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Research Article

SOLVING ASSIGNMENT PROBLEM USING MATLAB

[1]S.Deepa [2] D.Nagarajan [3] R.Palanikumar

[1&2&3]Asst. Professor, Department of Mathematics, Srimad Andavan Arts and Science College (Autonomous), Trichy – 05.

Email id: palanikumar2261982@gmail.com

ABSTRACT

In this paper we used MATLAB coding and some modification in ROA method, the optimal solution of assignment problem tracking within seconds. MATLAB coding result has reached several orders.

Keywords: Assignment problem, MATLAB coding, ROA method.

MSC Code: 90B80

INTRODUCTION

Assignment Problem (AP) is completely degenerated form of a Transportation Problem. It appears in some decision-making situations. Such as assign tasks to machines, workers to jobs etc. AP refers to another special class of Linear Programming Problem in which the objectives is to assign a number of resources to the equal number of activities at a minimum cost (or maximum profit). Different methods have been presented for Assignment Problem [1–6].

AP was developed and published by Harold W.Kuhn(1995), who gave the name "Hungarian Method" because the algorithm was largely based on the earlier works of two Hungarian Mathematicians: Denes Konig and Jeno Egervary.

Moreover MATLAB is powerful software package. The name MATLAB stands for MATrix LABoratory, it deals with matrix (array). MATLAB can be used for math computations, modeling and simulations, data analysis and processing, visualization and

graphics and algorithm development and has many built in tools for solving problems. It is also possible to write programs in MATLAB, which are essentially groups of commands that are executed sequentially [7,8].

Now days MATLAB is widely used mathematics such as MATLAB with Numerical methods, Differential Equation, Operation Research, Fuzzy Logic etc. in this article MATLAB coding is used to solve Assignment Problem. This gives optimal solution within fraction of seconds.

ASSIGNMENT BASED FORMULATION

Let Assignment Problem of n resources to n activities so as to minimize the overall cost or time in such a way that each resources can associate with one and only one job. The cost matrix (c_{ij}) is given as below.

		Activity				*Available*
		A_1	A_2	...	A_n	
Resource	R_1	C_{11}	C_{12}	...	C_{1n}	1
	R_2	C_{21}	C_{22}	...	C_{2n}	1
	⋮	⋮	⋮	⋱	⋮	⋮
	R_n	C_{n1}	C_{n2}	...	C_{nn}	1
Requirement		1	1	…	1	

The cost matrix is same as that of a Transportation Problem except that availability at each of the resources and the requirement at each of the destinations is unity.

Let x_{ij} denote the assignment of i^{th} resources of j^{th} activity such that

$$; if\ he\ goes\ form\ city\ i\ to\ city\ j$$
$$; otherwise$$

Then the mathematical formulation of the assignment problem is subject to the constraints

$$\text{Minimize } z = \sum_{i=1}^{n}\sum_{j=1}^{n} c_{ij}x_{ij} \qquad (1)$$

$$\sum_{i=1}^{n} x_{ij} = 1 \text{ and } \sum_{j=1}^{n} x_{ij} = 1 : x_{ij} = 0 \text{ or } 1 \qquad (2)$$

For all i = 1,2,…,n and j = 1,2,….,n

ALOGORITHM–MODIFIED REVISED ONES ASSIGNMENT METHOD (MROA)

- Divide each row by $\sum_{i=1}^{n} a_i$.
- Divide each column by $\sum_{j=1}^{n} b_j$
- Check optimality (draw lines to covers all one) if it is equal to 'n' then go to last step.
- If drawn lines < n, then consider all element less than 1.5 in matrix as 1 and again check optimality.
- To select 1 from each row and column apply following rules
    1. Select only one 1 from each rows, i.e if more than one 1 occurred in row then ignore temporarily.
    2. Select only one 1 occurred in column, i.e. if more than one 1 occurred in column then ignore temporarily.
    3. After selection of single 1 from each row and column, then delete corresponding row and column.
    4. If still value remains in matrix then select minimum value from each row and delete corresponding row and column.
    5. Repeat step 3 and 4 until optimal solution is obtained.

MATLAB CODING FOR ASSIGNMENT PROBLEM BY MROA

It is assumed that reader has basic knowledge of MATLAB programming. In this problem 200 random number of sample illustration solved for matrix 3×3, 4×4, 5×5. This gives optimal result within fraction of seconds, for this we used system which contains Intel core i3 processor, 4GB RAM, Window 7 operating system.

```
%% MATLAB PROGRAMMING FOR ASSIGNMENT PROBLEM
%% BY:  S.DEEPA, D. NAGARAJAN and  R.PALANIKUMAR
clc
tic;
x = randi ( [2,10] ,3 ,3 );
xnv = x ;
x1 = x ;
minr = min (x ,[ ] ,2) ;
% nnminr (x) ;
[r  c] = size (x);
for  i = 1 : r
        for j = 1 : c
                x ( i , j ) = x ( i , j ) / minr(i) ;
```

```
        end
end
x;
  minc = min (x, [ ] , 1); % nnminr (x′)′ ;
for i = 1 : r
        for j = 1 : c
                x ( j , i ) = x ( j , i ) / minc(i) ;
        end
end
x;
 y = x ;
for i = 1 : r
        for j = 1 : c
                if x(i , j ) <= 1.1
                        x ( i , j )  = 1;
                end
        end
end
x;
count = 0;
  for i = 1 : r
  for j = 1 : r
        for  j = 1 : c
                if x ( j ,i ) ==1
                  count = count + 1;
                end
        end
        if count <= 1
        for I = i
                for j = 1 : c
                        if x( j , I )  == 1
                x( j, I ) = x ( j, I ) * 200;
                        end
                end
        end
        end
           count  0 ;
end
x;
cmp = nnmaxr (x) ;
iv = find (cmp ==200)′ ;
k = length (iv) ;
for  i = 1 : k
        for j = 1 : c
                if x ( iv (i) , j ) ~ =  200
                        x ( iv (i) , j )  =  0 ;
```

```
                end
        end
end
x;
cmpl = nnmaxr ( x′) ;
ivl = find (cmpl == 200)′ ;
kl = length (ivl) ;
for i = 1 : kl
        for  j =  1 : c
                if x( j,  ivl ( i )) ~ = 200
y = x
y = y. * xnv
        for  i = 1 : r
                minr = min( min (y))
                    [yc  yr] = find ( y′ == minr)
                        k1 = length (yr) ;
                for m = 1 : 1
% instead of k1 we will take 1st whatever value come
                y (yr (m) , yc (m) ) = y(yr(m) , yc(m)) +9 ;
                for j = 1 : c
                        if  y(yr(m) , j) ~ = y (yr(m) , yc(m))
                        y(yr(m) , j ) = 200 ;
                        end
                end
                        for j = 1 : c
                                if  y( j , yc(m)) ~ = y (yr(m) , yc(m))
                                        y( j, yc(m)) = 200 ;
                                end
                        continue
                        end
                end
        end
y
x = y ;
for i  = 1 : r
        for j = 1 :  c
                if  x ( i , j ) = = 200
                        x ( i , j ) = 0 ;
                end
                if  x ( i , j )  ~ = 0
                        x ( i  , j ) = 1 ;
                end
        end
end
x;
   z = xnv . * x
```

```
Minvalue = ( sum(sum( z))
   end
        if  count  ==r
                x
                Minvalue _z = sum(sum(x))
        end
xnvv
toc;
```

Comparison with optimal solutions for random instances				
S.No.	Matrix Size (m × n)	Number of sample solved	Efficiency (%)	Time(sec)
1	3 × 3	200	87	0.01 sec
2	4 × 4	200	81	0.02 sec
3	5 × 5	200	74	0.03 sec

The performance of this MATLAB coding is satisfactory, reliable, efficient and faster.

CONCLUSION

Assignment Problem with MATLAB has best practical and theoretical significant. New method is applied to solve Assignment Problem using MATLAB, which is faster. It is applicable for Travelling Salesman Problem. The Programming in MATLAB will save lot of time from complex iterative calculations.

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