The Study of Logistics Distribution Routing optimization problem Based on B2C e-commerce

Xiuxia Yu[1,a],Yinghong Dong[2,b],Li Yue[3,c]

[1,2,3]Department of Computer Science,Changchun University, Changchun, China

[a]yxx6765@sina.com,[b] 419799001@qq.com, [c]36047417@qq.com

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Abstract. This essay aims at the intelligence of logistics and distribution and uses the ideas of the systematic engineering to analyze the vehicle route optimization problem based on the characteristics of B2C e-commerce and has already established path optimization model of constraint three-dimensional distribution. According to the nearest distribution method it has transferred the multiple distribution centers VRP problem into a single distribution center problem and has designed the method of tabooing search for the initial algorithm. Ultimately it made the exchange generated method in the neighborhood search algorithm come true, and used examples to demonstrate the effectiveness of this kind of algorithm.

Introduction

With e-commerce coming, especially in the mode of B2C e-commerce, the characteristics of diversified commodities requirement, customer-tailored requirement and small lot with more times distribution lead the traditional VRP failure of meeting all the requirements of e-commerce logistics distribution. The distributing center in the mode of B2C e-commerce needs to store multiple quotients to satisfy different customers, that is, needs to choose appropriate distributing route to meet the time requirements from different customers, at the same time, also needs the enough distributing equipments to improve responding ability to customers' requirements. Under the policy of meeting customers' requirement in priority in logistics distribution service, the VRP in the B2C e-commerce mode has to realize the commodities diversification and meet the customer-tailored requirement.

Optimizing vehicle routing is a key point in logistics distribution optimization system. How to economically arrange the distributing routes is very important for logistics distribution decision-makers. Reasonably assigning vehicles, further optimizing the distributing routes is very important both to theory and practice in distributing cost cutting down aspect, in logistics and distribution integration development aspect, in setting up a modern logistics and distribution control system and its development aspect.

The analysis of logistics and distribution in the B2C e-commerce mode

The concept and characteristics of B2C e-commerce . United Nations Economic Cooperation and Development organization defines the Electronic Commerce as Electronic Commerce is a kind of business transaction made through open internet, is a certain result by information society and is also a unique business model in the information society. B2C e-commerce is a kind of business models that sellers or companies service or supply commodities to customers through internet websites. B2C e-commerce is a kind of consuming models, which upgrades from traditional market, for easier consuming and lower cost. Logistics distribution is the backbone of B2C e-commerce, without advanced logistics distribution, the e-commerce can't be perfect. And information system is the backbone of logistics distribution, without information system, the modern logistics distribution system can't be done. Therefore, B2C e-commerce is a perfect combination of logistics distribution and information technology. Only with this, can B2C e-commerce develop well.

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B2C e-commerce takes advantage of internet to share the information and optimizes each operating segment in the perspectives of modern logistics distribution supply chain, there are three characteristics:

B2C e-commerce not only sells through internet web, but also combines all the companies' information on the business network for the purpose of individual service.

B2C e-commerce develops from analysis of whole supply chain to the business process outsourcing.

B2C e-commerce realizes the elaboration in business organization structure and develops toward e-organization.

The relationship between e-commerce and logistics distribution .The logistics distribution defined by B2C e-commerce is that distributing companies assort, mark, pack and allocate commodities strictly in accordance with customer's orders by means of internet technology, modern information equipment, software system and advanced management, then deliver the commodities in certain time, at certain place, and with certain quantity to all customers without any limits to meet their commodities requirement. The analysis of the relationship between e-commerce and logistics distribution in the following three aspects:

1) The logistics distribution is an important part of e-commerce: Without the support of modern logistics distribution, e-commerce can't realize the easy-shopping to customer. Any e-commerce activities will be just a talking.

2) The logistics distribution is the assurance of e-commerce. The customer service at e-commerce is finishing the business by distributing. Excellent logistics distribution system can not only successfully finish the business activities, but also impress well to customer.

3) The logistics distribution is a key point to raise e-commerce companies' competition ability in the market. It's necessary to a success e-commerce company to have an in-scale, excellent logistics distribution. It works out a best distributing program according to customer requirement to cut shipment cost, accordingly to help customers to pay less for their goods.

Logistics Distribution routing optimization three-dimensional constraint model and its algorithm.

VRP problems in logistics distribution represent mainly as following two points:

1. Supposing there is a distributing center, and it will send the goods to several customers. Each customer has his certain requirements to goods. The distributing vehicle takes the goods in the distributing center and will deliver the goods at customer hand. The target is to design vehicle routing with the least cost.

2. The dealer needs to take the goods to their distributing center from several factories. The distributing vehicle starts at distributing center to take goods from several factories. With full loading, it comes back to distributing center. Supposing the factory can supply the goods as schedule, the target is to design vehicle routing with the least cost.

These two situations actually are the same, to deliver the goods to several sites and to take the goods from several sites. If one site with enough quantity goods, vehicle can go in straight short path with full loading. If the quantity is not big enough at one site, the vehicle will take the goods at several sites. This is the basic characteristic of allocating distribution to organize the disperse customers and to deliver the goods in combination.

Logistics Distribution routing optimization three-dimensional constraint model. The basic principle of logistics distribution routing optimization model in B2C e-commerce can be described as following: according to the order information placed by customer in one certain time, such as the required quantity and the required delivery place, B2C e-commerce Company grasps the distributing web in this certain time by means of information technology such as GIS technology. In order to meet the least distributing cost target, it will optimize the distributing routing based on the web which should also meet the all the constraint requirement, such as the required good quantity, the distributing center and the loading limit of the vehicle, etc. The total cost here includes the vehicle distributing cost and the vehicle one-off starting cost.

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Three-dimensional constraint model for distributing routing optimization. There are m distributing centers in one area; n customer sites; total k distributing vehicles; there are Ap distributing vehicles quantity in distributing center P; the goods ordered by customers are diversified; based on the above-mentioned conditions, in the principle of meeting customer requirement and setting up the least distributing cost function, to establish a time, space and weight, three-dimensional constraint model for distributing routing optimization as following:

$$\min \sum_{k\in K}\sum_{i\in E}\sum_{i\in E} c_{ij} d_{ij} x_{ijk} + \sum_{k\in K} F_K \max(z_{jk}) \tag{1}$$

$$T_{ajk} \le t_{jk} \le T_{bjk}, \forall k \in K \tag{2}$$

$$\sum_{j\in D}\sum_{k\in L} b_{jl} z_{jk} \le B_K, \forall k \in K \tag{3}$$

$$\sum_{j\in D}\sum_{k\in L} q_{jl} z_{jl} \le Q_{k,} \forall k \in K \tag{4}$$

There are two kinds of symbol in the model, that is, the decision variant in the model and model parameter.

Decision variant. X_{ijk} means whether vehicle *k* is from customer or distributing center *i* to *j (*to *j* doesn't mean delivering goods to customer j), if yes, the X_{ijk} will be 1, if not, the X_{ijk} will be 0.

Z_{jk} means whether the vehicle *k* will deliver goods to customer *j*, if yes, the Z_{jk} will be 1, if not, the Z_{jk} will be 0.

Model parameter :

L---category aggregation of the delivered goods {1,,,,*L*};

A_P *--- the vehicle quantity in distributing center p;*

F_k *--- the one-off starting cost of vehicle k, which including the using and wearing down of vehicle;*

C_{ij}*--- the transporting cost of vehicle k in the routing (i, j) unit;*

q_{jl} ---- the weight of goods L required by customer j;

b_{kj} --- the size of good L required by customers j;

t_{jk} --- the shipping time of distributing vehicle to customer j;

t_{jk} --- the distance between customers or distributing center i and j, that is, the distance between routing i and j;

Q_k --- the maximum loading weight per vehicle;

B_k ---the maximum loading space per vehicle;

T_{ajk} ,T_{bjk} --- the time range respected by customer to the goods arrival;

There are two sections in target function (1), one section means the distributing cost; the other section means the vehicle one-off wearing down cost, and labor cost; in function (2), means the time constraint, that is, the time when vehicle arrives at the customer's site should be in the customer respected time range; in function (3), means the space constraint, that is, the total goods' space delivered by the vehicle can't be bigger than the vehicle's space itself; in function (4); means the weight constraint, that is, the total goods' weight delivered by the vehicle can't be heavier than the vehicle's loading weight.

The algorithm for three-dimensional constraint model. Tabooing search algorithm is a kind of modern algorithm with adaptable memory ability and responding search ability. With adaptable memory ability, the tabooing search algorithm can be more effective to search solution space, and this differs from genetic algorithm and simulation annealing algorithm. The last two algorithms only search solution in the neighborhood at random or according the probability. While tabooing search algorithm search the solution in strategic, compared with probability, the strategic search can get more information. Therefore, in the tabooing search algorithm, because it emphasizes on responding, even if it search a worse solution, it can find a strategic improving way.

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Arithmetic basic idea: first, to assign customer site according to the assignment proximity principle which can transfer the multiple distribution centers VRP problem into a single distribution center problem. Second, to get tabooing search initial solution by means of initial solution design algorithm. Third, to initialize the tabooing search parameter. Fourth, to design the method for tabooing search in neighborhood. Last, to search and get result.

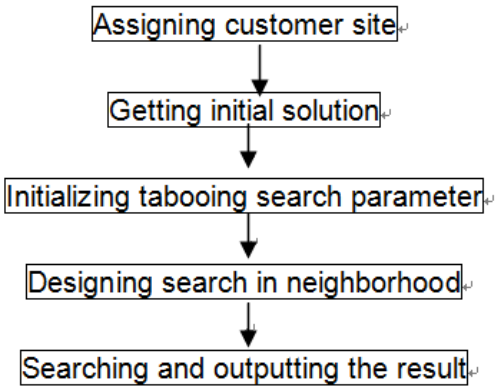

Fig. 1 Arithmetic designed idea

Conclusion

This essay analyzes the disadvantage of distributing routing optimization problem in the B2C e-commerce mode, and sets up a Three-dimensional constraint model for distributing routing optimization in the B2C e-commerce mode. This model with time space and weight three-dimensional constraints and it's more appropriate to the real situation on logistics distribution in the B2C e-commerce mode. Because the final target of the modern logistics distribution is customer satisfaction by delivering goods effectively and quickly. When designing the arithmetic with three-dimensional constraints, the priority is to meet the customer's requirement, that is, to meet the arriving time requirement of customer. Therefore, the optimized route in the designed arithmetic may not be the shortest one, but it's the best one with meet the customer requirement.

This essay will be of great reference to Logistics Distribution Company in cutting its distribution cost, increasing its management and service level, improving its competition ability, and also will be of great help both to theory and practice in intelligence logistics distribution system and intelligence transportation system.

References

[1]Laporte G , Mercure H .,Nobery Y. An exact algorithm for the asymmetrical capacitated vehicle routing problem J. N etworks,1986,(1 6):33-46

[2]Christofides N., Vehicle Routing in The Traveling Salesman Problem: A Guide Tour of Combinatorial Optimization M.Wiley. Chichester,1985

[3]Cheng R.Gen M.Fuzzy Vehicle Routing and Scheduling Problem Using Genetic Algorithms A.Genetic Algorithms and Soft Computing Springer, Berlin ,1996,68 3-709

[4]Xian QianTing. Modern logistics management. Southeast university press.2003

[5] Shiming, Xiang, Visual C++ Digital Image and Graphic Processing, Beijing: Electronics Industry Publication, 2002, pp.12-32

[6] (USA)Joel Siegel Jae Shim. MaiHua Yin Translation. A Database Management System. Beijing: Tsinghua university press, 2003

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