Optimization Strategy on Cash Transportation Routing of Banks

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Abstract. This paper studies the cost control strategy on cash transportation of China's banking industry under the context of the global financial crisis. It analyses the actual work law of the bank cash transportation profoundly and the impact factors at the transportation costs, and constructs the single- material vehicle routing optimization model with rigid time constraints. It uses the genetic algorithm to design a solution for the model. It establishes a practical example based on the actual data from the savings network of CCB and traffic information of Hohhot urban road network, and gets a satisfactory solution, which verifies the effectiveness of the optimization model.

Key words: Cost control, Vehicle routing, Optimization model, Genetic algorithm

1 Introduction

In March 2007, the U.S. subprime crisis outbreak formally, then evolved and deepened, which triggered the most serious financial crisis since 30 years of last century of American history and caused a big shock in global financial markets. It led to an international financial crisis. Lots of financial institutions had been closed down one after another, follow that the world's major stock markets fell sharply, investors suffered heavy losses, world economic growth in severe decline. According to incomplete statistics, the global stock market capitalization had suffered the loss of more than 27 trillion U.S. dollars since the beginning of 2008 to October 2008 [1] .
Impact of the financial crisis is extensive and far-reaching, which also led to a range of effects on our economy. In response to the growing spread of financial crisis, in second half of 2008, our government adopted a series of decisive measures, the companies also made a variety of means to reduce costs. Meanwhile, the low-carbon economy with purpose that reduces the carbon emissions is developing rapidly worldwide. How to reduce emissions and pollution is which the scholars from various countries study actively. Number of savings outlets in the front line of banking services, which are most grassroots organizations in the entire banking system, also is the extremely important foundation institution. Because of their large number and

wide distribution, the daily transportation costs to transport all savings of the savings outlets, which is a huge expenditure over many years. In the context of the global financial crisis, how to control the cost of transportation effectively has an important practical significance to the healthy development of China's banking industry.

2 The decision of armored car transportation route based on the structure of urban road network

Control of transportation costs has to use the means of optimization of transportation scheduling, which is based on the characteristics of transportation tasks, road network data, the condition of the vehicles that can be used, assigns the transport vehicles and determines driving routes, transports the monetary savings needed to be shipped to from the savings outlets to return the specified location within the limited time, which makes comprehensive evaluation index on transport costs and transport time best. The core issue is the selection of the shortest path.

2.1 Problem Description

The grassroots organizations of banking institutions are savings outlets, which are service window for the general customer, the contents of daily work fixes relatively. They need get the cashes daily from armored car from 8:00 to 8:40, and bags the day cashes then transport it back to treasury by the armored car when settlement is completed at 5:20-6:10. Also, if the day savings in a single savings outlet exceed the prescribed limits, you need to return the excess amount of units to treasury by the armored car. Therefore, the number of used armored car of banking Management is greater than or equal twice daily, the distance is long and the arrival time of the armored car has a strict limit. Considering the long term, lower cash-carrying transportation costs to improve transport efficiency have a great significance to costs control on the banking operation.

According to the actual work requiring, in the rigid time constraints, based on the key considerations of economic rationality of transport, it need to consider vehicle loading rate, the number of dispatched trucks, a reasonable line and other issues. Therefore, this research can be attributed to the optimization decision problem based on urban road network structure, that with single varieties of goods, fully loaded, through all outlets, time constrained, and to minimize the total transportation cost from the starting point of delivery to the receiving point, that a "vehicle routing with time windows problem" (Vehicle Routing Problem with Time Windows, VRPTW). In order to accurately establish the mathematical model of the problem, following assumptions are made particularly:

- Urban transport network is the complete network and no direction.
- The transport sector banks have sufficient and different load vehicles which can be scheduled using, and does not consider the problem of vehicle maintenance.
- The starting and finishing point of armored car is the same point, that is the starting point and the end of transportation.
- The savings outlets only be accessed each time in a activities of a particular cash-carrying, each armored car services only one route.

- A collection of savings outlets and monetary transportation route is known, and the time transformation weights associated with the path and transport costs transformation weights are known.

- All savings outlets have deadline constraints, but the sooner or later two deadline fixed, the extra conditions are determined by the status of deposits.

2.2 Model

2.2.1 The idea of modeling

To build a single variety of materials VRPTW model, it must focus on analyzing the factors and weight that affect the transport costs with strong time request, and try to simplify the model structure so as to solve easy. At the same time it adds the last time constraints to the model and quantifies the time period. Following, it focuses on the function construction with last time deadlines.

The VRPTW vehicle routing problems with time windows comply with the armored vehicle transport characteristics in the urban road network. The crux of the matter is to transfer the time function cost to the cost function so that it comply with the goal of economic unity, if it violates the time constraints, the cost function will tend to infinity. If the armored cars reach the savings outlets too early, its security will not be guaranteed. If it reaches too late, it will affect the efficiency and safety of whole system. Therefore, it sets $D_i^{'}$ to the first time deadlines and D_i to the latest time deadlines for cash-carrying of savings outlets, $M \to \infty$ is a large enough positive number, according to the actual time of point i T_i get the construction function with the last time deadlines constraint as follows:

$$G(T_i) = \begin{cases} 0 & D_i^{'} \le T_i \le D_i \\ M & T_i > D_i \text{或} T_i < D_i^{'} \end{cases} \tag{1}$$

2.2.2 Model Objective function

$$\min Z = \sum_{i=0}^{k} \sum_{j=0}^{k} \sum_{v=1}^{n} \alpha_{ij} \cdot d_{ij} \cdot X_{ijv} + \sum_{v=1}^{n} C_v \tag{2}$$

Constraints:

$$\sum_{i=1}^{k} R_i \cdot Y_{iv} \le Q_v \text{，} \quad \forall v \in V \tag{3}$$

$$\sum_{v=1}^{n} Y_{iv} = 1, \quad \forall v \in V, \quad i = 1, 2, \cdots, k \tag{4}$$

$$\sum_{i=0}^{k} X_{ijv} = Y_{jv}, \quad \forall v \in V, \quad j = 0, 1, 2, \cdots, k \tag{5}$$

$$\sum_{j=0}^{k} X_{ijv} = Y_{iv}, \quad \forall v \in V, \quad i = 0, 1, 2, \cdots, k \tag{6}$$

$$\exists X_{ijv} = 1, \quad T_j = T_i + S_{iu} + S_{ijv} \Rightarrow \tag{7}$$

$$T_j = X_{ijv} \cdot \left(T_i + S_{iu} + S_{ijv}\right), \quad i = 0, 1, 2, \cdots, k, \quad j = 0, 1, 2, \cdots, k, \quad i \neq j$$

$$D_i^{'} \leq T_i \leq D_i \Rightarrow \tag{8}$$

$$G\left(T_i\right) = \begin{cases} 0 & D_i^{'} \leq T_i \leq D_i \\ M & T_i > D_i \text{或} T_i < D_i^{'} \end{cases}$$

Where:
i, j—the savings outlets, i = 0 point is the starting point of armored car, but also the end point, the treasury.
V—All vehicles armored car collection;
K—savings outlets collection;
d_{ij}—The distance from point i to point j;
α_{ij}—the economical weights per unit distance (transportation costs);
β_{ij}—the timeliness weights per unit distance (time consumption factor);
C_v—the fixed cost of vehicle v be used (average daily cost of hiring staff, routine maintenance costs, all taxes, etc.);
Q_v—The maximum load capacity of vehicle v;
T_i— the actual time of reaching point i , T_0 is the time from the starting point;
S_{ijv}—the time taking from point i to j;
S_{iu}—the cash-installation time at the point i;
M—large enough positive number;
R_i—the money supply of savings outlet i needed to transport (the multiple of defined volume) $i = 1, 2, \cdots, k$;
$D_i^{'}$—the earliest time when armored car arrived savings outlets;

D_i —the latest time when armored car arrived savings outlets;

$$X_{ijv}=\begin{cases}1 & \text{when car } v \text{ drive } from\ i \text{ to } j\\ 0 & \text{when car } v \text{ donot drive } from\ i \text{ to } j\end{cases}$$

$$Y_{iv}=\begin{cases}1 & \text{the cash } \sup ply\ of \text{ point } i\ is\ served \text{ by car v}\\ 0 & \text{the cash } \sup ply\ of \text{ point } i\ is \text{ not } served \text{ by car v}\end{cases}$$

Objective function (2) makes the costs of armored vehicle transportation (the sum of total costs and fixed costs of vehicles) minimum. Constraint equation (3) is the load capacity constraint to ensure that the money supply responded by the vehicles v don't exceed the maximum capacity; Constraint (4) ensure that the cash to be sent in each savings outlets is delivered only by a single vehicle; Constraint (5) said that if the money to be delivered of savings outlets *j* is distributed by the vehicle *v*, the vehicle v must travel from the savings outlets *i* to j; Constraint (6) said that if the money to be delivered of savings outlets *i* is distributed by the vehicle *v*, then after the vehicle *v* has deposited the cashes of savings outlets I, it must go to another savings outlet; Constraint (7) is the service time expression, which reflects the arrival time relationship between the savings outlets j and the previous savings outlet serviced by the same truck, $T_j \geq T_i$; Equation (8)is the last time constraints, which ensures the timeliness of armored vehicles transportation. In order to facilitate solving the model calculation, it need to convert the directly constraints into the penalty function, which is well versed in the objective function, then there is:

$$\min Z=\sum_{i=0}^{k}\sum_{j=0}^{k}\sum_{v=1}^{n}\alpha_{ij}\cdot d_{ij}\cdot X_{ijv}+\sum_{v=1}^{n}C_v+M\cdot\max\left(\sum_{i=1}^{k}R_i\cdot Y_{iv}-Q_v,0\right)+M\cdot\max\left(T_i-D_i,D_i'-T_i,0\right) \quad \textbf{(9)}$$

3 Model algorithm

3.1 Model Algorithm

Genetic Algorithm is the mathematical model that imitation of genetic selection and survival of the fittest evolutionary, which was first proposed in 1975 by the professor J.H.Holland in University of Michigan. At the same time, he published the representative monographs <Adaptation in Natural and Artificial Systems>, the genetic algorithm proposed by Professor JH. Holland was often called simple genetic algorithm (SGA).

Genetic algorithms include: the creation of the initial population, evaluation of each chromosome, selection, crossover, mutation in the population and post-assessment procedures, and include encoding and decoding, initialization groups, fitness function, reproduction, crossover and mutation factors. Considering the nature of the research and model features, this paper selects the genetic algorithm to solve VRPTW model, solution procedure is as follows:

(1) chromosome structure design: Chromosome structural design is to determine the length and way of the chromosome encoding. Considering the specific circumstances of the vehicle path decision problem, it should use natural number encoding, which represents the starting point of armored car with "0" and a collection of savings outlets with "1,2, ..., k". For example, chromosomal "03450120670", represents that the vehicle assignment and route options is that the three cars start from the starting point of departure, to deliver the currency for seven savings outlets. "0" is the starting point; the middle of the "0" does not have to be expressed in the specific procedure code. As follows:
   - The first armored car path: the starting point → dot3 →dot5 →dot 4 → the starting point;
   - The second armored car path: the starting point outlets → dot2 →dot1 → the starting point;
   - The third armored car path: the starting point for network → dot6 → dot7 → the starting point.
   - Chromosome length = the total number of savings outlets + 1.

(2) Determination on the genetic control parameters:Genetic algorithm parameter settings has a large effect on the algorithm, so which needs to be selected carefully. The usually parameters include: population size *N*, crossover probability P_c , mutation probability P_m and the set of the end computing conditions.Groups of population size *N* is the number of solutions which realizes search in each generation, which usually is selected within 10 to 200; crossover probability P_c is the proportion that the offspring number by cross-algebra takes up individuals number of the total population, to ensure the expansion of the search space, it general values 0.5 ~ 1; mutation probability P_m is the ratio that the mutated gene number take up the total number of genes, which set the range of 0 ~ 0.05. When the genetic algorithm satisfies certain conditions, terminate the evolution cycle, and stop rules often are: the maximum number of failures (the iterations number when it can not get a better solution), the maternal chromosomes have reached the pre-set standards, achieved the goals set in advance and the setting maximum number of evolution generations MAXGEN and so on.

(3) To generate initial population:Genetic algorithm is a population-based search method, it must prepares for genetic operators with the N initial population composed of individuals, and each individual is representation of a solution. Therefore, the initial group is the groups at the beginning of "evolutionary" computation, is the initial solution set, it usually generated initial population with the random method so as to reach all the states. To improve the convergence speed of the algorithm, it can generate the initial groups according to the following steps:
   - Step1: Random sorting for the savings outlets.
   - Step2: It calculates from left to right, if the capacity of first car is greater than the savings amount of first k saving outlets (per unit volume), and less than

the savings amount of first k +1 saving outlets, which are the savings outlets substring 1: "1 2 ··· k" responsible by the first vehicles;

- Step3: Deleting the first k savings outlets in sort, with the same method determining the savings outlets substring 2: "k +1 k +2 ··· l" served by the second vehicle. Repeating that until all the armored car and savings vehicles are assigned completely;
- Step4: Connecting all the substrings after "0" is inserted between the two substrings, then it can get an initial chromosome after head and tail is added "0".
- Step5: Giving the savings outlets new order random, it can be another chromosome with the same steps. Calculation operation repeatedly until the number of chromosomes is equal to population size *N*.
- In order to avoid a large number of infeasible solutions generated in the initial population, it check on the chromosome with constraints (3) and (8), the chromosome corresponds to a feasible solution of the problem if satisfying the condition, which is added to the population; otherwise, chromosome corresponds to the feasible solution, which should be discarded.

(4) Fitness evaluation:Genetic algorithms need evaluate the fitness of chromosomes whether good or not through the size of chromosomes fitness function in the process of solution. Fitness is calculated by the (3.1), the fitness function is obtained by the transformation of the objective function, the variable value X_{ijv} 、 Y_{iv} 、 T_i in the objective function is obtained by selecting calculation of each chromosome codes.

$$f_h = \frac{Z_{\min}}{Z_h} \tag{3.1}$$

Where, f_h represents the fitness function of chromosome h, $Z_{\min}$ represents the transportation costs of best chromosome in the same group, Z_h represents the transportation costs of the chromosome h.

Aim at the problem on transportation route decision of the armored car, the chromosome whose fitness is large corresponds to the transportation routes options whose transportation cost is small, which have a larger probability of genetic to the next generation.

(5) The genetic operations: selection, crossover and mutation

1) The selection operator: In this paper designs the selection operator through the method with retaining the best chromosome combined with roulette.

2) The crossover operator: Crossover operator uses the parent genetic to generate a new chromosome, whose cross-process carry out in two steps: First, it pairs the chromosomes in father groups randomly; the second is that the paired parent chromosome gets genes cross-recombination and exchange the genetic information, which generates a progeny chromosome. The cross-operator happens in a certain probability, which is called crossover probability P_c. The convergence of genetic algorithm is mainly decided by the convergence of crossover operator [2] .

For the path problem of the cash-carrying transportation network, it is disorder between the chromosome sub-paths and order within the sub-path, if it uses the past some crossover operator, which will not be able to maintain the excellent characteristics of the parent, and may even receive a large number of infeasible solutions. Therefore, it preserve good gene combinations from their parents, this paper structures the maximum special retained crossover.

3) The mutation operator:Mutation operation is to avoid the permanent loss of some genetic information caused by the cross-selection process, which can avoid the shortcomings of only getting local solutions. Exchange mutation operator is a local optimization technique, in essence, which is the exchange to the sections of feasible solution to improve the driving line of armored cars.

Because there are many 0 in the chromosomes of transport path decision-making program, normal crossover and mutation operators are not suitable for transport routes decision-making problem, so it need to construct a special bit-based exchange mutation operator. Such as chromosomes"01203450670", to identify the gene "5" and gene "6" to exchange, it gets a new chromosomal "01203460570" by the exchange of location [3].Variation as follows:

- Step1: to produce a random number r between [0,1];
- Step2: If $r \le P_m$,it selects a chromosome randomly, in which selects two non-zero genes arbitrarily; if $r > P_m$, it goes into the next step directly;
- Step3: After exchanging the location of the selected two non-zero genes, it constitutes a new chromosome.

(6) Genetic evaluation:The crossover and mutation operators do not produce better chromosomes necessarily. For that, it need to take the genetic evaluation in order to ensure that the convergence rate. It calculates the each fitness chromosome after crossover and mutation and compares with the fitness before the cross then chooses the largest fitness populations to enter the next generation.

3.2 Algorithm Flow

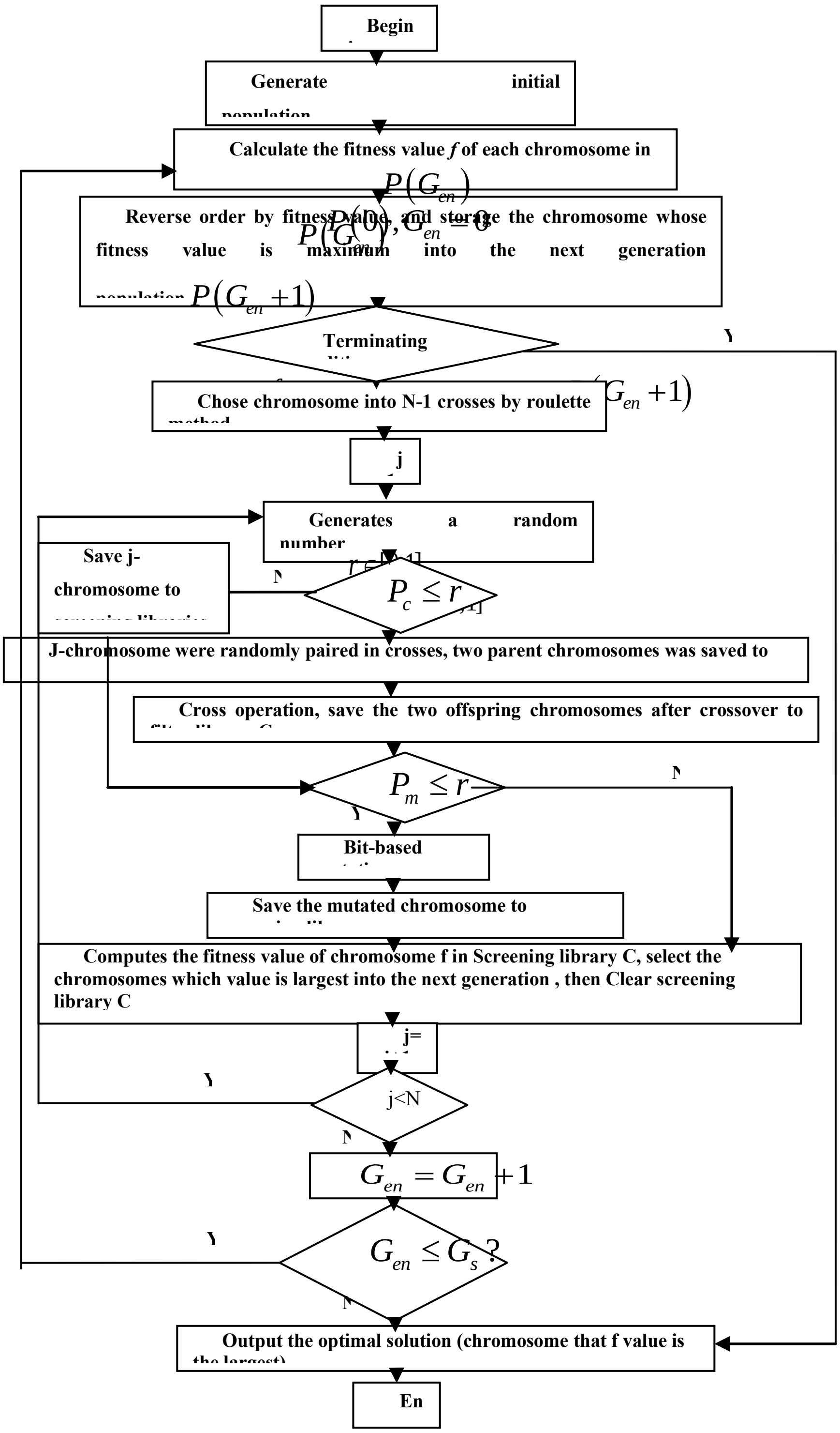
Begin
Generate initial population
Calculate the fitness value f of each chromosome in $P(G_{en})$
$P(0), G_{en} = 0$
Reverse order by fitness value, and storage the chromosome whose fitness value is maximum into the next generation population $P(G_{en}+1)$
Terminating
Chose chromosome into N-1 crosses by roulette method
$P(G_{en}+1)$
j
Generates a random number
$r \in [0,1]$
Save j-chromosome to screening libraries
$P_c \le r$
J-chromosome were randomly paired in crosses, two parent chromosomes was saved to
Cross operation, save the two offspring chromosomes after crossover to
$P_m \le r$
Bit-based
Save the mutated chromosome to
Computes the fitness value of chromosome f in Screening library C, select the chromosomes which value is largest into the next generation , then Clear screening library C
j=
j<N
$G_{en} = G_{en}+1$
$G_{en} \le G_s$?
Output the optimal solution (chromosome that f value is the largest)
En

Fig.1 the genetic algorithm solving process of path decision-making model in cash truck transportation network

Note: section of information from: zhang yi .Research on the method and decision theory of disaster relief supplies and logistics [D]. Doctorate thesis, Chang'an University, 2007

The flow of solving the path optimization decision model with genetic algorithm is shown in Fig.1.

4. the practical examples

According to the actual data information of the savings outlets in Inner Mongolia Branch of China Construction Bank, the operating conditions on armored car department of Management units and traffic network data of Hohhot, it constructs the optimization model of the transport routing of armored car based on the urban road network. The actual operational procedures: the CCB armored cars (normalized and owned by the operation and management section of Construction Bank) usually stops in the Construction Bank vault, it sends several armored cars within the time limit to perform the tasks of all saving outlets in Hohhot with the daily job requirements, and then shipped back the deposit to the vault of each saving outlets security.

In this case, the CCB vault is the starting point (point i = 0) of armored car and destination point after the transport task is completed. In the practice work, the CCB savings outlets requires that the armored cars arrive as early as 8:00-8:40 am and 4:40-5:30 pm, if not it will affect the normal operation of the savings outlets, which will take a security risk to the transportation.

The CCB Branch Office of Inner Mongolia in Hohhot has 52 savings outlets, due to the limited space of this article, from which it takes the data of 10 savings outlets and only considers the activities of cash transportation in afternoon to establish an example. If it needs to solve a greater number of network problems the actual work, just modify the input data of program. 10 savings outlets require to transport the 70 units of volume (special bag that loads models of bank), after the clearing the amount of money in the afternoon. The maximum capacity of a single armored car is 30 units of volume and the cost of vehicle operation is 100. It requires assigning the armored car to start from the treasury and selects transportation routes, which makes the transportation cost to minimize under the conditions of time requirements of the savings network.

Table 4.1 the actual name of the savings dots that grade points correspond to

Saving outlets	**Saving outlets name**
0	**Treasury（starting point）**
1	**Iron road savings bank**

2	**Station west street Branch**
3	**Xi lin north road Branch**
4	**Unity Community Branch**
5	**Dong da Square Branch**
6	**Tian qu Square savings bank**
7	**Hu lun south road Branch**
8	**Ulanqab west street Branch**
9	**New city south street Branch**
10	**Chang’ an Golden Block Branch**

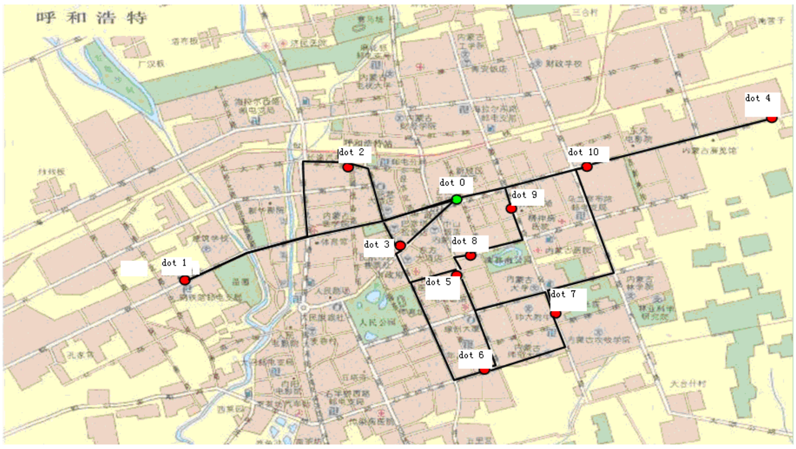

Fig. 1. the distribution map of savings network of Construction Bank in Hohhot area and its shortest path

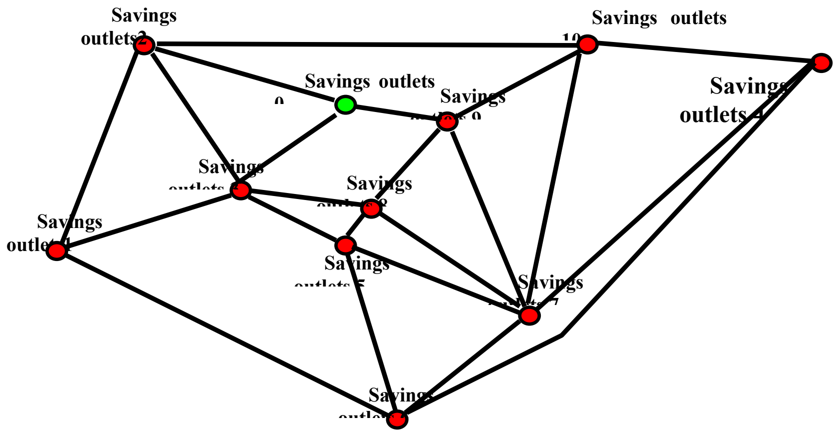

Fig. 2. The network topology of savings network and its shortest distance between points

Table 2 the cost matrix of pots in inter-network transformed from the distance

Saving outlets	1	2	3	4	5	6	7	8	9	10
0	3.650	1.780	1.414	2.973	1.821	2.891	2.164	1.038	0.519	1.763
1	0	3.149	3.018	6.598	4.932	5.418	6.829	4.205	4.263	5.278
2	3.149	0	1.331	4.983	2.896	3.651	4.216	2.407	2.533	3.742
3	3.018	1.331	0	4.270	1.387	2.390	2.904	1.133	1.812	3.034
4	6.598	4.983	4.270	0	5.290	5.778	4.528	4.029	2.880	1.219
5	4.932	2.896	1.387	5.290	0	1.342	1.774	0.418	1.543	3.226
6	5.418	3.651	2.390	5.778	1.342	0	1.269	1.778	2.892	4.554
7	6.829	4.216	2.904	4.528	1.774	1.269	0	1.780	1.635	3.306
8	4.205	2.407	1.133	4.029	0.418	1.778	1.780	0	1.106	2.824
9	4.263	2.533	1.812	2.880	1.543	2.892	1.635	1.106	0	1.672
10	5.278	3.742	3.034	1.219	3.226	4.554	3.306	2.824	1.672	0

According to the r the armored car's average speed in the city, this paper takes 60km / h (1km/min), which can sets different values in practical applications at different cities according to traffic conditions. Here comes the time consumption matrix between the saving outlets.

Table 4.3 the time-consuming matrix of pots in inter-network transformed from the distance (min)

Saving outlets	1	2	3	4	5	6	7	8	9	10

0	3.650	1.780	1.414	2.973	1.821	2.891	2.164	1.038	0.519	1.763
1	0	3.149	3.018	6.598	4.932	5.418	6.829	4.205	4.263	5.278
2	3.149	0	1.331	4.983	2.896	3.651	4.216	2.407	2.533	3.742
3	3.018	1.331	0	4.270	1.387	2.390	2.904	1.133	1.812	3.034
4	6.598	4.983	4.270	0	5.290	5.778	4.528	4.029	2.880	1.219
5	4.932	2.896	1.387	5.290	0	1.342	1.774	0.418	1.543	3.226
6	5.418	3.651	2.390	5.778	1.342	0	1.269	1.778	2.892	4.554
7	6.829	4.216	2.904	4.528	1.774	1.269	0	1.780	1.635	3.306
8	4.205	2.407	1.133	4.029	0.418	1.778	1.780	0	1.106	2.824
9	4.263	2.533	1.812	2.880	1.543	2.892	1.635	1.106	0	1.672
10	5.278	3.742	3.034	1.219	3.226	4.554	3.306	2.824	1.672	0

Table 4.4 the deposits needed to transport in every savings pots (unit volume)

Transportation Materials / Saving Outlets	1	2	3	4	5	6	7	8	9	10
savings	6	8	7	8	6	7	8	6	7	7

Because the title design is known , they take the Treasury to be the starting point, at between 5:20-6:10 pm daily, arriving 10 savings outlets to perform models transportation tasks; the volume capacity of each armored car is 30 units, a total of cash that should be transported of 10 savings Outlets is 70 units volume, so it first

determines to arrange more or equal to 3 armored car to perform the transportation task of models to 10 savings outlets; according to the general models of armored car, which gets the actual city driving Hundred kilometers to 16L/100km and the 93 # gasoline the average price of the 3,4month in 2009 of Hohhot is 5.3RMB / L, which obtain the cost of actual fuel consumption per kilometer that 0.832RMB/km.
The chromosome length is 10 +1 = 11, it takes the population size N = 150 and according to the nature, type and experience of this example takes the crossover probability $P_c = 0.5$, mutation rate $P_m = 0.02$, M = 99999. Algorithm termination condition is set to meet: genetic evolution generations reach 100 generations, that is $G_s = 100$.
According to the known data, the parameters listed in Table 4.1, Table 4.2, Table 4.3 and Table 4.4, Table 4.5 below. Using of algorithm design and the above process, based on the AMD Athlon (tm) 64 X2 Dual Core Processor 3600 + processor, 1.91Ghz, 1.50GB RAM, Window xp computer system, through the preparation of C + + program, using VC + + operators it gets the results shown in Figure 4.3.

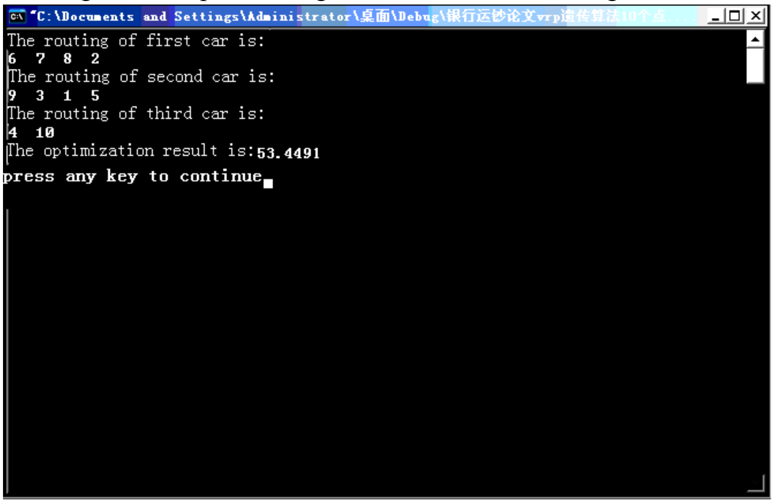

Fig. 3. The running results of example program

Operation Results:
The best chromosome 0-6-7-8-2-0-9-3-1-5-0-4-10-0, the optimal distance 53.4491km. The specific arrangements for transport path are shown in Table 4.5.
In the conditions that the transport equipment is adequate and meet the time requirements, in order to reduce the total mileage to save the cost of the emergency distribution, in principle, the different needs of the same point should be responsible by one car (or team) to transport as far as possible from. In addition, the numerical example of solutions is the global satisfaction solution, which distributes in strict time limit. And the penalty cost is zero. It solved the decision problem of cash distribution path.

Table 4.5 the number of deposits needed to transport, time of loading cash, time interval

Saving outlets *i*	**the number of deposits needed to transport** R_i	**time of loading cash** S_{iu} (min)	**time interval** $D_i^{'} \sim D_i$
1	6	4.5	4:40～5:30
2	8	5.4	4:40～5:30
3	7	4.8	4:40～5:30
4	8	5.7	4:40～5:30
5	6	4.2	4:40～5:30
6	7	5.1	4:40～5:30
7	8	5.4	4:40～5:30
8	6	4.2	4:40～5:30
9	7	5.1	4:40～5:30
10	7	5.1	4:40～5:30

Table 4.6 the results of the path decision-making of cash transportation

Vehicle	**Loading**	**The Sorts of Distribution by site**	**Transportation costs**	**The truck-setting out costs**
1	29	0−6−7−8−2−0	8.426	10
2	26	0−9−3−1−5−0	10.069	10
3	15	0−4−10−0	4.955	10

5 Conclusion

It outbreaks the global financial crisis in 2008, which cause a great extent to the countries in the world, national economists and government put together a large number of human and financial resources to research the strategy. China's economy also suffered a certain degree of influence. In the backdrop of the world financial crisis, it is particularly important to study the control strategy on the transport costs of China's banking shall.

This paper focuses on constructing the optimization model of single- material vehicles routing with rigid time constraints and establish a practical example based on that the actual network data of Construction Bank savings outlets and Hohhot urban traffic network data, which obtains a satisfactory result and verified the validity of the optimization model. It plays an important role at the bank's real cash-carrying transport work of grass-roots institutions. Meanwhile, the decision research on cash-carrying transport path in the case of complexity traffic is the contents needed to continue to study in the next step.

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