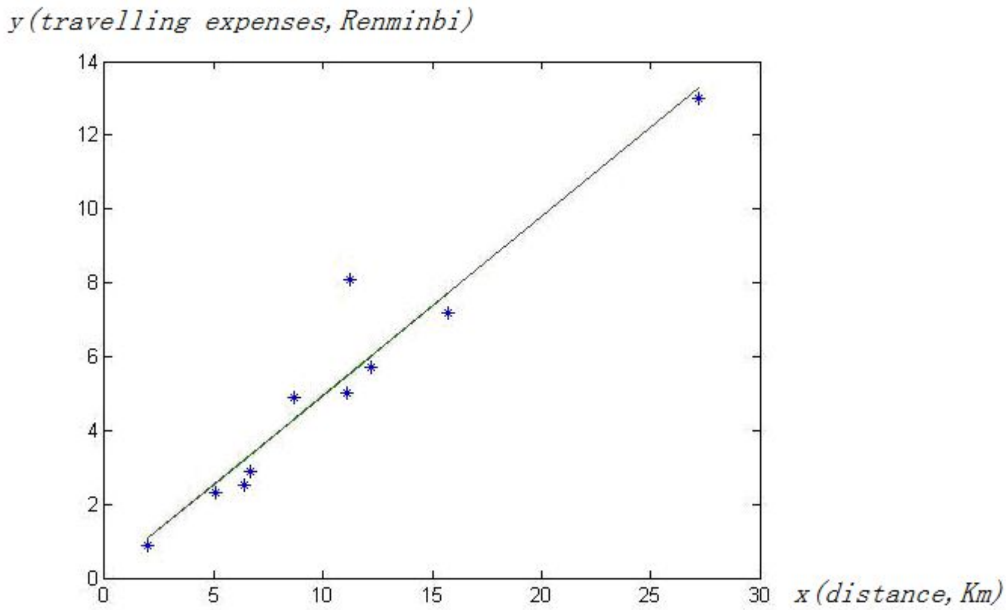

Figure 1 the relationship between distance and toll

According to results of the proceedings, the regression equation derived from tolls and between: $y = 0.489x - 0.06$.

According to the equation, we have come to Beijing to take the vehicle away price of about $0.5 Yuan / Km$

5.3 From model

This model numbers denote:

1—Qianmen Street, Tiananmen Square, the Forbidden City, Zhongshan Park (this four locations are in close proximity, can be combined into an attraction), 2—Summer Palace, 3—Tao Ranting, 4—the North Sea, 5—Yuanmingyuan, 6—Temple of Heaven, 7—Zoo 8—Great Wall, 9—Fragrant, 10—after the sea, Prince Gong's Mansion (the two locations are in close proximity, can be combined into an attraction), 11—Underwater World,12—Tsinghua University, 13—Peking University,14- Happy Valley.

Attractions position shown in Figure 2.

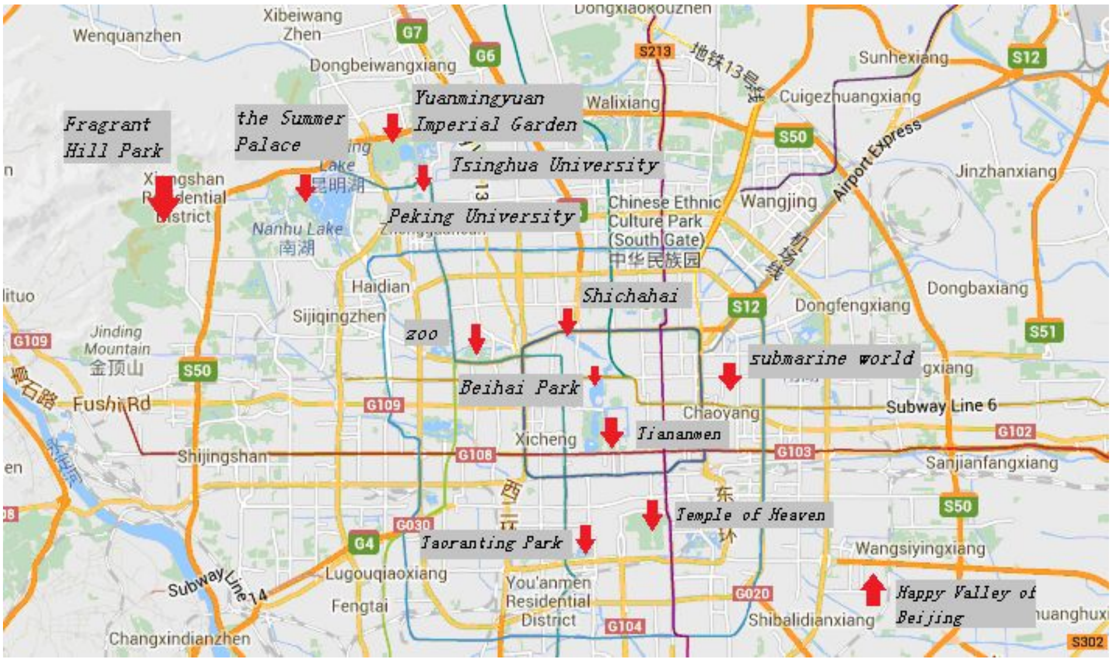

Figure 2 Beijing attractions location maps

According to the survey data, now any distance between two spots statistics, as shown in Table 2.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	0	18.9	5.3	2.9	16.8	4.3	8.9	67.6	25.2	4.9	6.6	16.9	17.2	13.7
2	18.9	0	20.9	16.7	3.1	21.9	10.9	55.4	8.9	15.2	22.8	6	3.3	31.1
3	5.3	20.9	0	6.5	18.7	3.7	10.8	69.9	26.9	8.4	11.2	16.9	19.2	11.4
4	2.9	16.7	6.5	0	14	5.8	6.1	64.9	22.5	2.4	5.8	12.2	14.4	15.2
5	16.8	3.1	18.7	14	0	19.4	8.9	56.1	11.3	12.7	19.6	3.1	1.9	28.5
6	4.3	21.9	3.7	5.8	19.4	0	11.6	69.9	27.9	6.8	8	17.7	20	9.6
7	8.9	10.9	10.8	6.1	8.9	11.6	0	63.8	16.4	7.6	12.2	8.6	8.8	22.9
8	67.6	55.4	69.9	64.9	56.1	69.9	63.8	0	65	68.2	66.7	60.8	61.8	83.7
9	25.2	8.9	26.9	22.5	11.3	27.9	16.4	65	0	22.3	27.6	14.9	12.2	44
10	4.9	15.2	8.4	2.4	12.7	6.8	7.6	68.2	22.3	0	5.5	11	13.5	15.9
11	6.6	22.8	11.2	5.8	19.6	8	12.2	66.7	27.6	5.5	0	17.8	19.1	10.7
12	16.9	6	16.9	12.2	3.1	17.7	8.6	60.8	14.9	11	17.8	0	3	26.7
13	17.2	3.3	19.2	14.4	1.9	20	8.8	61.8	12.2	13.5	19.1	3	0	28.2
14	13.7	31.1	11.4	15.2	18.5	9.6	22.9	83.7	44	15.9	10.7	26.7	28.2	0

Table 2 distances between attractions

5.4 Line model

5.4.1 Application Hamiltonian path problem

The so-called Hamiltonian path problem is that: in the n and m vertex directed line segments directed graph , and asked if we can find a path , starting from the vertex 0 , to end the vertex , on the way through each vertex once and only once. This way is called a Hamiltonian path. Hamiltonian path problem is a combination of mathematics in a typical class of NP-complete problems, which is a great amount of calculation of this issue, is beyond the scope of a polynomial algorithm in Figure 3 there is a Hamiltonian path, which is $0 \to 1 \to 2 \to 3 \to 4 \to 5 \to 6$.

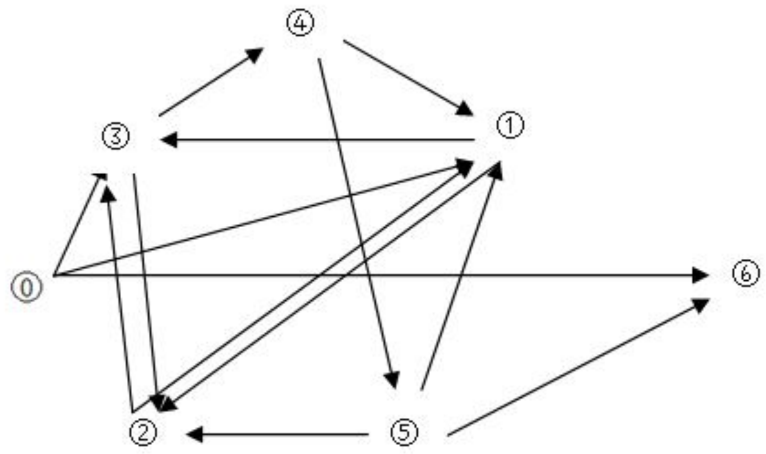

Figure 3 one of the seven vertices digraph

Solving optimal Hamiltonian circuit, where the application WinQSB Software Networking model module solving drawn:

05-24-2014	From Node	Connect To	Distance/Cost		From Node	Connect To	Distance/Cost
1	Node1	Node4	2.9	8	Node12	Node13	3
2	Node4	Node10	2.4	9	Node13	Node5	1.9
3	Node10	Node11	5.5	10	Node5	Node2	3.1
4	Node11	Node6	8	11	Node2	Node9	8.9
5	Node6	Node3	3.7	12	Node9	Node14	44
6	Node3	Node7	10.8	13	Node14	Node8	83.7
7	Node7	Node12	8.6	14	Node8	Node1	67.6
	Total	Minimal	Traveling	Distance	or Cost	=	254.10
	(Result	from	Nearest	Neighbor	Heuristic)		

That is the optimal Hamilton circuit is:

$1 \to 4 \to 10 \to 11 \to 6 \to 3 \to 7 \to 12 \to 13 \to 5 \to 2 \to 9 \to 14 \to 8 \to 1$

Its minimum distance is: $254.10km$

5.5 0—1model

5.5.1 Establishment of the objective function

Through the analysis, we can know what the goal is: to spend the least money to visit as many places as possible. Obviously, that costs the least and visit the attractions to two goals for the problem. Therefore, our approach is to satisfy the corresponding constraints, first determine the number of scenic spots, and then calculate the least cost in this case. This will eventually obtained several tourist routes, you can choose according to their own actual conditions.

The total cost of the tour is composed of 2 parts, respectively, the total cost and the cost of transportation in tourist attractions. We define:

m ——Each person's total tourism expenditure;

m_1 ——The total cost of each person's traffic;

m_2——Take everyone's tourist attractions.

In order to get the objective function:

$$Min \quad m = m_1 + m_2 \tag{1}$$

1, the total cost of transportation

Because the c_{ij} said i from the first attractions to the j sites required for transportation costs, while the r_{ij} is to determine whether the i from the first attractions directly to a 0 - 1 variable j attractions, so we can easily get the traffic cost:

$$m_1 = \sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij} \times c_{ij} \tag{2}$$

2, tourist attractions

Because the c_i represents the total consumption in the i sites, also can show whether the r_{ij} to the i and the j sites, and the whole tourism route eventually form a closed loop, so the $\sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij} \times (c_i + c_j)$ will actually delegates at the Institute to the attractions of the cost calculation for two times, and we have to take the tourist attractions for the:

$$m_2 = \frac{1}{2} \times \sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij} \times (c_i + c_j) \tag{3}$$

According to equation (1), (2), (3) we can obtain the objective function:

$$\begin{aligned} Min \quad m &= m_1 + m_2 \\ &= \sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij} \times c_{ij} + \frac{1}{2} \times \sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij} \times (c_i + c_j) \end{aligned} \tag{4}$$

3, constraint conditions

1 Time constraints

Travel time should be no more than 55.5 hours, and these include the journey time and stay in the tourist attractions of the time. Because the t_{ij} said i from the first attractions to the first j attractions journey time required, so the way the overall time required for $\sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij} \times t_{ij}$; t_i said at the time the i spots stay, the delegates at the time always stay tourist attractions for $\frac{1}{2}\times\sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij}\times\left(t_i+t_j\right)$. Therefore, time constraint for the total:

$$\sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij}\times t_{ij}+\frac{1}{2}\times\sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij}\times\left(t_i+t_j\right)\le 55.5 \qquad (5)$$

②Tourist attractions number constraint

According to the hypothesis, the tour route is a closed loop, which will eventually return to the starting point, to form a loop, so that the number of $\sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij}$ tourist attractions, here we assume to tourist attractions number is n $(n=2,3,\ldots,14)$.

So the number of constraints as tourist attractions:

$$\sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij}=n \qquad (n=2,3,\ldots,14) \qquad (6)$$

③0 - 1 variable constraint

We can put all the attractions are joined in a circle and each of the spots as the last point circle. For each point, only allow up to one side to enter, also only allowed one edge, and as long as there is a side to have an edge. So the available constraints:

$$\sum_i r_{ij}=\sum_j r_{ij}\le 1 \qquad \left(i,j=1,2,\cdots\cdots 14\right) \qquad (7)$$

And because travel route for a loop . So:

When $i=1,\sum_{i=1} r_{ij}=1$;

$j=1,\sum_{j=1} r_{ij}=1$,

Comprehensive above knowable,

$$\sum_i r_{ij}=\sum_j r_{ij}\le 1 \qquad \left(i,j=1,2,\cdots\cdots 14\right)$$

$$\sum_{i=1} r_{ij}=1 \qquad \sum_{j=1} r_{ij}=1 \qquad (8)$$

Similarly, when i , $j\ge 2$, $r_{ij}=r_{ji}=1$ is the impossible, that is not possible to travel between the two, because it obviously does not meet the attractions as many principles. So we can get constraint:

$$r_{ij}\times r_{ji}=0 \qquad \left(i,j=2,3,\cdots\cdots 14\right) \qquad (9)$$

5.5.2 To establish the model of

In summary, we get the general model for the type (4):

$$Min \quad m = m_1 + m_2$$
$$= \sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij} \times c_{ij} + \frac{1}{2} \times \sum_{i=1}^{14}\sum_{j=1} r_{ij} \times (c_i + c_j)$$

Constraints are obtained by (5), (6), (7), (8), (9):

$$s.t. \begin{cases} \sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij} \times t_{ij} + \frac{1}{2} \times \sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij} \times (t_i + t_j) \le 55.5 \\ \sum_{i=1}^{14}\sum_{j=1}^{14} r_{ij} = n & (n = 2,3,\cdots,14) \\ \sum_{i} r_{ij} = \sum_{j} r_{ij} \le 1 & (i, j = 1,2,3,\cdots,14) \\ \sum_{i=1} r_{ij} = 1 \qquad \sum_{j=1} r_{ij} = 1 \\ r_{ij} \times r_{ji} = 0 & (i, j = 2,3,\cdots,14) \end{cases}$$

5.5.3 Solving the model and result analysis:

1, prepare the model

Through access to information, we can get the value of d_{ij}, according to the formula $t_{ij} = d_{ij} / v$ can be obtained from the t_{ij}, also according to the formula $c_{ij} = d_{ij} \times m$ can get corresponding c_{ij} $(i, j = 1,2,\ldots,14)$.

Through the network some travel we Beijing for consultation, we come to the conclusion that in time for the best i sites in the i sites and their total consumption: In time each of the spots:

$(\text{Unit}: \text{hour})$

1	2	3	4	5	6	7	8	9	10	11	12	13	14
6	4	2	2	5	2.5	4	7	3	4	3	3	3	7

Total consumption in each of the spots:

$(\text{Unit}: \text{RMB})$

1	2	3	4	5	6	7	8	9	10	11	12	13	14
100	35	5	10	25	15	15	45	10	40	85	0	0	200

2, model

The short-term travel route evaluation based on time to sort out five scenic spots, according to the Networking model module in Appendix 2 data with WINQSB software to obtain the optimal Hamiltonian circuit.

That is: 1→4→6→3→11→1.

The line is the shortest distance is $46.20km$, adult spend 440 Yuan, students spend 340 Yuan.

In other cases, we according to the constraint conditions to establish the model, using LINGO software, the following several tourist route is determined, according to determine the number of spots, the minimum cost, as shown in table three.

Table three $n = 5,6,7$ at the least cost

The number of tourist attractions n	5	6	7
Adult expenditure (yuan / person)	25	40	55
The children spend (yuan / person)	12.5	20	27.5
Travelling expenses	30	30	32.5
Route	3→4→12→13→9→3	3→6→4→12→13→9→3	3→6→4→7→12→13→9→3

Table four $n = 8,9,10$ at the least cost

The number of tourist attractions n	8	9	10
Adult expenditure (yuan / person)	80	115	155
The children spend (yuan / person)	40	57.5	77.5
Travelling expenses	33.5	35	37.5
Route	3→6→4→7→12→13→5→9→3	2→5→13→12→7→4→6→3→9→2	2→5→13→12→7→4→10→6→3→9→2

Table five $n = 11,12,13$ at the least cost

The number of tourist attractions n	11	12	13
Adult expenditure (yuan / person)	200	285	385
The children spend (yuan / person)	100	142.5	192.5
Travelling expenses	90	95	97.5
Route	2→5→13→12→7→4→10→6→3→9→8→2	2→5→13→12→7→4→10→11→6→3→9→8→2	1→4→10→11→6→3→7→12→13→5→2→9→8→1

Table six $n = 14$ at the least cost

The number of tourist attractions n	14
Adult expenditure (yuan / person)	585
The children spend (yuan / person)	292.5
Travelling expenses	125
Route	1→4→10→11→6→3→7→12→13→5→2→9→14→8→1

According to the above solution analysis and model data, planning out 10 routes are available for visitors to choose. Among them, in line four as an example, draw the planning road map, as shown in figure 4.

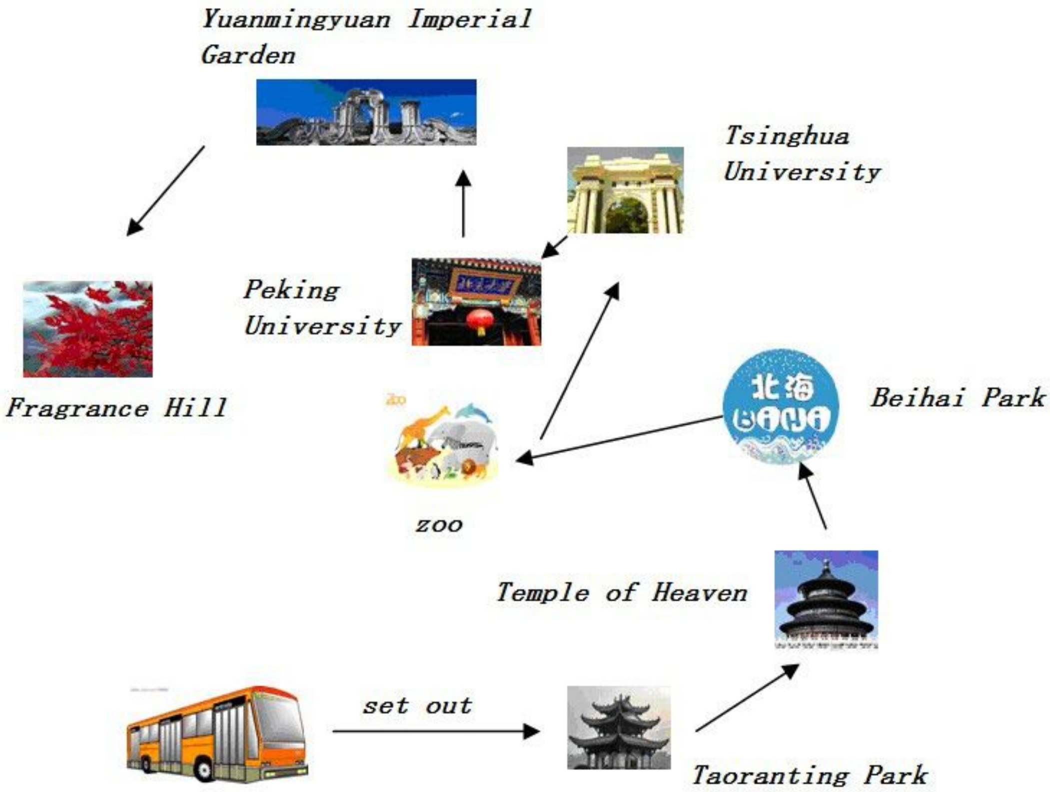

Fig. 4 route four outing

3, the subject line

Because of the design of the circuit is the summer of parents with students out of tourism, so we consider not only is the limiting factor of the material aspect, also considered the spiritual needs, different families have different preferences, therefore, we developed four high quality and inexpensive subject line, more for the different needs of the family, more in line with their will choose.

Table seven theme route list

Theme Project	Route	Cost (Yuan / person)	The time for the (day)	The special instructions
Cultural line	1→6→3→10→ 5→2→8→1	743	4	There are a lot of family in Beijing is interested in the culture of the capital, is the history of yearning, therefore, culture is the family line will be a good choice.

The tour line	1→3→11→12→13→5→1	550	3	Summer travel, there are some parents with children long knowledge, long experience mentality with children out of tourism, so, the tour line became the home of a good choice.
Landscape line	4→10→11→9→8→4	580	3	There are many families to enjoy the natural scenery of Beijing and came to Beijing, landscape line can be regarded as a good route.
Interesting line	7→14→11→8→7	723	3	There are many natural parents want their children to have fun together, also let the children through the travel to relax, you can choose the taste line.

Thematic lines shown in Figure 5.

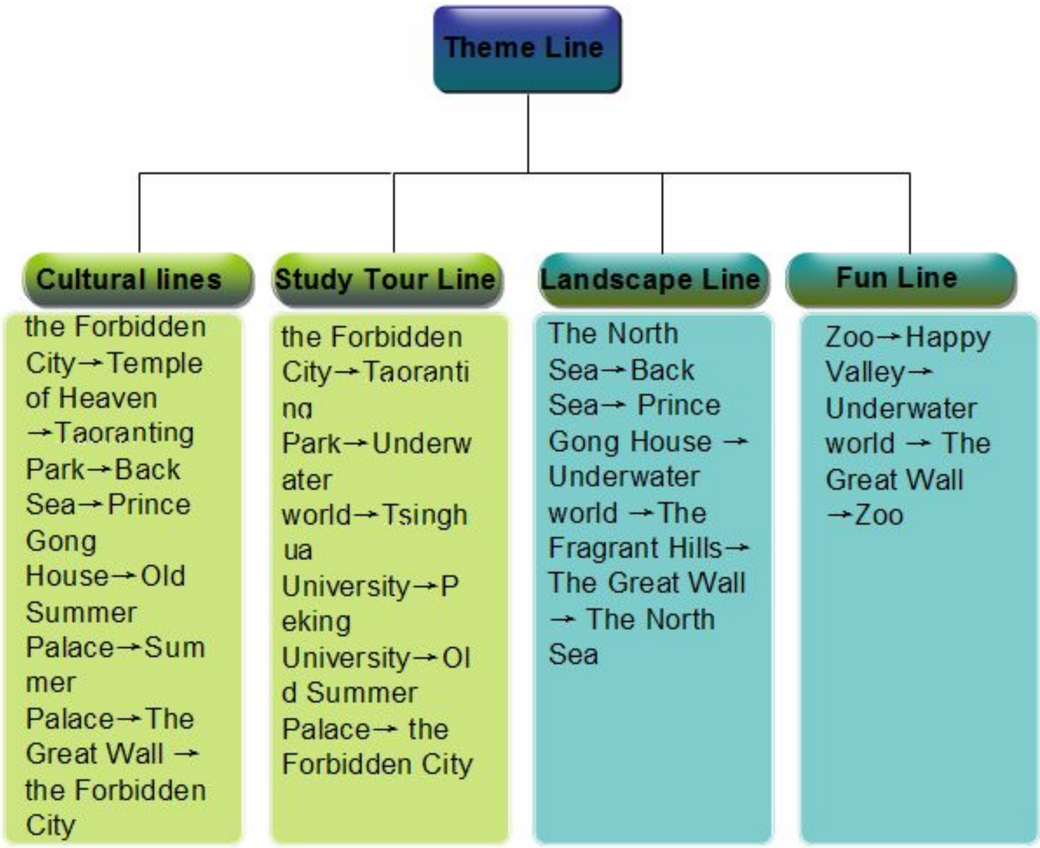

Figure 5 topics Roadmap

Ultimately, the data collected through the statistics and analysis , mathematical modeling method , suitable for all the family to develop a Summer Family Package , as shown in Table 8 .

Package classification	**Package Name**	**Packages Route**	**The cost of adult（yuan/each person）**	**The cost of children（yuan/each person）**
Two - Day Tour Package	1	Tian’anmen Square→Beihai Park→Temple of Heaven→TaoRanTing→Underwater World→Tian’anmen Square	440	340
	2	TaoRanTing→Beihai Park→Tsinghua University→Beijing University→Xiangshan→TaoRanTing	230	240
	3	TaoRanTing→Temple of Heaven→Beihai Park→Tsinghua University→Beijing University→Xiangshan→TaoRanTing	280	260
	4	TaoRanTing→Temple of Heaven→Beihai Park→Beijing Zoo→Tsinghua University→Beijing University→Xiangshan→TaoRanTing	295	270
Three-Day tour package	1	TaoRanTing→Temple of Heaven→Beihai Park→Beijing Zoo→Tsinghua University→Beijing University→Yuanmingyuan→Xiangshan→TaoRanTing	425	385
	2	Summer Palace→Yuanmingyuan→Beijing University→Tsinghua University→Beijing Zoo→Beihai Park→Temple of Heaven→TaoRanTing→Xiangshan→Summer Palace	490	435
Four-Day tour package	1	Summer Palace→Yuanmingyuan→Beijing University→Tsinghua University→Beijing Zoo→Beihai Park→Prince Gong's Mansion→Temple of Heaven→TaoRanTing→Xiangshan→Summer Palace	655	575
	2	Summer Palace→Yuanmingyuan→Beijing University→Tsinghua University→Beijing Zoo→Beihai Park→Prince Gong's Mansion→Temple of Heaven→TaoRanTing→Xiangshan→Great Wall→Summer Palace	700	600

Five-Day tour package	1	Summer Palace→Yuanmingyuan→Beijing University→Tsinghua University→Beijing Zoo→Beihai Park→Prince Gong's Mansion→Underwater World→Temple of Heaven→TaoRanTing→Xiangshan→Great Wall→Summer Palace	880	740
	2	Tian’anmen Square→Beihai Park→Prince Gong's Mansion→Underwater World→Temple of Heaven→TaoRanTing→Beijing Zoo→Tsinghua University→Beijing University→Yuanmingyuan→Summer Palace→Xiangshan→Great Wall→Tian’anmen Square	905	715
	3	Tian’anmen Square→Beihai Park→Prince Gong's Mansion→Underwater World→Temple of Heaven→TaoRanTing→Beijing Zoo→Tsinghua University→Beijing University→Yuanmingyuan→Summer Palace→Xiangshan→Beijing Happy Valley→Great Wall→Tian’anmen Square	1310	1020
Theme packages	Culture Line	Qianmen,Tian’anmen Square,Palace Museum,ZhongShan Park→Temple of Heaven→TaoRanTing→Houhai， Prince Gong's Mansion→Yuanmingyuan→Summer Palace→Great Wall→Qianmen,Tian’anmen Square,Palace Museum,ZhongShan Park	1150	
	Visit and learn Line	Qianmen,Tian’anmen Square,Palace Museum,ZhongShan Park→TaoRanTing→Underwater World→Tsinghua University→Beijing University→Yuanmingyuan→Qianmen,Tian’anmen Square,Palace Museum,ZhongShan Park	850	
	Sight Line	Beihai Park→Houhai， Prince Gong's Mansion→Underwater World→Xiangshan→Great Wall→Beihai Park	880	
	Fun Line	Beijing Zoo→Beijing Happy Valley→Underwater World→Great Wall→Beijing Zoo	1030	

6 Model Evaluations and Promotion

6.1 Evaluation Model

Advantages :

1、In this paper, clear thinking , models appropriate to draw a reasonable solution ;

2、This paper uses a 0-1 success variables , so the establishment and programming model can proceed smoothly.

Inadequate:

In reality, there may be between the two spots outside the highway the other modes of transportation, such as cars , subways, increased these considerations , the result will be more reasonable.

6.2 The extension of the model

Models can be considered such as: such as traffic jam, factors affected by weather, as a constraint condition further, so that we can build a more accurate model, and makes the result more practical.

0-1 programming method and used in this paper, problems, plan also is applied to solve the mutual exclusion constraints mutual exclusion problem, fixed cost problem and the assignment problem. Application of the Hamiltonian path problem, also applies to the company delivery, rescue route etc..

Some modification of the model, the optimal can be extended to such as clean car street cleaning, security personnel on duty patrol route arrangement problem.

7 References

[1]Jiang Qiyuan、XieJinxing、YeJun , 《a mathematical model (third edition)》, Beijing : Higher Education Press, 2003 .

[2]ZengWuyi、《Statistics》, Beijing : Peking University Press, 2006 .

[3] ZhaoJing、DanQi, 《Mathematical modeling and mathematical experiments》, Higher Education Press, 2001 .

[4]YangXueqing、LiuChongkan, 《a Hamiltonian path problem based on DNA finite automata algorithms》.http://www.cnki.net/, 2014

[5]ZhouPin、ZhaoXinfang, 《MATLAB Mathematical Modeling and Simulation 》, Beijing , National Defense Industry Press, 2009 .

[6]ShiGuangyan， " Optimization method " , Beijing : Higher Education Press, 1999 .

[7] Hotel accommodation price inquiries , http://www.zjxc.cn/lixingshe3/szlxs186, 2014

[8]Beijing and morning and evening peak traffic jam locations, http://www.517666.com.cn/, 2014

[9] road passenger transport , http://www.china-holiday.com/, 2014

[10]YaoEnyu 、 HeYong 、 ChenShiping, " Mathematical programming and combinatorial optimization " , Hangzhou: Zhejiang University Press , 2001.

[11] XieJinxing、XueYi, 《Optimization Modeling and LINDO / LINGO software》, Beijing : Tsinghua University Press, 2005.

Appendix

1, MATLAB program

```
>> clear
x=[15.7 6.7 17.2 11.1 6.4 2 5.1 12.2 8.7 27.2];
y=[7.2 2.9 8.1 5.0 2.5 0.9 2.3 5.7 4.9 13];
n=length(x);
yb=mean(y);
xb=mean(x);
x2b=sum(x.^2)/n;
xyb=x*y'/n;
b=(xb*yb-xyb)/(xb^2-x2b);
a=yb-b*xb;
y1=a+b.*x;
plot(x,y,'*',x,y1);
```

2, based on a comprehensive evaluation of the time

	Cost	Grade	Traffic	Time	Comprehensive Evaluation
6	5	5	0	5	4.5
3	5	4	1	5	4.3
4	5	4	1	5	4.3
1	5	5	1	4	4.2
12	5	4	1	4	3.9
13	5	4	1	4	3.9
9	5	4	0	4	3.8
2	4	5	1	3	3.6
11	2	5	1	4	3.6
7	5	4	0	3	3.4
10	4	4	1	3	3.3
5	4	4	1	2	2.9
8	4	5	0	1	2.7
14	1	4	0	1	1.8

3, based on the cost of the comprehensive evaluation

	Cost	Desirability	Traffic	Time	Comprehensive Evaluation
1	5	5	1	4	4.4
4	5	4	1	5	4.25
12	5	4	1	4	4.05
13	5	4	1	4	4.05
3	5	3	1	5	3.9
2	4	5	1	3	3.85
6	5	3	0	5	3.8
7	5	4	0	3	3.75
8	4	5	0	1	3.35
11	2	5	1	4	3.35
5	4	4	1	2	3.3
9	5	2	0	4	3.25
10	4	3	1	3	3.15
14	1	4	0	1	1.95