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An Initiation of Dynamic Programming to Solve the Graphical as well as Network Problems for the Minimum Path between Nodes

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ABSTRACT

Dynamic programming is a useful technique for making a sequence of interrelated decisions. It provides a step wise procedure for finding the optimal combination of decisions. Dynamic programming provides a useful way to find out the minimum distance between the two nodes within the network. The multistage decision policy with recursive approach will provides an efficient way while using Dynamic programming. In multistage decision process the problem is divided into several parts called as sub problems and then each sub problem will be solved individually and the final result will be obtained by combining the results of all the sub problems.

Key words: Dynamic programming, multistage decision policy, sub problems, interrelated decicions

INTRODUCTION

Dynamic programming is a useful technique for making a sequence of interrelated decisions. It provides a step wise procedure for finding the optimal combination of decisions. Dynamic programming provides a useful way to find out the minimum distance between the two nodes within the network.

The multistage decision policy with recursive approach will provides an efficient way while using Dynamic programming. In multistage decision process the problem is divided into several parts called as sub problems and then each sub problem will be solved individually and the final result will be obtained by combining the results of all the sub problems.

Let us take an example of a network for which the minimum path between the first node and the last node would be calculated.

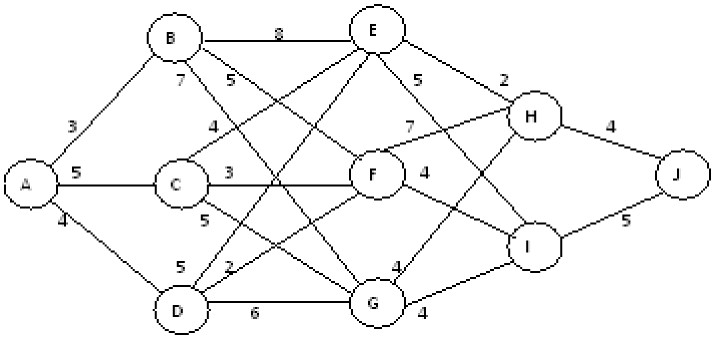

Fig. 1: The network with associated path costs

The problem in figure-1 shows the road map and the distance between the cities of a transportation problem. If the salesman has to travel from city A to city J, then what should be the best way and the minimum path to reduce the total transportation cost?

While using the Dynamic Programming approach first we have to divide the given network into the multistage problem. Now the problem can be divided into four parts to run from state A to state J.

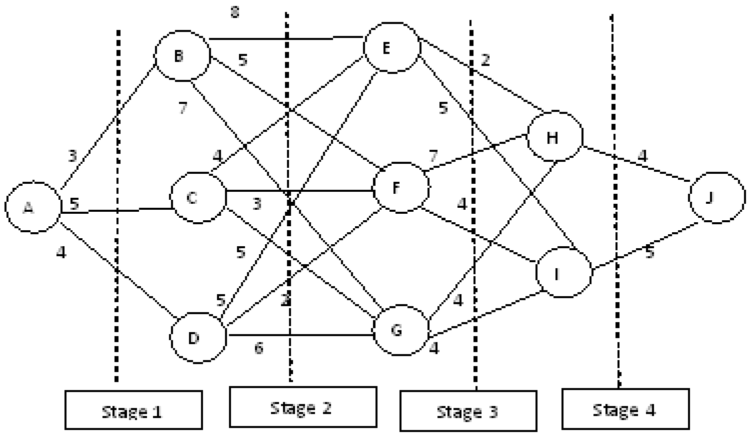

Fig. 2: Multistage Sub division of the Transportation Problem

	B	C	D
A	3	5	4

	E	F	G
B	8	5	7
C	4	3	5
D	5	2	6

	J
H	4
I	5

	H	I
E	2	5
F	7	4
G	4	4

Let the decision variable x_n(n=1, 2,3,4) be the immediate destination on stage n. Thus the root selected is $A \rightarrow x_1 \rightarrow x_2 \rightarrow x_3 \rightarrow x_4$, were $x_4 = J$.

Let $f_n(s, x_n)$ be the total cost of the overall transportation for the remaining stages, given that the person is in state s , ready to start stage n, and selects x_n as the immediate destination. Let x_n^* denote any value of x_n that minimizes $f_n(s, x_n)$ and let $f^*_n(s)$ be the corresponding minimum value of $f_n(s, x_n)$.

So

$f^*_n(s) = \min f_n(s, x_n) = f_n(s, x^*_n)$.

Where

$f_n(s, x_n)$ = Immediate cost(stage n) + Minimum future cost(stage n+1).

Now for n=4 i.e. Fourth stage

N=4

s	$f^*_4(s)$	x^*_4
H	4	J
I	5	J

Now for n=3 i.e. Third stage

$f_3(s, x_3)= C_{sx3} + f^*_4(x_3)$

S	H	I	$f^*_3(s)$	x^*_3
E	6	10	6	H
F	11	9	9	I
G	8	9	8	H

Now for n =2 i.e. for Second stage.

$f_2(s, x_2)= C_{sx2} + f^*_3(x_2)$

s E F G $f^*_2(s)$ x^*_2

B	14	14	15	14	E or F
C	10	12	13	10	E
D	11	11	14	11	E or F

Now for n=1 i.e.

$$F_1(s, x_1) = C_{sx1} + f^*_2(x_1)$$

s	B	C	D	f*1(s)	x*1
A	17	15	15	15	C or D

Thus the total minimum cost from A to J is $f^*_1(A) = 15$.

The possible roots are
$A \rightarrow C \rightarrow E \rightarrow H \rightarrow J$,
$A \rightarrow D \rightarrow E \rightarrow H \rightarrow J, \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow$
$A \rightarrow D \rightarrow F \rightarrow I \rightarrow J$.

This method will provide a better way to find out all the minimum paths with in a network or any transportation problem. All the routes to reach the destination can be expressed in very précised manner.

The advantage of using Dynamic Programming Approach with recursive processes will provide a better phenomenon to get the minimum paths and to minimize the overall transportation cost of any real life problem related with network and graphs.

REFERENCES

1. Book: Operations Research By Fredric S. Hiller
2. Andreatta, G. and Romero, L., Stochastic shortest paths with recourse, *Networks,* **18**: 193-204 (1988).
3. Daellenbach, H.G. and De Kluyver, C.A., Note on multiple objective dynamic programming, *Journal of the Operational Research Society*, **31**: 591-594 (1980).
4. Denardo, E.V. and Fox, B.L., Shortest-route methods: 1. reaching, pruning, and buckets, *Operations Research*, **27**: 161-186 (1979a).
5. Denardo, E.V. and Fox, B.L., Shortest-route methods: 2. group knapsacks, expanded networks, and branch- and-bound, *Operations Research*, **27**: 548-566 (1979b).