Session 7 highlights

6 Steps of Risk Management

Know the order they are in

Know the purpose for each step, what each means, how they are different

FMEA & RPN

Establishing a Risk Prioritization Number (RPN)

What does it mean, what does it do for me, how do I use it?

PERT & CPM

Know what these are and what they stand for

AON & AOA

Know difference & pros and cons

AOA horrible

AON used in most software packages

Slack / Float / Critical Path

What impact they can have on the project

FMEA: sometimes useful to sort on the RPN number column to see the decending order. But do not sort on any of the other columns.

Resource Allocation Session 8a

Introduction

- Projects Compete With One Another for Resources
  - Resources that are not consumed
  - Resources that are consumed
- Goal of Resource Allocation is to Optimize Use of Limited Supply
- Requires making trade-offs
  - Time constrained
  - Resource constrained
  - Scope constrained?

Resources are granted to the project in order to meet the project's performance objectives. Timing and supply of resources play a key role.

CRASH DURATION: resources required to expedite a task (which is probably behind)

You want to CRASH a project, are the resources available? It will cost money to do so.

Goal is to always optimize resources, but there are always trade offs.

Does the benefit justify the cost? Is it worth it? Is it the right decision?

We want the solution which gives the best value for the dollar ***and*** gives satisfaction.

We also must be conscience of **SCOPE CONSTRAINT**!

But there is a possibility for adjustment of scope to accomplish a goal.

Expediting a Project

Typically called **CRASHING** a project. **Not the same as Fast Tracking.**

Critical Path Method

- Normal Duration Estimates
- Normal Costs
- Crash Duration Estimates
- Crash Costs
- Crash Cost Per Day

$$\frac{\text{Normal Duration - Crash Duration}}{\text{Crash Cost - Normal Cost}}$$

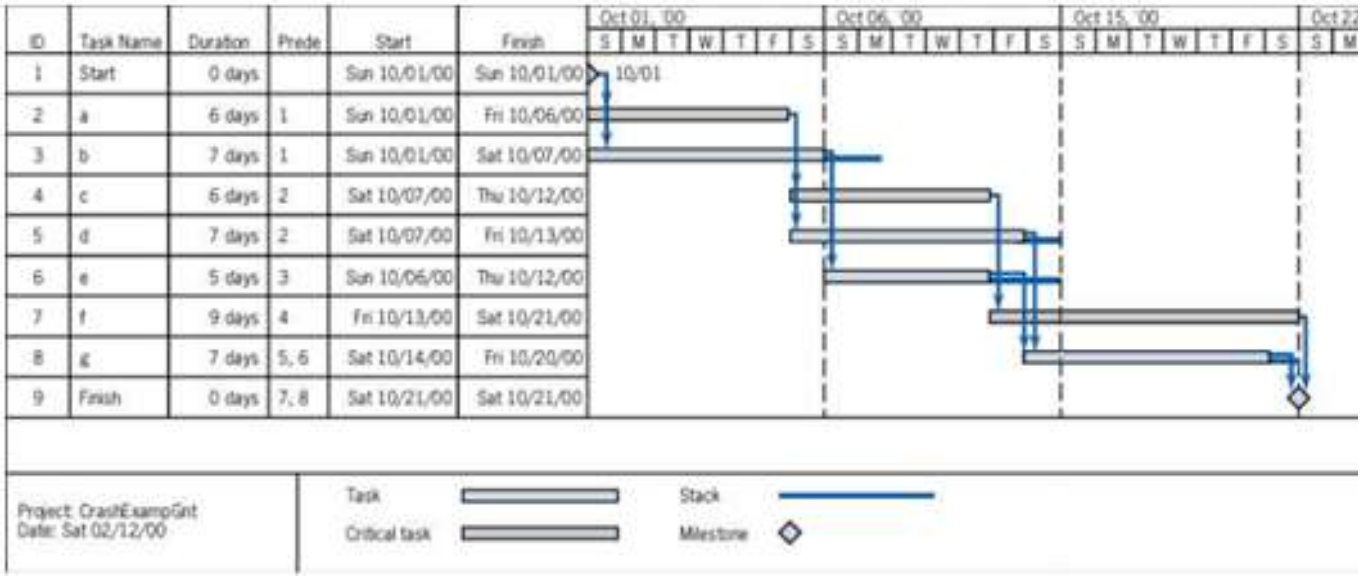
In our costing calculations we are looking at:

- How long is it going to take normally?
- How long will it take if I crash it?
- What does it cost normally?
- What does it cost if I crash it?

Use these to figure out the benefit.

Figure 6-1(a), 21 – Day Project

See Excel Exercise / Solution

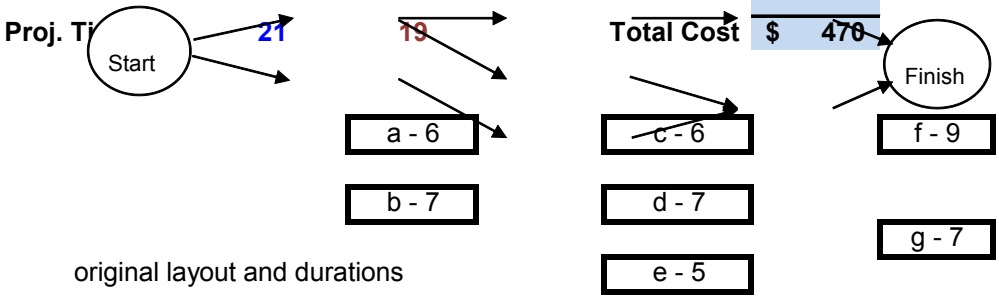


ID	Task Name	Duration	Prede	Start	Finish
1	Start	0 days		Sun 10/01/00	Sun 10/01/00
2	a	6 days	1	Sun 10/01/00	Fri 10/06/00
3	b	7 days	1	Sun 10/01/00	Sat 10/07/00
4	c	6 days	2	Sat 10/07/00	Thu 10/12/00
5	d	7 days	2	Sat 10/07/00	Fri 10/13/00
6	e	5 days	3	Sun 10/06/00	Thu 10/12/00
7	f	9 days	4	Fri 10/13/00	Sat 10/21/00
8	g	7 days	5, 6	Sat 10/14/00	Fri 10/20/00
9	Finish	0 days	7, 8	Sat 10/21/00	Sat 10/21/00

Mantel Chapter 6 - Table 6.1

Activity	Pred.	Mod. Duration	Normal Duration	Crash Duration	Normal Cost	Crash Cost	Incr. Cost / Day
a	--	5	6	5	$ 60	$ 90	30
b	--	7	7	4	$ 50	$ 150	33
c	a	6	6	**4**	$ 100	$ 160	N/A
d	a	7	7	7	$ 30	$ 30	N/A
e	b	5	5	4	$ 70	$ 85	15
f	c	8	9	7	$ 40	$ 120	40
g	d, e	7	7	4	$ 50	$ 230	60

			Cost	$ 400
Activity Paths	Norm. Dur.	Mod Dur.		$ 30
a-c-f	21	19		$ 40
a-d-g	20	19		
b-e-g	19	19		
Proj. Ti	**21**	**19**	**Total Cost**	**$ 470**



original layout and durations

First we look at the critical path.

1. **Determine the critical path.**
2. **Work only on tasks which are along the critical path.**
3. **Between items on CP, cost becomes next tier.**

We want to get it down to 20 days. We begin with a CP of A-C-F=21 days.

"a" has 1 day at a cost of $30. I guess "Mod, Duration" is Modified Duration as in modified to meet the new target date. Change Mod. Duration from 6 to 5 for Activity A. This changes Mod Dur in the path area to 20. Good! But now must add in cost.

Key: the crash duration column tells you the lower limit. Cannot go below this.

What next? We like E (it's cheap) but it is not on the critical path.

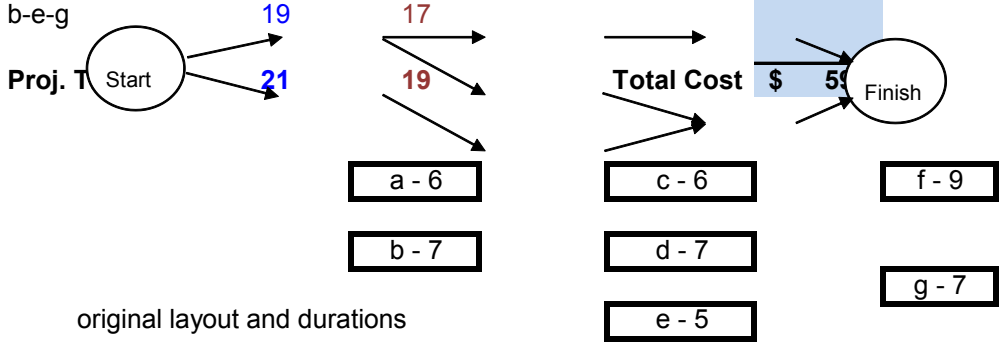
Now we want to get it down to 19 days. CP is still the same, A-C-F=20 days. Which is the next best candidate for crashing? Must be A, C, or F. A cannot go lower. C and F have time to give. C has no "incremental crash cost" meaning if you crash it you take the whole amount. For this reason F looks good for 1 day at a cost of $40. Now we want to get down to 18 days! What

is the critical path now? They are all 19 days so they are all on the critical path. Can we attack all 3 in one step? Nothing is common among all three. (see below)

Mantel Chapter 6 - Table 6.1

Activity	Pred.	Mod. Duration	Normal Duration	Crash Duration	Normal Cost	Crash Cost	Incr. Cost / Day
a	--	5	6	5	$ 60	$ 90	30
b	--	7	7	4	$ 50	$ 150	33
c	a	6	6	**4**	$ 100	$ 160	N/A
d	a	7	7	7	$ 30	$ 30	N/A
e	b	5	5	4	$ 70	$ 85	15
f	c	8	9	7	$ 40	$ 120	40
g	d, e	5	7	4	$ 50	$ 230	60
				Cost	$ 400		

Activity Paths	Norm. Dur.	Mod Dur.		
a-c-f	21	19		$ 30
a-d-g	20	17		$ 40
b-e-g	19	17		$ 120
Proj. T	**21**	**19**	**Total Cost**	**$ 5**



original layout and durations

Here we must crash all three paths to get the project down to 18 days. Must attack all three paths. We know A is spent. Must deal with C or F.

N/A in Incremental Cost / day column is indicating that you cannot go down incrementally (this is called a fixed duration crash). You can either do 6 or 4 days, if you do 4 days the crash cost is $160. Lets attack G, take it down 2 days for $120.

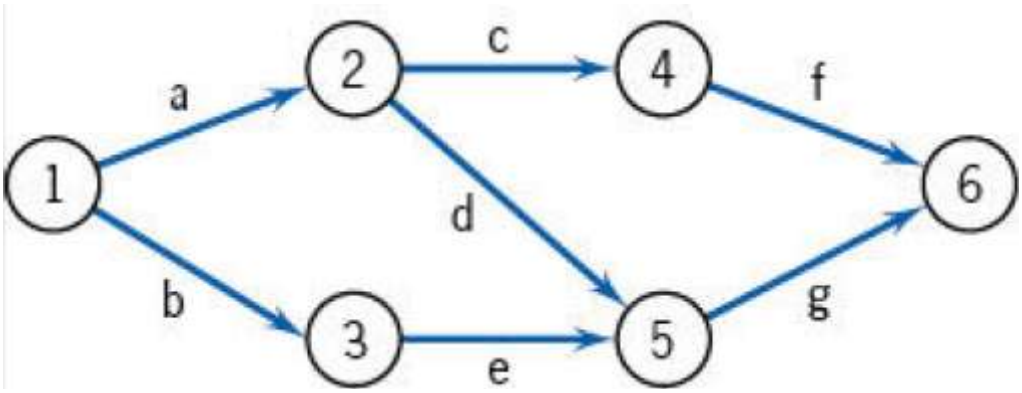
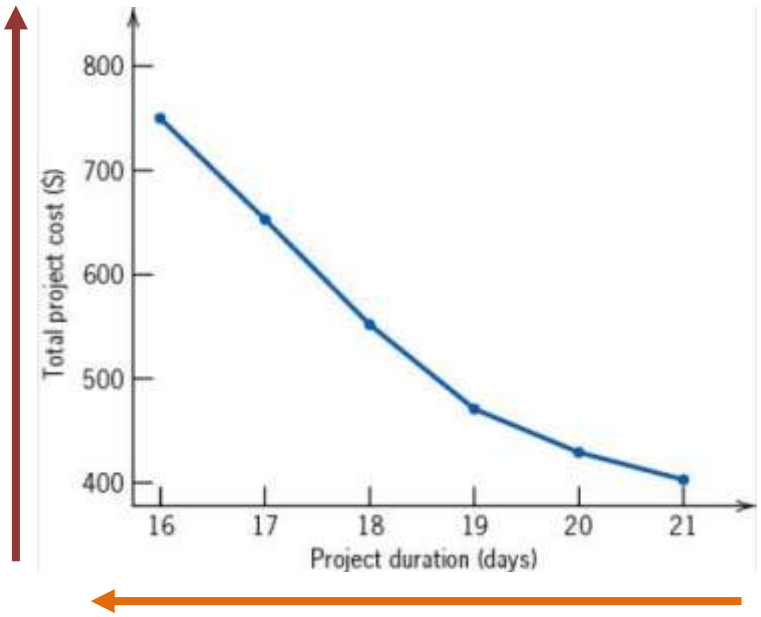


Figure 6-6, Project Cost vs Project Duration for sample Crash Problem



Probabilistic Activity Durations

- Three time estimates made for both normal resource loading and crash resource loading
- Variance of normal activity may be different than variance of crash time

Excel Solver Method for Project Crashing

- Target Cell
  - minimize crashing costs
- By Changing Cells
  - amount to crash activities
  - time events occur
- Constraints
  - amount each activity can be crashed
  - precedence relationships
  - complete project by specified time
  - nonnegativity

(Linear Programming)

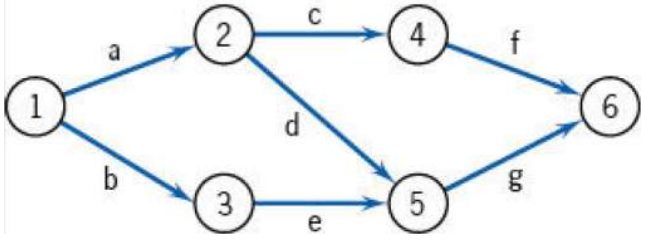
Limits on how far you can crash down an activity.

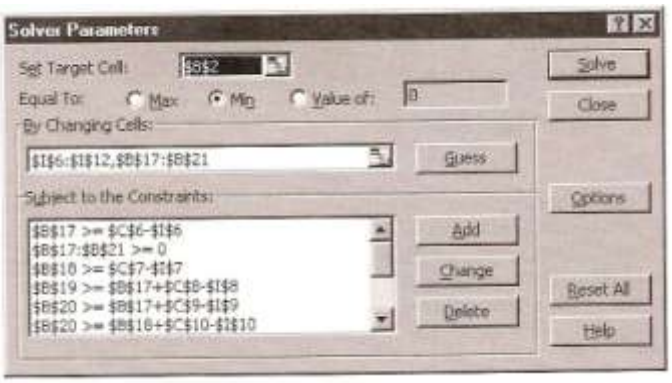
Steps must be in order.

Set up goal solver and give it the constraints. Tools|Solver.

Table 6.2 Sample "Crash" Problem in Table 6-1 Transferred to an Excel ® Spreadsheet

	A	B	C	D	E	F	G	H	I	J	K
1	Deadline:	21									
2	Total Cost:	$400									
3											
4			Normal	Crash	Normal	Crash	Cost per	Maximum	Amount	Crashing	Actual
5	Activity	Preced.	Duration	Duration	Cost	Cost	Day	Crash Amt.	to Crash	Cost	Time
6	a	—	6	5	$60	$90	$30.00	1		$0.00	6
7	b	—	7	4	$50	$150	$33.33	3		$0.00	7
8	c	a	6	4	$100	$160	$30.00	2		$0.00	6
9	d	a	7	7	$30	$30	N.A.	0		N.A.	7
10	e	b	5	4	$70	$85	$15.00	1		$0.00	5
11	f	c	9	7	$40	$120	$40.00	2		$0.00	9
12	g	d, e	7	4	$50	$230	$60.00	3		$0.00	7
13	Total				$400					$0.00	
14											
15		Event									
16	Node	Time									
17	2										
18	3										
19	4										
20	5										
21	6										
22											
23	Key Formulas:										
24	Cell B2	=E13+J13									
25	Cell G6	=(F6−E6)/(C6−D6) {copy to cells G7:G12}									
26	Cell H6	=C6−D6 {copy to cells H7:H12}									
27	Cell J6	=I6*G6 {copy to cells J7:J12}									
28	Cell K6	=C6−I6 {copy to cells K7:K12}									





Fast Tracking a Project [188]

- Used Primarily in Construction Industry
- Building phase started before design and planning phases completed
- Particularly appropriate when large proportion of work is routine

The risk is REWORK! (right hand side of DSM grid) "Building" while not yet done designing.