CE 4990 - Construction Scheduling

Resource Allocation

February 16, 2012

Resource Management

Resource management can be broadly classified into resource allocation and resource leveling. This note focuses on allocating a shared resource that is limited in availability - for example skilled labor crews and special purpose equipment such as a crane. Two resource allocation methods will be discussed: the Series and Parallel method and the Brooks method.

Series & Parallel Method[1]

The following steps can be used to allocate resources to a project using the Series method.

- Schedule activities to start as soon as their predecessors have been completed.

- If more than one activity using a specific limited resource can be scheduled, priority is given to the activity with the *earliest late start.*

- If the activities are tied for the early late start date, give priority to the activity with *least total float.*

- If the activities are tied for total float, give priority to the activity with the *largest number of resources.*

- If the activities are tied in the number of resources, give priority to the *activity that has already started* (top priority in the series method).

- If no activity has been selected with the above rules, simply start the activity that occurs first in the *input order.* Any other rule could be used here. After the other rules have resulted in ties, there are probably no great consequences associated with selecting one activity over another. Input order is simply one way of making a choice. Additional rules could relate to the equipment being used, the numeric value assigned to the activity, or some other criteria.

When allocating resources to activities ensure that resource limits are not exceeded for any allocation. The Parallel method also uses the above allocation scheme - however, in the Series method once an activity is scheduled it should not be interrupted. The method is illustrated using the following problem from the textbook.

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[1]Chapter 6 in Hinze
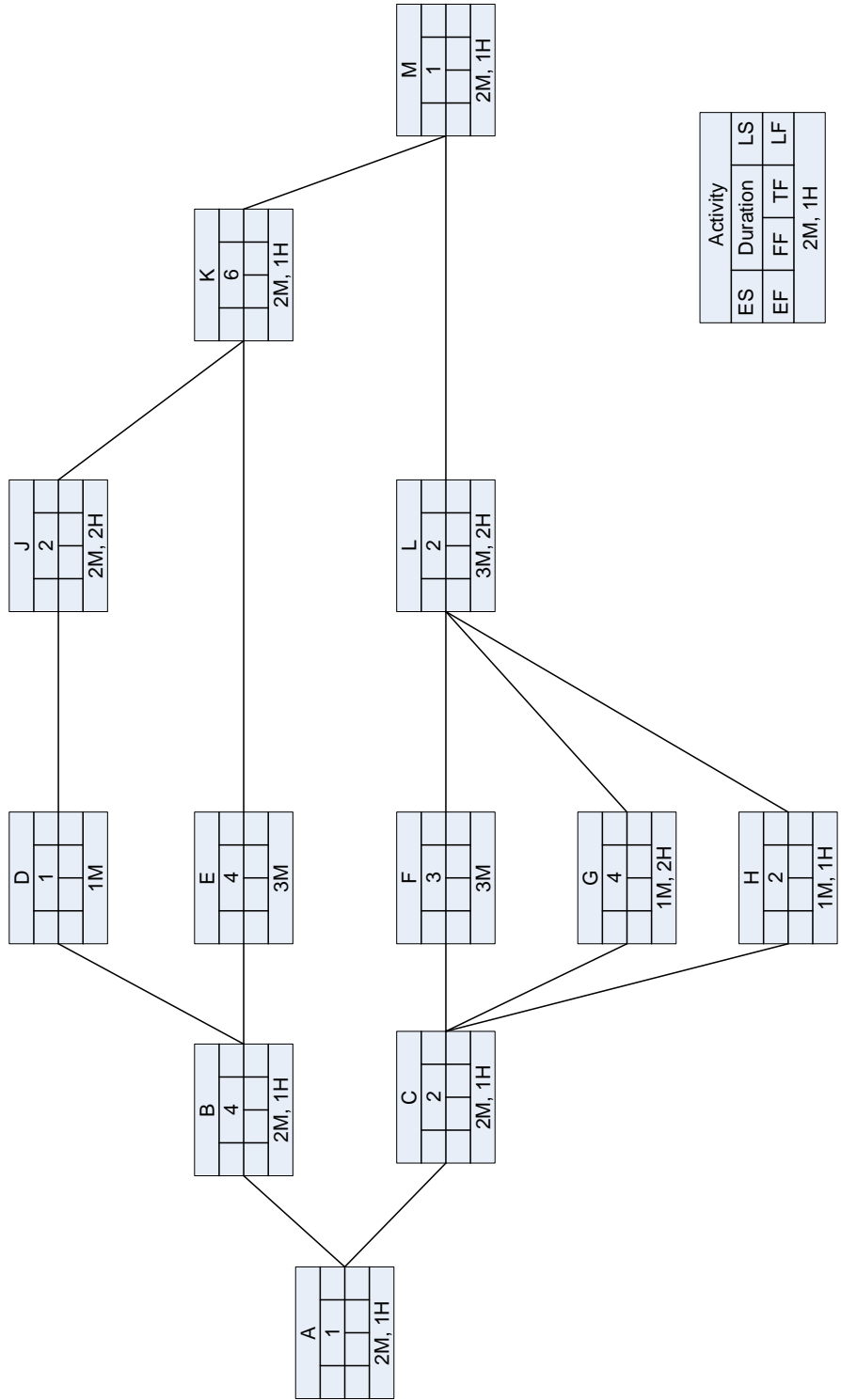
Brooks Method[2]

The following steps can be used to allocate resources to a project using the Brooks method.

- Calculate the ACTIM value for each activity. The ACTIM value is the total number of days available from the activity late start date to the end of the project. Activities with higher ACTIM values are prioritized.

- Construct the accounting table as in the Figure. *Act. ready* are the activities that are ready to be scheduled at any time, i.e. activities whose immediate predecessors have already been scheduled. *TNow* is the control time point in the project at which you assign resources and schedule activities. The initial value of *TNow* is 1 (beginning of day). Typically any time point at which an activity is completed is considered a *TNow*.

- On arriving at each *TNow* update the available resources for the next *TNow* of interest - i.e. total available resources minus the ones that are currently in use for an ongoing activity.

- Also update the *Act. ready* list - including all the activities that are currently scheduled and are eligible to be scheduled.

- Schedule an activity from the *Act. ready* list based on resource availability and highest priority - i.e., when enough resources are available and providing the activity has the highest ACTIM value of all the activities that are in the *Act. ready* list.

- After scheduling each activity update the total resources in use at that time point.

When allocating resources to activities ensure that resource limits are not exceeded for any allocation. Note, the Brooks method can be conducted in both a "Parallel" and "Series" ways.

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[2]Chapter 6 in Hinze

Legend:

ES	Activity	LS
EF	Duration	LF
	FF	TF	
	2M, 1H	

Activity network:

- A — 1 — 2M, 1H
- B — 4 — 2M, 1H
- C — 2 — 2M, 1H
- D — 1 — 1M
- E — 4 — 3M
- F — 3 — 3M
- G — 4 — 1M, 2H
- H — 2 — 1M, 1H
- J — 2 — 2M, 2H
- K — 6 — 2M, 1H
- L — 2 — 3M, 2H
- M — 1 — 2M, 1H

Connections:
- A → B, A → C
- B → D, B → E
- C → F, C → G, C → H
- D → J
- E → K
- F → L, G → L, H → L
- J → K
- K → M
- L → M

Act	Resource	Dur	TF	LS		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
A	2M 1H	1	0	1																							
B	2M 1H	4	0	2																							
C	2M 1H	2	6	8																							
D	1M 0H	1	1	7																							
E	3M 0H	4	0	6																							
F	3M 0H	3	7	11																							
G	1M 2H	4	6	10																							
H	1M 1H	2	8	12																							
J	2M 2H	2	1	8																							
K	2M 1H	6	0	10																							
L	3M 2H	2	6	14																							
M	2M 1H	1	0	16																							

Activity		
ACTIM		

Activity									
Duration									
Prec. by									
M needed									
H needed									
TStart									
TFin									

TNow									
M avail.									
H avail.									
Act. ready									
Act. sched.									
M in use									
H in use									