me293 – Project Management & Social Responsibility

Project Crashing Example

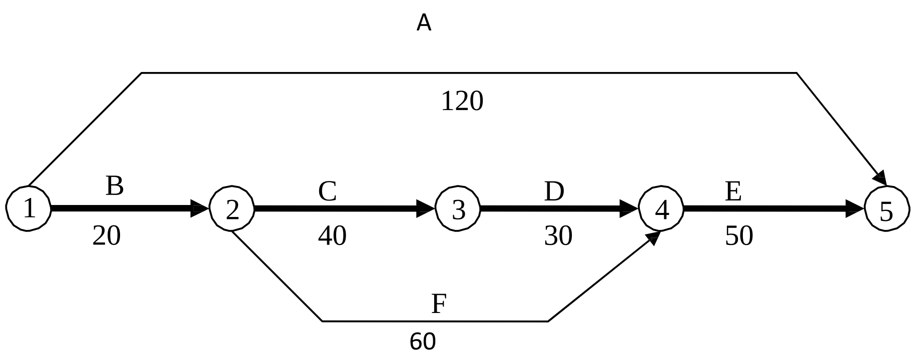
The network diagram below, shows the normal schedule for a project, with the task durations in days.

As with most projects, one can complete this project faster than the 'Normal' scheduled time (crashing the project) but doing so will cost the client more money. The table below summarizes the time-cost information for each of the activities. The 'Normal' project duration is the sum of the durations that make up the critical path. They are B, C, D and E.

The 'Normal' project duration is (20 + 40 + 30 + 50 =) 140 days.

The owner wants you to finish the project in 110 days.

Find the minimum possible cost for the project if you want to finish it in 110 days.
(Assume that for each activity there is a single linear, continuous function between the crash duration and normal duration points).



Activity	Normal duration (days)	Crash Duration (days)	Normal Cost	Crash Cost	Crash Cost Slope (d$/dt)
A	120	100	12000	14000	100 $/day
B *	20	15	1800	2800	200
C *	40	30	16000	22000	600
D *	30	20	1400	2000	60
E *	50	40	3600	4800	120
F	60	45	13500	18000	300

<u>Solution:</u>

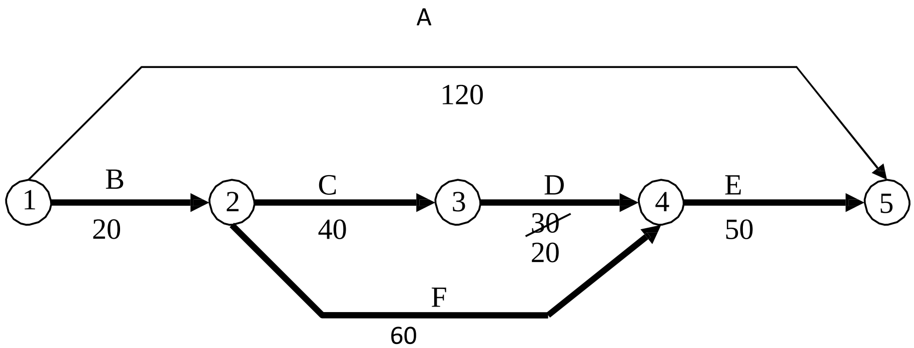
Assume that the duration-cost relationship for each activity is a single linear, continuous function between the crash duration and normal duration points. Using the normal duration (ND), crash duration (CD), normal cost (NC), and crash cost (CC), the crash cost slope for each activity can be determined as follows:

$$Crash\ Cost\ Slope = \frac{CC - NC}{ND - CD}$$

The normal cost for the project is the sum of a normal cost for each activity. The normal cost for the project is $48,300 and the normal duration is 140 days. The activity(s) which should be crashed is/are the one(s) on the critical path which will add the least amount to the overall project cost. This/these will be the activity with the flattest or least-cost slope. The duration can be reduced as long as the critical path is not changed or a new critical path is created. In addition, the activity duration cannot be less than the crash duration.

Crash Decision 1

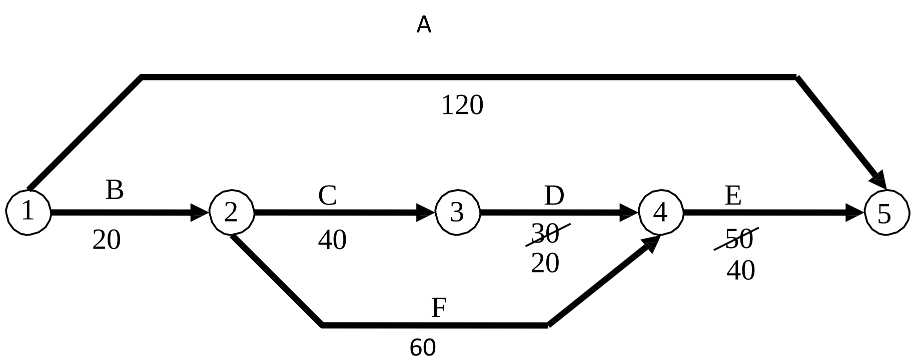
S_D = \$60/day (least-cost slope). A maximum of 10 days can be cut from the schedule by reducing the duration of activity D to the crash duration of 20 days.



The new overall duration is now 130 days. If you now consider the consequences of crashing Activity D you will see that there are now multiple critical paths (B-F-E and B-C-D-E). Total project cost at this duration is the normal cost of \$48,300 plus the cost of crashing the activity D by 10 days (60 x 10 = \$600) for a total of \$48,900.

Crash Decision 2

The next activity to be crashed will be the activity E, since it has the least-cost slope (\$120 per day) of any of the activities on the critical path. Activity E can be crashed by a total of 10 days. Crashing the activity E by 10 days will cost an additional \$120 per day or \$1,200.



The project duration is now 120 days and the total project cost is \$50,100. There are now three critical paths (A, B-C-D-E, and B-F-E).

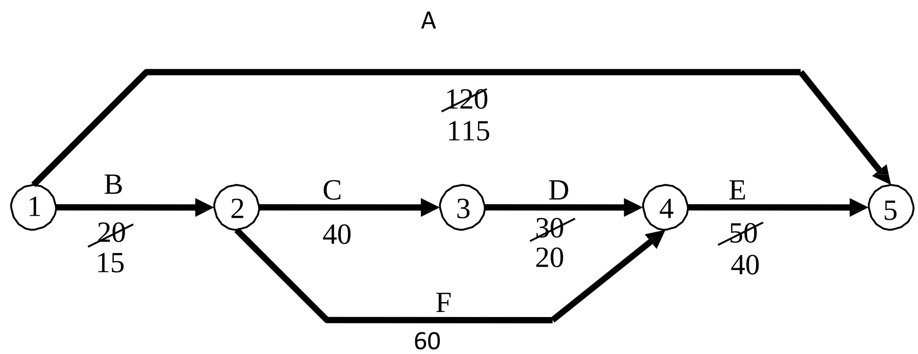
Crash Decision 3

The next stage of crashing requires a more thorough analysis since it is impossible to crash one activity alone and achieve a reduction in the overall project duration. Activity A must be paired with each of the other activities to allow the determination of which crashing combination gives the least overall cost slope for those activities which have available days to be crashed.

Activity A (\$100) + activity B (\$200)	= \$300 / day crashed
Activity A (\$100) + activity C (\$600) + activity F (\$300)	= \$1,000 / day crashed

The least-cost slope will be activity A + activity B for a cost increase of \$300 per day. Reducing the project duration by 5 days will add 5 x 300 = \$1,500 crashing cost and the total project cost will be \$51,600. Activity

B cannot be crashed any more.



Crash Decision 4

Final step in crashing the project to 110 days will be accomplished by reducing the duration of activity A by 5 days to 110 days, reducing activity C by 5 days to 35 days, and reducing activity F by 5 days to 55 days. The combined cost slope for the simultaneous reduction of activity A, activity C, and activity F will be $1,000 per day. For 5 days of reduction this will be an additional $5,000 in total project cost. The total project cost for the crashed schedule to 110 days of duration will be $56,600.

Safety Factor for Project Management Design

Now that we have been successful at taking the project form an original 'Normal' project duration of 140 to a new 'Crashed' duration of 110 the ALL THE ACTIVITIES ARE ON THE CRITICAL PATH. All of them. Yikes! That means there is no slack anywhere in the project schedule and everything must run on time.

As a project manager this may represent a risk not worth accepting.

One way of dealing with this is to add a project schedule 'Safety Factor'. Instead of doing exactly what the client wants you might really work out a Crash Scenario where the project duration is 110 – 2 day = 108 days. Doing so will cost the client more money but will build in overall slack period of 2 days and help to ensure that the project is actually completed on time.