

CE 4990 - Construction Scheduling

Resource Leveling

February 17, 2012

Minimum Moment Algorithm¹

The goal of this method is to minimize resource buildups by considering the advantages of shifting any noncritical activities. The duration of the project is fixed - therefore, the critical activities are not altered. Hence, only the start times of activities with positive free float can be adjusted. relevant assumptions:

- Once an activity has been started, it cannot be interrupted; once an activity has started, it must be completed.
- Resource consumption is constant over the duration of an activity.
- The network logic is not questioned when resource leveling is done; unless the final solution is not considered acceptable. It is assumed that
- Only one resource is leveled at a time. It is assumed by leveling one resource that other resources will similarly be leveled to some extent.
- If an identical number of resources were required each day, no leveling would be required.

The smoothing of most resources occurs by using the minimum-moment approach. This is done iteratively through consideration of all the non-critical activities. After each iteration the resource distribution is tallied and checked. The algorithm is as follows:

- For each day in the bar chart, all the activities that could be scheduled to occur on the day in question are considered.
- For each activity that is considered - typically a non-critical activity - the optimal number of float days to be utilized is established. This is done by calculating an *Improvement Factor* (IF) for each potential change in the start date.

$$IF(A, N) = R \times (R_v - R_o - R \times (N_r)) \quad (1)$$

Where A = activity designation

N = number of free float days consumed

R = the number of resources used by the activity per day

R_v = number of resource days currently assigned to those days that will be vacated when the activity start date is changed

R_o = number of resource days currently assigned on those days that will be occupied when the activity start date is changed

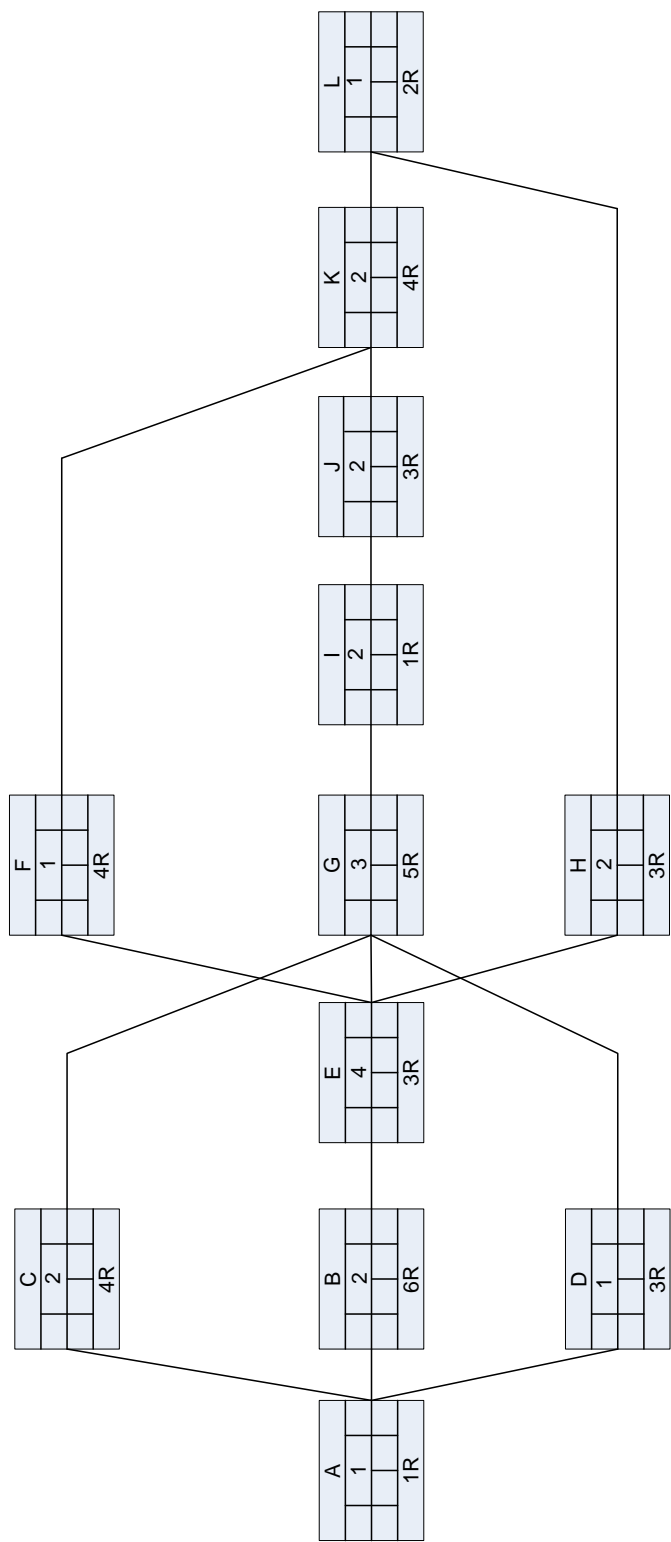
N_r = the smaller value of the number of days of free float consumed and the duration of the activity

¹Refer to Chapter 6, Hinze

The improvement factor must be 0 or some positive value in order for a benefit to be derived by reassigning the start date of an activity. The largest improvement factor determines the number of free float days to use.

- If improvement factors are calculated for several activities, the governing value is the activity with the largest improvement.
- If two activities are tied with the same improvement factor, they are prioritized for reassignment of the start date based on the following criteria in order: activities with most resources per day, the activity that will use up the largest number of free float days, the activity with the latest start date, priority is given to the activities on the basis of input order.

Conduct this on a backward pass first moving activities the most number of days to the right with the highest IF. After that conduct a forward pass considering the utilization of back float using the IF.



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	C4	C4					F4									
A1	B6	B6	E3	E3	E3	E3	G5	G5	G5	I1	I1	J3	J3	K4	K4	L2
	D3						H3	H3								

1	13	10	3	3	3	3	12	8	5	1	1	3	3	4	4	2

Cycle 0
Cycle 1
Cycle 2
Cycle 3
Cycle 4
Cycle 5
Cycle 6