The use of linear programming in solving the transportation problem with the various Method

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Abstract— The Transportation Problem is one of the subclass of linear programming problem which the objective is to minimize transportation cost of goods transport to various origins to different destinations. Also located in the .field of marketing many production facilities close to each other to increase its production capacity and expand the national marketing network and international marketing. With the addition of the new capability, the organization wanted to know how to customize the best customer orders for products to reduce the total cost of production and transportation. In this paper we are representing the transportation problem for The National Company of dates to reduce transportation cost, Its working with 2 Collection centers and 2 depots and 1 Distribution Exhibition in Algeria. In this paper we are solve the transportation problem with the help of dual simplex and interior point method. Here we are solving this problem with the help of Dual simplex method, by using Matlab software and we are comparing the obtained optimal solution with interior point method.

Index Terms — linear programming, Modeling, Optimization, simplex method, simplex algorithm, Transportation Problem.

1 INTRODUCTION

TheTransport problems is one of the fundamental problems of the network problem which is generally used to re duce the cost of the transport product with a number of sources and a number of destination o¤ers and demand meet the requirement to reduce the .ow. The .rst transport problem presented by FLHitchcock [16] in his article, "distribution of product from many sources to many localities," and then visualization by TC Koopmans [17] in his historical paper «Optimum use of the transport system. » These two contributions have helped in the development of transportation routes, which involve a number of shipping sources and the number of destinations. In the recent past, the transport problem with another objective of reducing transport length has been studied by many researchers, such as Sharma and Swarup [8], Seshan and Tikekar [5], Prakash,. [11] Studied in the time transport problem. Surapati and Roy [12], Wahead Crown [13] and Zangibadi owners [14] presented a vague objective programming approach to determine the optimal solution to the multi-objective transport problem. In this paper we solve the transportation problem by the simplex method and compare the optimal solution with the interior point method... They each method used to solve linear programming binary variables. In this article, we use MATLAB software to solve all the way

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THEORETICAL AXIS

2.1 FORMULATION OF TRANSPORTATION PROBLEM IN LINEAR PROGRAMMING PROBLEM

Given m origins and n destinations, the transportation problem can be formulated as the following linear programming problem model:

Minimize:

$\sum_{i=1}^{m}\sum_{i=1}^{n} c_{ij}\, x_{ij}$……..(1)

Subject to constraint:

$\sum_{i=1}^{m} x_{ij} \le a_i$ i=1……m……..(2)

$\sum_{i=1}^{n} x_{ij} \ge b_i$ i=1……n……(3)

$X_{ij} \ge 0$…….. (4)

For all I and j

Where X_{ij} is the amount of units of shipped from origin $i$to destination j and c_{ij} is the cost of shipping one unit from origin i to destination j. The amount of supply at origin is ai and the amount of destination j is b_j. The objective is to determine the unknown x_{ij} that will the total transportation cost while satisfying all the supply and demand constraints. [16]

3 APPLIED AXIS

3.1 Search problem

Based on the statement of the Director General of the National office of dates that Algeria owns 18 million palm trees produce 850,000 tons per year. And that you need to organize the process and in this context, Mr. Director called for the .ght against smuggling and eliminate fraud.

In response to the appeal of the Director General, we e amined the problem that is the product storage and transport through phases where they are directed to export to Europe and some Asian countries and domestic marketing. You may have been to build a model in a mathematical formula and .nd a solution for the transfer and the lowest cost.

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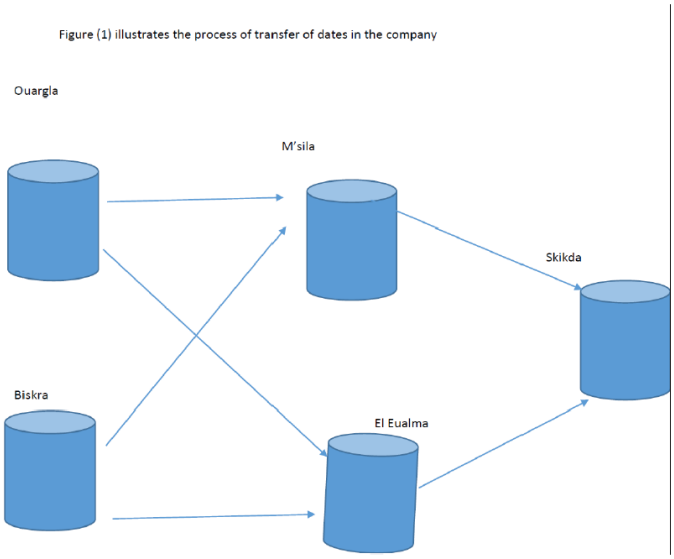

3.2 **Demand forecasting**

Where it was estimated quantity required by the exhibition in Skikda, is 200,000 tons.

Table (1) this table shows transportation costs measured in dinars per tone.

	Misila store	El eualma store	Skikda Exibition
ouargla store	33600	34800	……
BiskraStore	11220	14700	……
Misila store	…….	…….	10860
El eualma store	……..		19620

Table (2) this table shows the amounts transferred between stores and the store next door (measured in tons).

	Misila store	El eualma store	Skikda Exibition
ouargla store	195.000	195.000	……
BiskraStore	500.000	500.000	……
Misila store	…….	…….	200.000
El eualma store	……..		200.000

4 The mathematical model to the problem of transport

4.1 The definition of variables

To formulate a mathematical model variables must be defined:

Designate the number of tonnes transmitted to Ouargla store to Msila store

$X_{om} = X_1$

Designate the number of tonnes transmitted to Ouargla store to Eleualma

$X_{oe} = X_2$

Designate the number of tonnes transmitted to Biskra store to M.sila store

$X_{Bm} = X_3$

Designate the number of tonnes transmitted to Biskra store to Eleualma store

$X_{BE} = X_4$

Designate the number of tonnes transmitted to M.sila store to Skikda store

$X_{ms} = X_5$

Designate the number of tonnes transmitted to Eleualma store to Skikda store

$X_{es} = X_6$

Minimization Problem: Find the minimum value of $Z=33600x_1+34800\ x_2+11220\ x_3 14700\ x_4+19620\ x_5+10860\ x_6$

Minimization $Z=33600x_1+34800\ x_2+11220\ x_3+14700\ x_4+19620\ x_5+10860\ x_6$

Subject to:

$X_1+ x_3=195000.00$……(1)

$X_4+ x_5=500.000$……..(2)

$X_1+ x_4-x_2 \leq 0$……..(3)

$X_3+ x_5-x_6 \leq 0$……..(4)

$X_2+ x_6=200000.00$……(5)

$X_1 \leq 195.000$……(6)

$X_2 \leq 20.000$……(7)

$X_3 \leq 195.000$……(8)

$X_4 \leq 500.000$……(9)

$X_5 \leq 500.000$……(10)

$X_6 \leq 20.000$……(11)

4.2Transform the following linear program into standard form.

Minimizes $Z=33600x_1+34800\ x_2+11220\ x_3+14700\ x_4+19620\ x_5+10860\ x_6+0s_1+0s_2+0s_3+0s_4+0s_5+0s_6+0t_1+0t_2+0t_3$

Subject to:

$x_1 + x_3 + T_1 = 195.000$.....(1)

$x_4 + x_5 + T_2 = 500.000$.....(2)

$x_1 + x_4 \text{ . } x2 + S_7 = 0$.....(3)

$x_3 + x_5 \text{ . } x_6 + S_8 = 0$.....(4)

$x_2 + x_6 + T_3 = 200.000$.....(5)

$x_1 + S_1 = 195.000$.....(6)

$x_2 + S_2 = 200.000$.....(7)

$x_3 + S_3 = 195.000$.....(8)

$x_4 + S_4 = 500.000$.....(9)

$x_5 + S_5 = 500.000$.....(10)

$x_6 + S_6 = 200.000$.....(11)

4.3 The steps of the simplex.

Solution of Linear Programs by the Simplex Method

4.4 SETTING UP THE FIRST SIMPLEX TALEAU

c		**0**	**0**	**0**	**0**	**0**
v		**S_1**	**S_2**	**S_3**	**S_4**	**S_5**
Q		19500	200000	195000	500000	500000
33600	**X_1**	**1**	**0**	**0**	**0**	**0**
34800	**X_2**	**0**	**1**	**0**	**0**	**0**

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11220	**X_3**	**0**	**0**	**1**	**0**	**0**
14700	**X_4**	**0**	**0**	**0**	**1**	**0**
10860	**X_5**	**0**	**0**	**0**	**0**	**0**
19620	**X_6**	**0**	**0**	**0**	**0**	**0**
0	**S_1**	**1**	**0**	**0**	**0**	**0**
0	**S_2**	**0**	**1**	**0**	**0**	**0**
0	**S_3**	**0**	**0**	**1**	**0**	**0**
0	**S_4**	**0**	**0**	**0**	**1**	**0**
0	**S_5**	**0**	**0**	**0**	**0**	**1**
0	**S_6**	**0**	**0**	**0**	**0**	**0**
0	**S_7**	**0**	**0**	**0**	**0**	**0**
0	**S_8**	**0**	**0**	**0**	**0**	**0**
0	**T_1**	**0**	**0**	**0**	**0**	**0**
0	**T_2**	**0**	**0**	**0**	**0**	**0**
0	**T_3**	**0**	**0**	**0**	**0**	**0**

0	0	0	0
S_6	S_7	S_8	T_1
200.000	**00**	**00.00**	**19.500**
0	**1**	**0**	**1**
0	**-1**	**0**	**0**
0	**0**	**1**	**1**
0	**1**	**0**	**0**
0	**0**	**1**	**0**
0	**0**	**-1**	**0**
1	**0**	**0**	**0**
0	**0**	**0**	**0**
0	**0**	**0**	**0**
0	**0**	**0**	**0**
0	**0**	**0**	**0**
1	**0**	**0**	**0**
0	**1**	**0**	**0**
0	**0**	**1**	**0**
0	**0**	**0**	**1**
0	**0**	**0**	**0**
0	**0**	**0**	**0**

0	0	
T_2	T_3	**Z=**
500.000	**200.000**	**33.600**
0	**0**	**34.800**
0	**1**	**11.220**
0	**0**	**14.700**
1	**0**	**10860**
1	**0**	**19620**
0	**1**	**0**
0	**0**	**0**
0	**0**	**0**
0	**0**	**0**
0	**0**	**0**
0	**0**	**0**
0	**0**	**0**
0	**0**	**0**
1	**0**	**0**

0	**1**	**0**
1	**0**	**0**
0	**1**	**0**

5 Modeling the Problem using Matlab Solver

5.1 Read the solution

This section will demonstrate, to use Matlabl Solver to .nd the optimum transportation cost. The .rst step is to organize the spreadsheet to represent the model. Next step is to use the Solver to .nd the solution. In the Solver, we need to identify the locations (cells) of objective function, decision variables, nature of the objective function (maxim-ize/minimize) and constraints.

We apply all the steps Simplex method to .nd out that the best solution.Using MATLAB software. (Use linprog to co pute the solution.)

The command (linprog) from the optimization toolbox im-plements the simplex algorithm to solve a linear programing problem in the form

Now we are ready to solve the problem. First we set up the vectors and

Matrice:

```
>>A=[1 -1 0 1 0 0;0 0 1 0 1 -1];
f=[ 33600 34800 11220 14700 10860 19620 ];
b=[0 0 ];
l = [0 0 0 0 0 0];
Aeq = [1 0 1 0 0 0;0 0 0 1 1 0;0 1 0 0 0 1];
beq = [195000 500000 200000];
u=[195000 200000 195000 500000 500000 200000];
>> x = linprog (f , A, b, Aeq, beq, l, u)
```

Exiting: One or more of the residuals, duality gap, or total relative error has Grown 100000 times greater than its min-imum value so far:

The primal appears to be infeasible (and the dual un-bouned).

(The dual residual < TolFun=1.00e-008.)

```
x =
1.0e+005 *
0.7208
0.8543
1.8397
3.1038
1.8962
2.0951
Z = 1.8017e+005 (DA)
```

Table (4)

Shows the quantities that must be adhered to for the trans-fer between the Store and exhibition

	Misila *Store*	El eualma *Store*	*Skikda Exhibition*
ouargla *Store*	1.0e+005 *0.7208	8 1.0e+005	……..

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		*0.8543	
BiskraStore	1.0e+005 *1.8397	1.0e+005 *3.1038	……
Misila $Store$	……..	……..	1.0e+005 *1.8962
El eualma $Store$	……	……	1.0e+005 *2.0951

After Using Software on Transportation Problem and Linear Programming.
Formulation of Transportation Problem we are getting the optimal solution of our transportation problem which solving for The National Company of dates to reduce transportation cost presented in following table:

Table 5

Name of Methods	Constraints	Optimal Solution
interior point method.	$x_1 = 1.0e+005$ 0.7208 $x_2 = 1.0e+005$ * 0.8543 $x_2 = 1.0e+005$ * 0.8543 $x_3 = 1.0e+005$ * 1.8397 $x_4 = 1.0e+005$ * 3.1038 $x_5 = 1.0e+005$ * 1.8962 $x_6 = 1.0e+005$ * 2.095	Z = 1.8017e+005 (DA)
Big-M Method	$x_1 = 1.0e+005$ * 0.7208 $x_2 = 1.0e+005$ * 0.8543 $x_3 = 1.0e+005$ * 1.8397 $x_4 = 1.0e+005$ * 3.1038 $x_5 = 1.0e+005$ * 1.8962 $x_6 = 1.0e+005$ * 2.095	Z = 1.8017e+005 (DA)
Two-Phase Method	$x_1 = 1.0e+005$ * 0.7208 $x_2 = 1.0e+005$ * 0.8543 $x_3 = 1.0e+005$ * 1.8397 $x_4 = 1.0e+005$ * 3.1038 $x_5 = 1.0e+005$ * 1.8962 $x_6 = 1.0e+005$ * 2.095	Z = 1.8017e+005 (DA)
Dual Simplex Method	$x_1 = 1.0e+005$ * 0.7208 $x_2 = 1.0e+005$ * 0.8543 $x_3 = 1.0e+005$ * 1.8397 $x_4 = 1.0e+005$ * 3.1038 $x_5 = 1.0e+005$ * 1.8962 $x_6 = 1.0e+005$ * 2.095	Z = 1.8017e+005 (DA)

5.2 CONCLUSION

We have established the uniqueness and existence of optimal solution of the transportation problem for National Court Dates Company. This has been brought out through developed transportation problem into linear programming problem and applying the discuss methods in paper which yields the same four optimal solution as shown in table 5 and have stated the optimality conditions of the problem. And we get all method give the same result but dual simplex method is best with respect to VAM because dual simplex have minmum no. of iterations.
We conclude that the way Simplex better than interior point In a number of iterations and the implementation period National Company for distribution dates shrinking transportation costs to value:
Z = 1.8017e+005 (DA)

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