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Introduced a Special Model of Evolutionary Algorithms to Optimize Transportation Issues as Well as Issues of Transfer or Assignment

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A B S T R A C T

Advancement of Science, and sophisticated engineering systems, and the optimal use of these systems in order to increase productivity and related costs, the researchers found that the best way to optimize their systems to ensure the best possible outcome. Among these systems, transportation, and disposal systems that are particularly important today. In this paper, based on the particular model of evolutionary algorithms is proposed to reduce transportation costs. Due to the characteristics of logistic issues that this model has many advantages over other models.

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INTRODUCTION

First is the introduction of transportation problems and evolutionary algorithms are described, and the specific features that have transportation issues, a special model of evolutionary algorithms that comply with these problems are offered. Transportation issues are an important class of planning problems that are network flow model is called transport. In this model, the aim is to minimize transportation costs. The transportation of goods from origin to multiple destinations where the number of values in each source of supply and the quantity demanded at each destination are known. This paper presents a model of the evolutionary algorithm is presented based on the characteristics and specific transportation issues, transportation issues are resolved.

Defining the Model:

Transport issues need to be considered at the beginning, assuming the transport of m factories as a source and n is the destination warehouse as well as the production and supply of goods at the factory, i have ai (i = 1,2, ..., m) i requested amount of goods in stock j and bj (j = 1,2, ..., n) and cij the cost of transportation of goods in a single direction (i, j) that connects the origin i to destination j (Bazara, S.M. and J.J. Jarvis, 1977). The goal is to find the products that must be sent from the source i to destination j is to minimize transportation costs. According to these assumptions, the problem is that if xij is the amount of commodity i from source to destination j is a linear programming model such issues in this case is as follows.

$$\min \qquad z = \sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}x_{ij}$$

$$\text{st} \qquad \sum_{j=1}^{n} x_{ij} = a_i \qquad (i = 1,2,\dots,m)$$

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$$st \qquad \sum_{i=1}^{m} x_{ij} = b_i \qquad (i = 1,2,\dots,n)$$

Note that it is necessary to solve transportation problems in mind; the transport model must be balanced. The model is called balanced if:

$$\sum_{j=1}^{n} b_j = \sum_{i=1}^{m} a_i$$

Briefly, the model is called balanced if the total supply must equal the sum of all demands of all source destinations. But not so in practice. We are not parallel to the problems of imbalanced problems. There are two issues to convert unbalanced to balanced problems (Taha, H.A., 1971).

First step:
First, it is assumed that the demand is higher than production. In this case we have:

$$\sum_{j=1}^{n} b_j > \sum_{i=1}^{m} a_i$$

Solution that can be done to resolve the imbalanced, just a virtual source that provides additional value is added to the source.

$$a_{m+1} = \sum_{j=1}^{n} b_j - \sum_{i=1}^{m} a_i$$

Second step:
If the amount is greater than the demand, we have:

$$\sum_{i=1}^{m} a_i > \sum_{j=1}^{n} b_j$$

In this case you need to remove the uneven amount of excess demand is a virtual destination is added to the destination. It is the cost of transportation from origin to all destinations virtually zero, because the issue is not the origin of virtual goods. Similarly the cost of transport from the source to a destination is virtually zero because the virtual equivalent of sending goods to a destination is not sending the goods. In fact, virtual goods are not sent from the source to the destination.

Introduction of evolutionary algorithms Transport Model:

A branch of the evolutionary algorithm optimization techniques that are socially and principles of biological systems they are using. Although these algorithms provide simple models of biological processes in normal conditions, but in practice they have shown a lot of ability and performance. The idea of using evolutionary algorithms provides a limited population of elements, each of them will determine the exact point of the search space. In which individuals are identified by chromosome (Pohlheim, H., 1999). Population of chromosomes (population) of the evolutionary process found in nature is like stage. Initially, a random population of chromosomes is created by recombination and mutation and selection operators, and other operators depending on the developmental needs of the chromosome on which the new generation of chromosomes is obtained and then the new generation criteria optimality (Pohlheim, H., 1999) is investigated. If you meet the optimality criteria for the new generation of algorithm stops and the best chromosome as the optimal solution to the problem of generation and transport model is obtained. Otherwise, different genetic operators are applied on the chromosomes in the population are the new generation, and this process will continue until the optimality

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criteria being met. Better than other methods in optimization evolutionary algorithms have led to increased interest in algorithms that can include the following statement (Gen, M. and R. Chang, 1997).

1- The generation of parallel evolutionary algorithms performs a search of the other methods but act as a point.
2- Evolutionary algorithms require a lot of data that does not require the objective function.
3- Evolutionary algorithms are simple and understandable for many users.

Top experts in the field of evolutionary algorithms creates tried These algorithms are simpler and more understandable and also to provide a model of evolutionary algorithms with lower operation and high functionality are also optimized in various fields and the output of these algorithms will provide the best solution to the problem.

4- Specific algorithm Transportation for Transportation Model

This model is evolutionary algorithm that can be used to optimize transportation issues. Suppose the following assumptions have been transported (Dantzig, G.B., 1964):

$a_1=8$ & $a_2=4$ & $a_3=12$ & $a_4=6$
$b_1=3$ & $b_2=5$ & $b_3=10$ & $b_4=7$ & $b_5=5$

As noted in the discussion of evolutionary algorithms. First, a random feasible solution (solution that satisfies all the constraints are) is created. This set of solutions is called the generation of zero or first generation. A possible example of such a table is given below, in which the total number in each row must have the numbers and the total number in each column must be equal to the number of columns (Taha, H.A., 1971).

3	5	0	0	0	8
0	0	4	0	0	4
0	0	6	6	0	12
0	0	0	1	5	6
5	10	7	5	3	

Zero or first generation after generation as the objective function value is calculated for each of the answers. The present algorithm is presented for the general structure of evolutionary algorithms, the fitness value of the solutions obtained and the optimality criterion is examined for each of the solutions for the generation of solutions will satisfy the optimality criteria that the algorithm stops and the generation of solutions is chosen from among the best answer that the optimal solution is the same, otherwise we will be out of this generation to develop a new generation that will satisfy the optimality conditions. For this purpose, it is enough to use the evolution – genetic operators that the following are described in a complete and better than previous generations and generations of these operators are obtained, and the process continues to meet optimality conditions.

Selection operator:

The new operator is introduced in this part of the composition operator and the wheel selection technique is ranked chromosomes (Pohlheim, H., 1999). The operator of each chromosome in the first place is a generation that is so common in the ratings against the worst ranked first chromosome and the best chromosome is rated and formula based on the fitness of the chromosomes in a generation is obtained, where sp is a random number between the numbers one and two chromosomes in a generation is pos rank.

$$\text{Fittnes(pos)} = 2\text{-SP}+2\times(\text{SP}-1)\times\frac{(\text{POS}-1)}{(\text{N}-1)}$$

Suppose now we have the first generation of chromosomes is equal to n ranking in the worst case to answer with an answer, and so the rank is equal to n and their fitness value is calculated according to the above formula. As f1, f2, ..., fn are based on the following procedure will be. First, the value

$$F = \sum_{i=1}^{n} f_i$$

the answer is obtained, then the probability is calculated as follows:

$$P_i = \frac{f_i}{F}$$

and based on the cumulative probability of a response is computed as follows.

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$q_1 = p_1, q_2 = p_2 + q_1, \ldots, q_n = q_{n-1} + p_n$

and then take them on a single line segment from zero to one image. Such as figure (1)

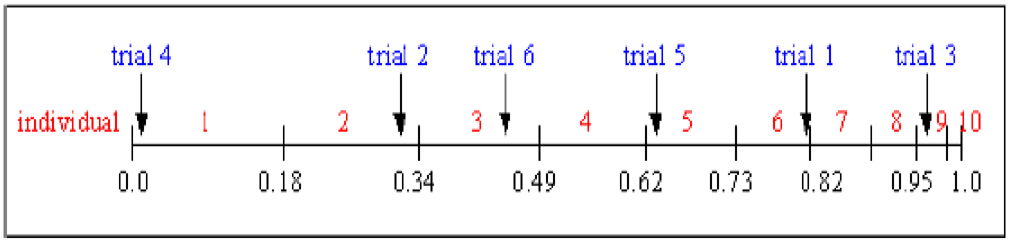

Fig. 1: The operator selected compound (Pohlheim, H., 1999).

However, the number of choices that must be made, a random number in the interval [0, 1] is chosen such that the answers are to these numbers are selected. It is clear that solutions stronger, larger fitness are more likely to choose them over other solutions is a generation that is based on the principles of Darwinian natural selection of organisms remain strong and the weak, are doomed to. Suppose n is the number of new chromosomes selected by the operator to select traffic models, which may be repeated a number of them. After being selected by the operator, the operator answers recombination on the generation of new chromosomes is to be achieved.

Transportation Models recombination operator:

The general method of operation is the first of a generation of randomly chosen pairs of chromosomes and both chromosomes are considered as two parents and transportation by a process model fits the specific model, the parental genes are modified and new solutions are created that their child is known. This can be done several times is that the variation of chromosomes in a generation. Recombination operator is a new operator, based on the properties of the transport model is designed to be used in the transport model.

Table 1: Answer the system as the first parents x1.

1	0	0	7	0
0	4	0	0	0
2	1	4	0	5
0	0	6	0	0

Table 2: Answer the system as the second parent x2.

0	0	5	0	3
0	4	0	0	0
0	0	5	7	0
3	1	0	0	2

However, the matrices X1 and X2, the matrix R is calculated as so:

$R_{ij} = ((x_{ij})_1 + (x_{ij})_2) \bmod 2$

Table 3: The matrix R is obtained according to the above formula.

1	0	1	1	1
0	0	0	0	0
0	1	1	1	1
1	1	0	0	0

And the matrix D is calculated according to the following formula

$$d_{ij} = \left[\frac{(x_{ij})1 + (x_{ij})2}{2}\right]$$

Table 4: Matrix D.

0	0	2	3	1
0	4	0	0	0
1	0	4	3	2
1	0	3	0	1

R1 and R2 are the matrix so that the matrix R is divided into two, so that:

$R = R_1 + R_2$

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Table 5: Matrix R1.

1	0	0	1	0
0	0	0	0	0
0	0	1	0	1
0	1	0	0	0

Table 6: Matrix R2.

0	0	1	0	1
0	0	0	0	0
0	1	0	1	0
1	0	0	0	0

Children are X2 ', X1' so that we have obtained as follows:
$X_1^{'} = D + R_1$ & $X_1^{'} = D + R_2$

Table 7: Table X1 'as first child.

0	0	5	0	3
0	4	0	0	0
0	0	5	7	0
3	1	0	0	2

Table 8: Table X2 'as the second child.

1	0	0	7	0
0	4	0	0	0
2	1	4	0	5
0	0	6	0	0

The above process of recombination operator, the answer to both of their parents was randomly selected and two new solutions are obtained as the two children. This process continues until there is a new chromosome number 2n is obtained. This action causes the proliferation of high fitness solutions with other solutions is that it increases the diversity of solutions.

Transportation Models mutation operator:

Administrative process so that the operator first randomly selects a chromosome from one generation and the chromosomes of the parents and by the way, is referred to below as the child becomes a new chromosome. The following example

Table 9: Sample Answer for Transportation Model.

0	0	5	0	3
0	4	0	0	0
0	0	5	7	0
3	1	0	0	2

Matrix is a 4 × 5 matrix as parents, we try to be a parent of X on Y matrix so as to obtain the number of rows and columns of the matrix X is less. Thus, the general trend is a natural number between [1, 4] is selected, the number is that number again random numbers in the interval [1, 4] is selected. Rows of the matrix X is considered as the number of columns and the same process is done in a similar way. If this is a first natural number in the interval [1, 5] is selected, the numbers are still a number of random numbers in the interval [1, 5] is selected. The numbers in the columns of the matrix X as it is considered as the matrix

Table 10: Sub matrix Y.

4	0	0
1	0	2

Based on the above matrix is a new matrix that is the sum of entries in any row or column is equal to the sum of each row or column of elements such that Y is the sub matrix. In other words, the sub matrix entries are generated in the following equations are obtained from the sub-matrix Y are true.

$$\begin{cases} y_{11} + y_{12} + y_{13} = 4 \\ y_{21} + y_{22} + y_{23} = 3 \\ y_{11} + y_{21} = 5 \\ y_{12} + y_{22} = 0 \\ y_{13} + y_{23} = 2 \end{cases}$$

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The new sub matrix as Y 'is obtained according to the above equations.

Table 11: Sub matrix Y '

2	0	2
3	0	0

Then a new matrix Y 'instead of the sub matrix X is Y's parent and the new child is calculated.

Table 12: Example of chromosome mutation.

0	0	5	0	3
0	2	0	0	2
0	0	5	7	0
3	3	0	0	0

The mutation operation is repeated until n as n A new mutant is obtained.

The general trend of algorithm:

The first generation of the feasible region are zero or initial generation, we randomly generated and their fitness values are obtained for the generation of optimality criteria then check if you are satisfy optimality criteria that the algorithm stops and the generation of the best chromosome is selected as the answer, otherwise the selection operator is executed on the generation of chromosomes and n number of new chromosome is selected. Then on chromosomes crossover operator is applied to the generation and amplification of chromosome is 2n to n chromosomes, this is the variation and proliferation of chromosomes. After this stage, the mutation operator is applied so that the n chromosomes into new chromosome are n. The process is the mutation operator. Thus, after 4n chromosome number of new processes is obtained. However, because so many people should remain constant from one generation of selection operator is used and n number of chromosomes of the chromosome is selected 4n and n is the new generation of chromosomes. However, as noted above process, we examine the optimality criteria for the generation of optimality criteria are met, the best chromosome is selected, otherwise the evolutionary operators are applied on the generation and the new generation is the process continue until the optimality criteria are met and the algorithm is stopped and the best response is achieved. The algorithm is designed based on the particular characteristics and capabilities of the transportation model are also applicable to other problems (Pohlheim, H., 1999).

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