**Optimal decisions of component ordering based on simulation of product**

**Abstract:** The optimal component ordering problem for the dealer who sell only one product is studied.In the case of uncertain product demand,this paper presents a discrete stochastic optimization model for the order size of single product component based on the best expectations of the dealer's profit ,proves the existence and uniqueness of the optimal solution using the marginal analysis method,gives the formula and method of optimal order quantity.The article uses the market demand satisfaction rate as a stochastic constraint on the model,discusses the optimal component ordering of the dealer in the case of random constraints and the absence of random constraints.Finally, the experimental results of the simulation data are used to verify the conclusion of this paper.

**Key Words:** Component ordering decision,Simulation,Marginal analysis

[[1]](#footnote-0)

1. Introduction

With increasing complexity, dynamic and uncertainty of the current market environment, the product life cycle is generally shortened. Some products which have longer life cycle in the past (such as mobile phone, computer and other electronic product in consumer durable), because of their fashion and other characteristics, have become a short life cycle product in the present. Short life cycle product often has the following characteristics: high uncertainty of demand for product, short life cycle of product, quick recession of the value, strong substitution effects of product

and other characteristics[1].Needless to say, this situation will continue for quite a long and predictable period of time,

which makes the market environment more severe, requires dealers who produce these products to respond more quickly and accurately to uncertain market demand.These dealers have a fixed business model. In order to profit, they first order some components from the parts manufacturers to , and then assemble them into a product, and finally sale them to the market. For the dealer, the order cost of the product component is high, but when the product has passed the sales period, the remaining components can only be processed according to their salvage value. So scientifically and [reasonably](https://translate.google.cn/" \l "en/zh-CN/javascript:void(0)) ordering components, not only can improve the dealer's profit expectations and help enterprises meet timely customer needs, but also can lay a good foundation for the long-term development of enterprises[2].Optimal decisions of component ordering for the product which has short life cycle attracts more and more scholars and experts.

There are many studies on the optimal ordering decisions of products which has short life cycle , newsboy model is most typical[3,4], it is mainly used to solve the problem of optimal order quantity under the stochastic demand with the purpose of maximizing the expected profit. However, the above literature studies the problem of product ordering quantity rather than the problem of the component ordering quantity

, and they are in the pursuit of profit maximization process, did not take into account the market demand to meet the rate. Based on the literature 1, this paper studies the problem of the component ordering quantity , and uses the market demand satisfaction rate as the constraint condition to solve the optimal solution .

The product produced by the dealer in the article are considered to be composed of general components and feature components.In the case of uncertain product demand, this paper presents a discrete stochastic optimization model which can solve the optimal order quantity of the component based on the biggest expectations of the dealer's profit, uses the market demand satisfaction rate as a stochastic constraint on the model,discusses the optimal component ordering of the dealer in the case of random constraints and the absence of random constraints.On the basis of analyzing the nature of the problem, we design the algorithm and use the simulation software to get the result, and put forward some suggestions on the management of the dealer.

1. Problem description and mathematical model

2.1 Description of the problem and explanation of mathematical symbol

In the face of random market demand, the dealer assembles these components which are ordered from the component manufacturer into short life cycle products, and then sells them to market.These components include general components and feature components. The order cost of per unit component areand, the order quantities of components are  and ,and the salvage value of components are  and . Without loss of generality, the salvage value of the component will be less than its cost namely .The dealer assembles these components into a product and will sell at  price to market. which represents the market demand of the product is a random variable, satisfies the distribution law which is and ,.

Dealer selling products must be profitable, that is to say .As the market demand for the product is random, so the dealer order components and then assemble them into product。 the most ideal situation is that the two kinds of components are no surplus and the needs of the market is exactly meet .In general, the product made of two components will encounter the following two cases:

1. the product can meet the market demand, but the components are left.
2. the components are not left, but the product can not meet the market demand.

When the components are left, the dealer handles remaining part of the component according to their salvage value. As the salvage value much smaller than the cost of ordering, ordering too many components will bring losses to the dealer. When the assembly volume of the product can not meet the needs of the market, which will cause the product out of stock, will reduce the dealer's service level, and will damage the corporate brand image.Taking into account the above two cases, the dealer orderes components and sets a minimum market demand satisfaction rate as a constraint.The purpose of the dealer is to make decisions about the order quantity of the product components, making the expectations of profit the greatest.

2.2mathematical model

we establishment of the mathematical model with the goal of the dealer's expected net income. Let  denote the net profit when the order quantity of components are  and and the market demand for the product is a random variable (still denoted by ) obtained by the dealer.According to the market demands for different products, the dealer's net profit has the following circumstances:

1. , That is, the products assembled by dealer can meet the needs of the market.



1. , That is, the products assembled by dealer can not meet the needs of the market.





Combined with the above two cases:







When the order quantities of the feature components and the general components respectively are  and  ,the dealer's expectation of net income is, that is to say.











In order to ensure a certain level of service, the order quantity of features components and general components ordered by the dealer must maintain a certain number,so that the probability that the proportion of users' needs satisfied perfectly becomes is , that is to say,above equation has the following constraint:



In summary:











This question denoted as,Here we solve the problem, that is, make decisions about  and .We make decisions about  and ,so that they not only meet the constraints, but also make the dealer's expection of net income become the biggest.

1. Solving and analysing of problems without random constraints

Here first in the case of =0 or =0, we discuss the problem which becomes an unconditional constraint optimization problem on a nonnegative integer set and obtain the optimal solution. Because is discrete, the following theorem can be obtained by using the marginal analysis method for expression :

**Theorem 1**:and, satifies following inequality.



Proof : Assuming , can be written as below









Then,we calculate 





1. 
2. 
3. 
4. Because,is clearly established.Using the same method, when , the above inequality is still true.
5. The inferences given by Theorem 1 are:
6. **Inference 1**:If  reaches the maximum at ,  must be established.

1. [↑](#footnote-ref-0)