Chapter 40
Application of Genetic Algorithms in Inventory Control

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ABSTRACT

The genetic algorithm (GA) is an adaptive heuristic search procedures based on the mechanics of natural selection and natural genetics. Inventory control is widely used in the area of mathematical sciences, management sciences; system science, industrial engineering, production engineering etc. but they have wide differences in mathematical and computation maturity. This chapter enables the reader to understand the basic theory of genetic algorithm and how to apply the genetic algorithms for optimizing the parameters in inventory control The current and future trend of the research with the definition of key terms of genetic algorithm has also incorporated in this chapter.

INTRODUCTION

At the time of national crises, economical, political, or cultural, the talents from different discipline join together to overcome the situations and tide over the crises. These joint efforts always results in new discoveries and techniques. Operations research (OR) is also the outcome of such situation of the last few decades. Thus Operations research is a scientific approach to problem solving via mathematical, economical and statistical models for the situations arising out of risk and uncertainty.

Operations research has got wide scope in the current era of social and business environment. The uncertainty of future, day to day increasing competitions and social interaction has greatly increased the difficulty of managerial decision makings. In general the operations research techniques can be applied to find out the optimum solutions of simple or complicated problems.

Inventory control is one of the main streams of the subject operations research which is widely studied in the area of mathematical sciences, management sciences; system science, industrial engineering, production engineering etc.

Inventory control is the body of mathematical and quantitative methods. On first consideration of the word "inventory control" seems to be virtually self explanatory and a definition would appear to

be obvious "control" hardly requires elucidation and "inventory" immediately bring to mind a stock of some physical commodity. In general as stock is depleted we will order, or produce some quantity of the item so that we can continue to meet the demand of future. Thus, a definition might be, inventory control deals with the determination of optimal procedures for procuring stocks of commodities to meet the future demand. Inventory control is a very critical component of planning and scheduling. Imagine a hospital stocking out of blood or the air force stocking out of mission-critical part when the enemy is attacking. In such situations inventory control can be a matter of life and death.

Recent trends in sciences and computers have led to improved modelling and understanding of various situations in all areas of human activity. In effect, human mind has to play a role model for soft computing. Real-world systems cannot be described mathematically due to the complexity of the components of the plant and the interaction between them, and consequently, the model may be subject to certain assumptions or conditions. In these models, the degree of mathematical precision is required to describe every aspect of the process, which is either prohibitive or non-trivial. In addition, for actual implementation of such systems, heuristics, gained through human experience, are often employed in the tuning of the final controller.

Genetic algorithm is a probabilistic search algorithm based on the mechanics of natural selection and natural genetics. Genetic algorithm is started with a set of solutions called population. A solution is represented by a chromosome. The population size is preserved throughout each generation. At each generation, fitness of each chromosome is evaluated, and then chromosomes for the next generation are probabilistically selected according to their fitness values. Some of the selected chromosomes were randomly mate and produce offspring. The phenomenon of crossover and mutation randomly occurs when offspring is produced. Because chromosomes with high fitness values have high probability of being selected, chromosomes of the new generation may have higher average fitness value than those of the old generation. The process of evolution is repeated until the end condition is satisfied. The solutions in genetic algorithms are called chromosomes or strings.

The complication to obtain the optimal values of decision variable of inventory models increases as the number of decision variable increases in the cost function of the inventory model over traditional calculus method and it's become more complicated if the nature of cost functions towards to highly non-linear in nature. Practically this situation arises in multi-item inventory modelling of substitutable products, inventory control of cell manufacturing, multi-echelon inventory modelling of deteriorating items or for perishable multi inters related items.

To overcome the complication to obtain the optimal values of decision variable via traditional calculus method we can use the genetic algorithm which is a good alternative for these situations. So in this chapter we provide a brief introduction of genetic algorithms, their key terminology and detailed of steps involved in genetic algorithm to apply in inventory control to obtain the optimal solution with numerical illustration using MATLAB.

BACKGROUND

Inventory control is very critical elements in any operations and this is the cost drivers and directly impacts the bottom lines in the balance sheet of the concerned organization. Inventory means value and is an asset of the business organizations. Every business has a standard for inventory turnaround that is optimum for their business. The health of the inventory directly related to the health of business.

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