Dynamic Programming Method

- In dynamic programming method, the unit commitment table is to be arrived at for the complete load cycle.

Advantages

- Reductions in the dimensionality of the problem i.e number of combinations to be tried are reduced in number.
- If a strict priority order is imposed, the numbers of combinations for a 4 unit case are:
- Priority 1 unit
- Priority 1 unit + Priority 2 unit
- Priority 1 unit + Priority 2 unit + Priority 3 unit
- Priority 1 unit + Priority 2 unit + Priority 3 unit + Priority 4 unit

The priority listing can be used only if:

- No load costs are zero.
- Unit input-output characteristics are linear between 0 output and full load
- Phase shift transformer tap position
- Switched capacitor settings
- Reactive injection for static VAR compensator
- Load shedding
- DC line flow.

Assumptions:

- Total number of units available, their individual cost characteristics and the load cycle on the station are assumed priori(previously)
- A state consists of an array of units with specified units operating and the rest off- line.
- The start-up cost of a unit is independent of the time it has been off-line(i.e., fixed amount).
- There are no costs for shutting down a unit.
- There is a strict priority order and in each interval a specified minimum amount of capacity must be operating.

Forward Dynamic programming method Advantages

- Algorithm to run forward in time from the initial hour to the final hour.

- Forward dynamic programming is suitable if the start-up cost of a unit is a function of the time it has been off-line(i.e, fixed amount)
- Previous history of the unit can be computed at each stage.
- Initial conditions are easily specified.

Algorithm

- One could set up a dynamic-programming algorithm to run backward in time starting from the final hour to be studied, back to the initial hour.
- Conversely, one could set up the algorithm to run forward in time from the initial hour to the final hour.
- The forward approach has distinct advantages in solving generator unit commitment. For example, if the start-up cost of a unit is a function of the time it has been off-line (i.e., its temperature), then a forward dynamic-program approach is more suitable since the previous history of the unit can be computed at each stage.
- There are other practical reasons for going forward.
- The initial conditions are easily specified and the computations can go forward in time as long as required.
- A forward dynamic-programming algorithm is shown by the flowchart
- The recursive algorithm to compute the minimum cost in hour K with combination Fcost (K,I) = min { Pcost (K,I) + Scost (K-1,L;K,I) }

Where

Fcost(K.I) = R (K,I)

Fcost(K, I) = least total cost to arrive at state (K , I) Pcost(K,I) = production cost for state (K ,I)

Scost(K - 1, L: K , I)= transition cost from state (K - 1, L) to state (K , I)

State (K, 1) is the Zth combination in hour K. For the forward dynamic programming approach, we define a strategy as the transition, or path, from one state at a given hour to a state at the next hour.

Note that two new variables, X and N, have been introduced in Figure. X

= number of states to search each period

N = number of strategies, or paths, to save at each step

These variables allow control of the computational effort (see below Figure).For complete enumeration, the maximum number of the value of X or N is $2^N - 1$

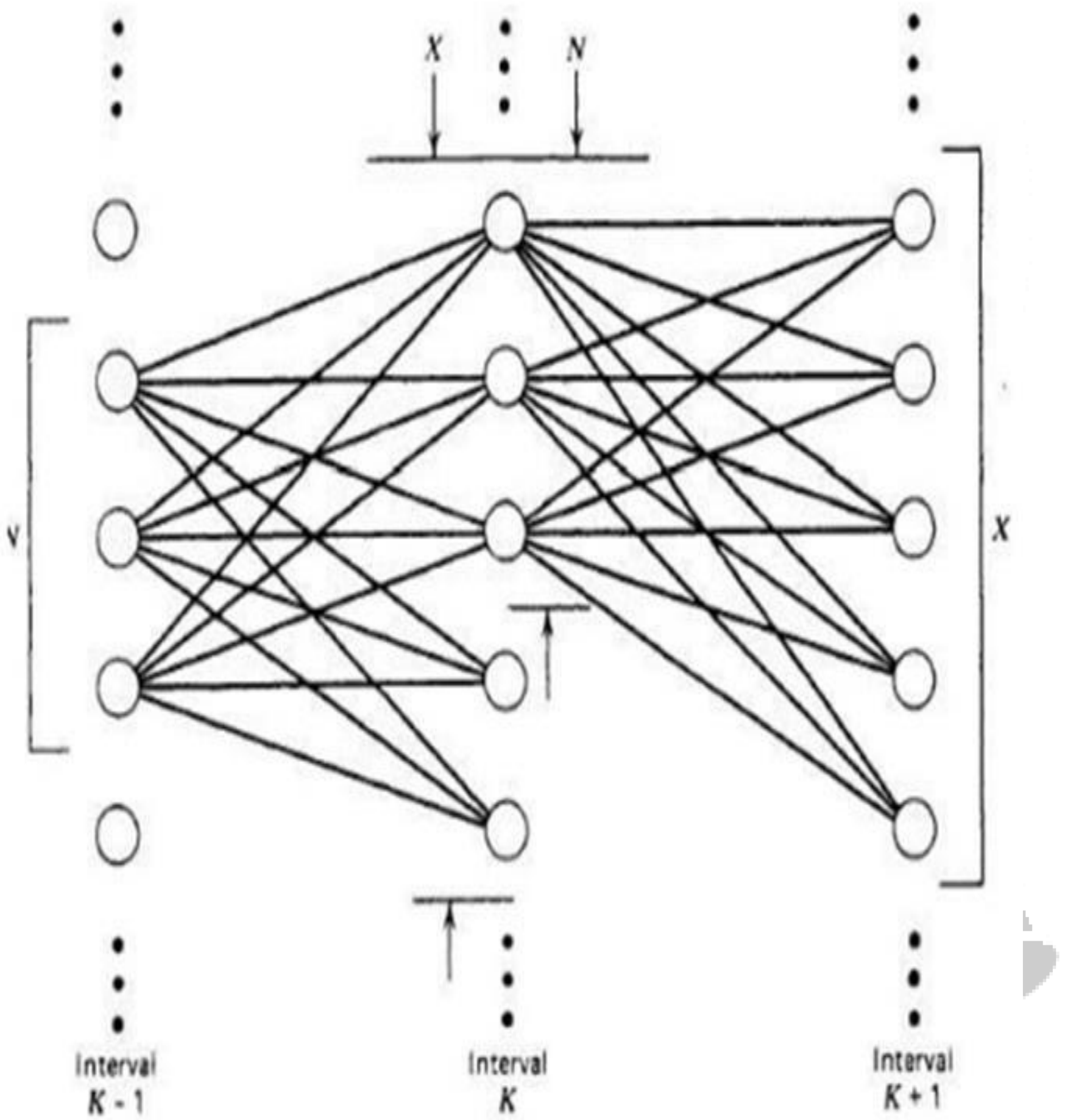
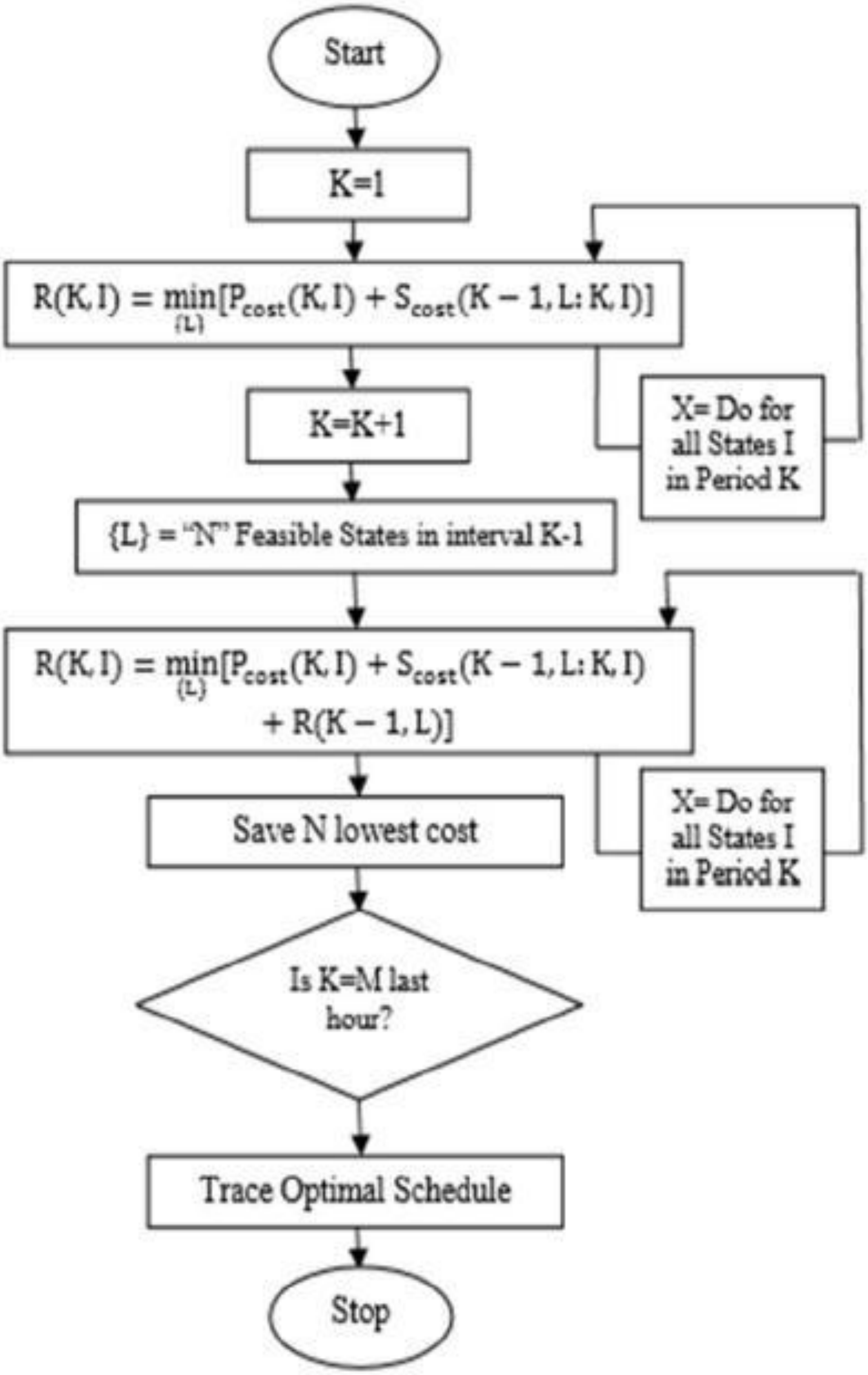


Fig.1Dynamic programming algorithm


Start
K=1
R(K, I) = min{L}[Pcost(K, I) + Scost(K − 1, L: K, I)]
X= Do for all States I in Period K
K=K+1
{L} = "N" Feasible States in interval K-1
R(K, I) = min{L}[Pcost(K, I) + Scost(K − 1, L: K, I) + R(K − 1, L)]
X= Do for all States I in Period K
Save N lowest cost
Is K=M last hour?
Trace Optimal Schedule
Stop