Al-Mustaqbal University
Department: Medical Instrumentation Techniques Engineering
Class: 4th
Subject: Project Management
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1st term / Lecture: Project Evaluation & Review Technique (PERT)

Lec 9 - Project Planning Techniques

Project Evaluation and Review Technique (PERT)

Part 2

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COST ANALYSIS

The two important components of any activity are the cost and time. Cost is directly proportional to time and vice versa.

For example, in constructing a shopping complex, the expected time of completion can be calculated using the time estimates of various activities. But if the construction has to be finished earlier, it requires additional cost to complete the project. We need to arrive at a time /cost trade-off between total cost of project and total time required to complete it.

المكونات المهمة لاي نشاط هي الكلفة والوقت ،الكلفة تتناسب بشكل مباشر مع الوقت والعكس صحيح.
مثلا: في عملية انشاء مجمع للتسوق فان الوقت المتوقع للإنجاز يمكن حسابه بتخمين أوقات مختلف الأنشطة.
لكن اذا كان المطلوب انهاء عملية الانشاء في وقت مبكر فان ذلك يتطلب كلفة إضافية لإتمام المشروع.
اي اننا بحاجة الى موازنة بين الكلفة الكلية للمشروع والوقت الكلي المطلوب لإتمامه.

Normal time:

Normal time is the time required to complete the activity at normal conditions and cost.

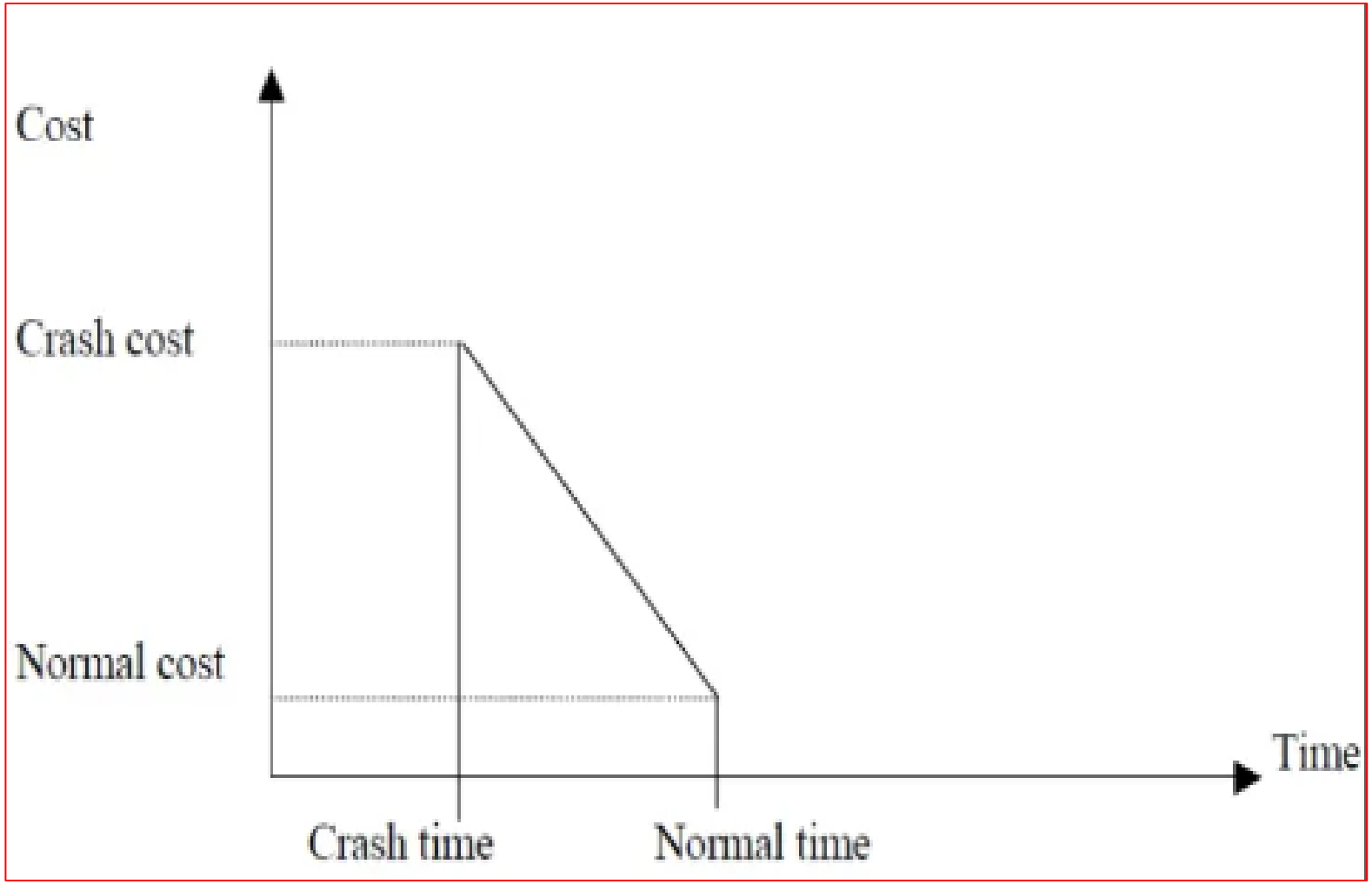
Crash time:

Crash time is the shortest possible activity time , crashing more than the normal time will increase the direct cost.

Cost Slope:

Cost slope is the increase in cost per of time saved by crashing.

A linear cost curve is shown in Fig.



$$\textbf{Cost Slope} = \frac{\textbf{Crash Cost} - \textbf{Normal Cost}}{\textbf{Normal Time} - \textbf{Crash Time}} = \frac{C_c - N_c}{N_t - C_t}$$

Example: **An activity takes 4 days to complete at a normal cost of 500 $.If it is possible to complete the activity in 2 days with an additional cost of 700 $, what is the cost slope of the activity?**

$$Cost\ Slope = \frac{C_c - N_c}{N_t - C_t} = \frac{700 - 500}{4 - 2} = 100\ \$$$

It means , if one day is reduced we have to spend 100 $ extra per day.

Project Crashing

Procedure for crashing

Step1: Draw the network diagram and mark the Normal time and Crash time.

Step2: Calculate TE and TL for all the activities.

Step3: Find the critical path and other paths.

Step 4: Find the slope for all activities and rank them in ascending order.

Step 5: Establish a tabular column with required field.

Step 6: Select the lowest ranked activity, check whether it is a critical activity.

If so, crash the activity, else go to the next highest ranked activity.

NOTE: The critical path must remain critical while crashing.

Step 7: Calculate the total cost of project for each crashing.

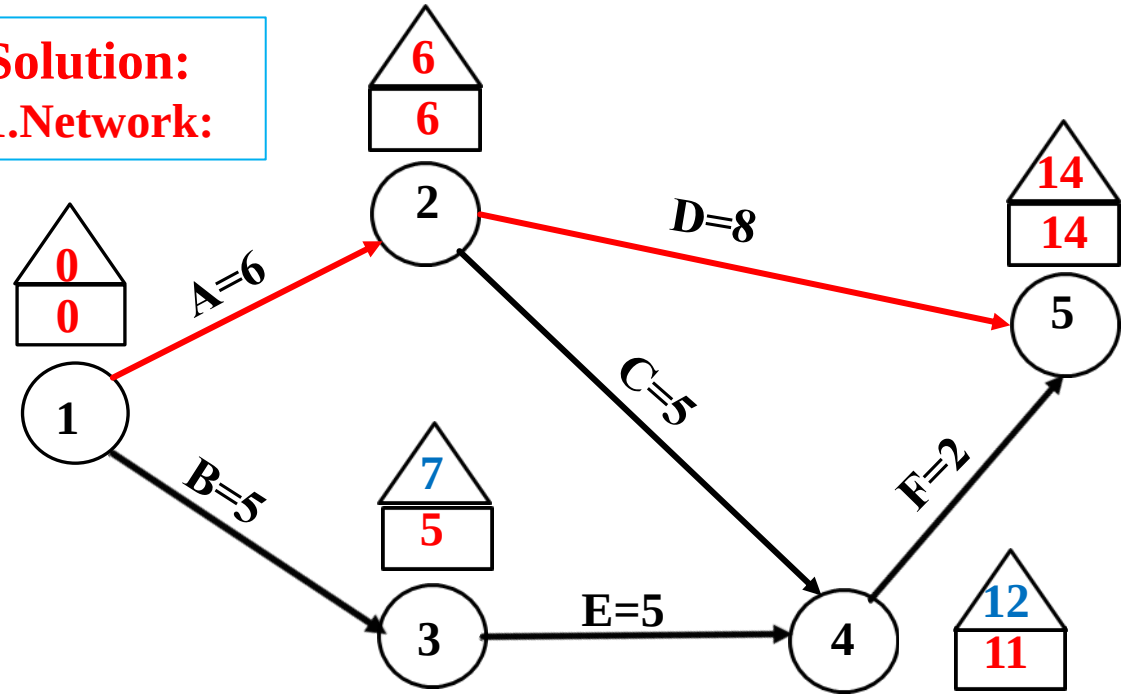
Step 8: Repeat step 6 until all the activities in the critical path are fully crashed.

Example: The following table gives the activities of a project and other data:

Activity	Preceded by	Normal		Crash	
		Time (days)	Cost ($)	Time (days)	Cost ($)
A	---	6	50	4	80
B	---	5	80	3	150
C	A	5	60	2	90
D	A	8	100	6	300
E	B	5	140	2	200
F	C , E	2	60	1	80

Crash the activities to find the minimum duration of the project and the project cost associated.

Solution:
1.Network:



Critical Path is : 1-2-5
Project Duration = 14 days

2. Cost slope and Rank calculated:

$$Cost\ Slope = \frac{C_c - N_c}{N_t - C_t}$$

Cost slope for activity 1-2 = $\frac{80-50}{6-4} = 15$ \$

Activity	Cost Slope	Rank
1-2	15	2
1-3	35	4
2-4	10	1
2-5	100	5
3-4	20	3
4-5	20	3

3. Sequence of Crashing:

Path	Number of days crashed
1-2-5	~~14~~ ~~12~~ ~~11~~ 10
1-2-4-5	~~13~~ ~~11~~ 10
1-3-4-5	~~12~~ ~~11~~ 10

4. Cashed Cost & Crashed time:

Activity crashed	Project duration	Critical Path	Total Cost ($)
---	14	1-2-5	490
1-2 (2) 2-5 (2) 2-4 (1) 3-4 (2)	10	1-2-5 1-3-4-5 1-2-4-5	490 + (2×15) + (2×100) + (1×10) + (2×20) = 770

H.W: **The following table gives the activities of a project and other data ,Crash the activities to find the minimum duration of the project and the project cost associated.**

Activity	Time (Weeks)		Cost (Rs)	
	Normal	Crash	Normal	Crash
1-2	9	4	1300	2400
1-3	15	13	1000	1380
2-3	7	4	7000	1540
2-4	7	3	1200	1920
2-5	12	6	1700	2240
3-6	12	11	600	700
4-5	6	2	1000	1600
5-6	9	6	900	1200