IIT ROORKEE

NPTEL ONLINE CERTIFICATION COURSE

Project Management for Managers

Lec – 47

Time and Cost Relationship

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Time and Cost Relationship

Crashing : Process of reducing time of the project.

Elements of costs

(i)Material
(ii)Labour
(iii) Expenses

Material

Direct : Raw material and components

Indirect: consumable stores, lubricants, cotton waste, cleaning material, stationary , etc.

(ii) Labour

Direct : Employees engaged in manufacturing/activity of a project.

Indirect: Store clerk, material handling staff, supervisors, foremen, works manager etc.

(iii) Expenses :

Direct- Payments made to consultants, designers, hiring charges of m/cs, cost of rework.

Indirect- Rent of building, telephone bills, insurance, lighting expenses.

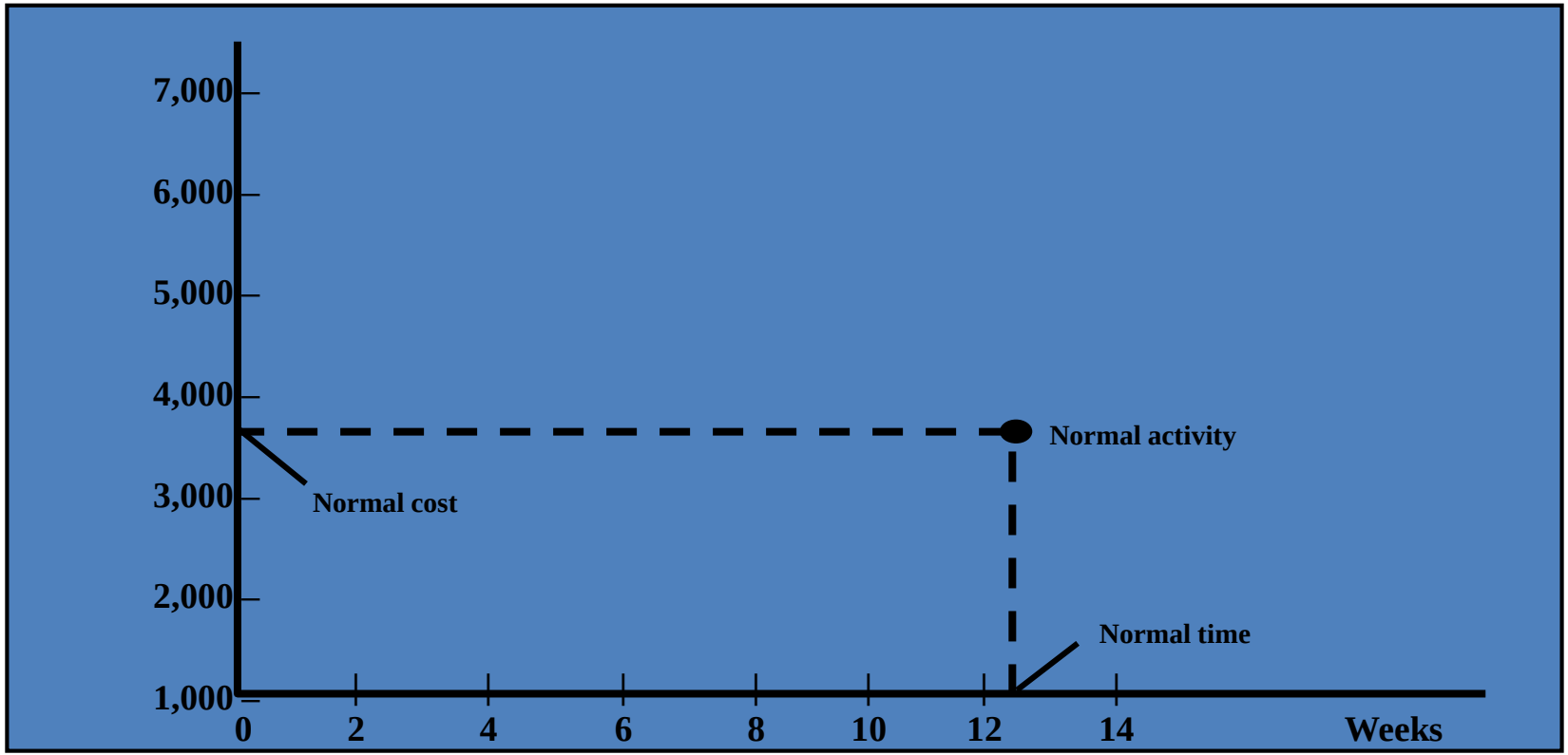
Crashing of a Project

Crashing : Process of reducing time of the project.

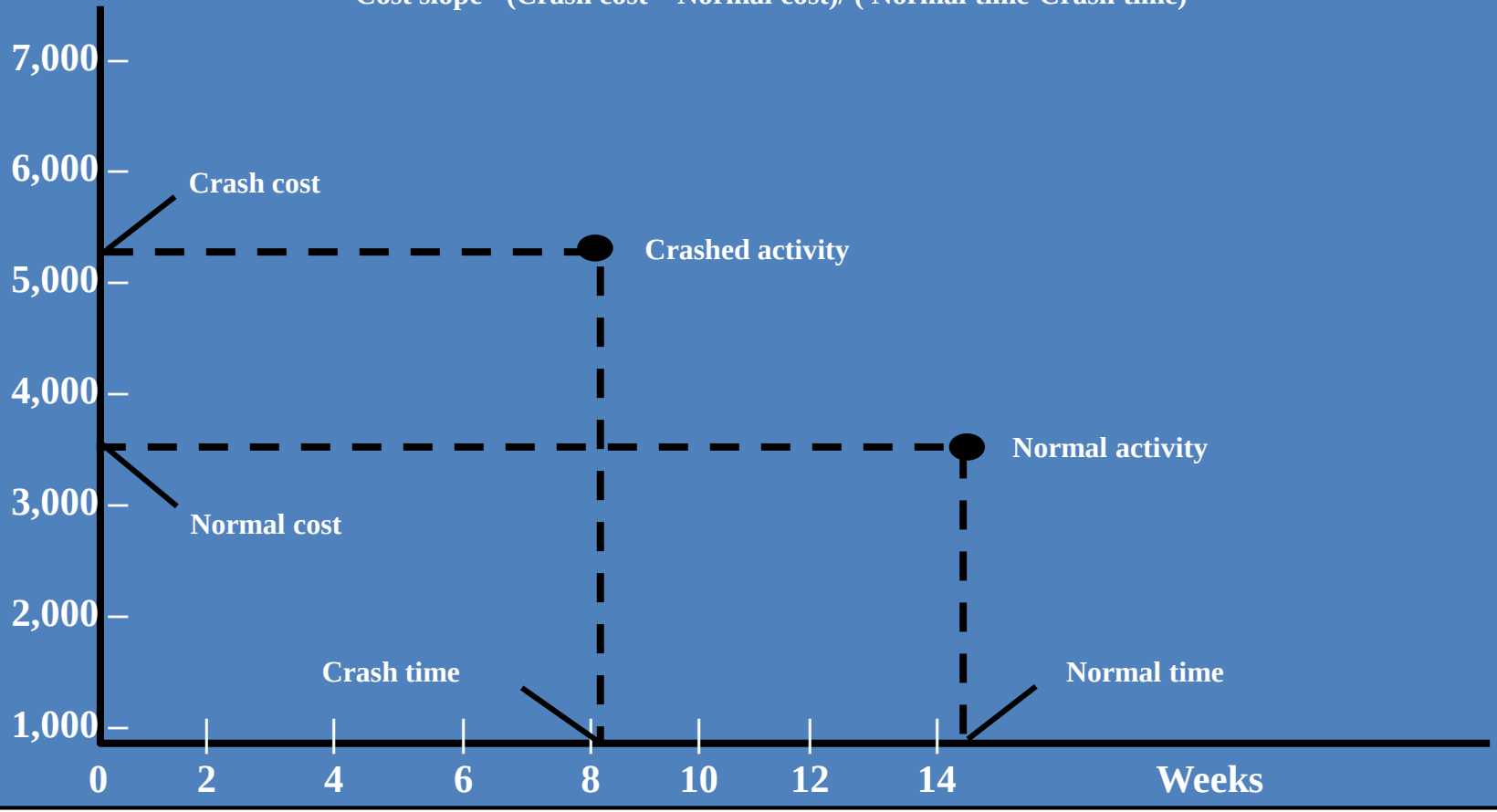
Direct cost: Cost of resources required to for an activity (men, material, etc).

Indirect cost: Indirect costs associated with material , labor and expenses.

Crashing of a Project

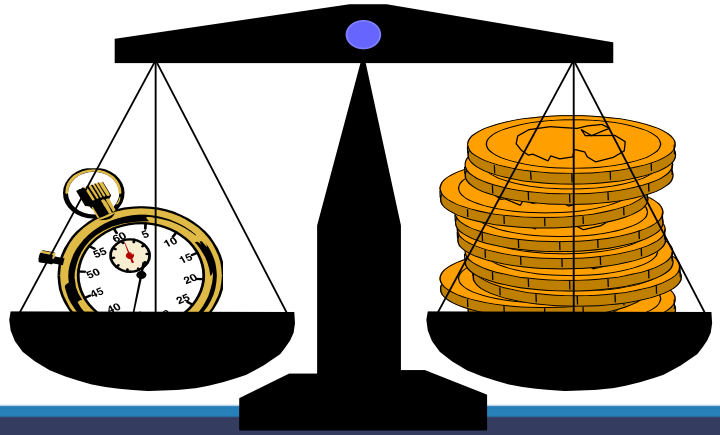


Cost slope= (Crash cost – Normal cost)/ (Normal time-Crash time)

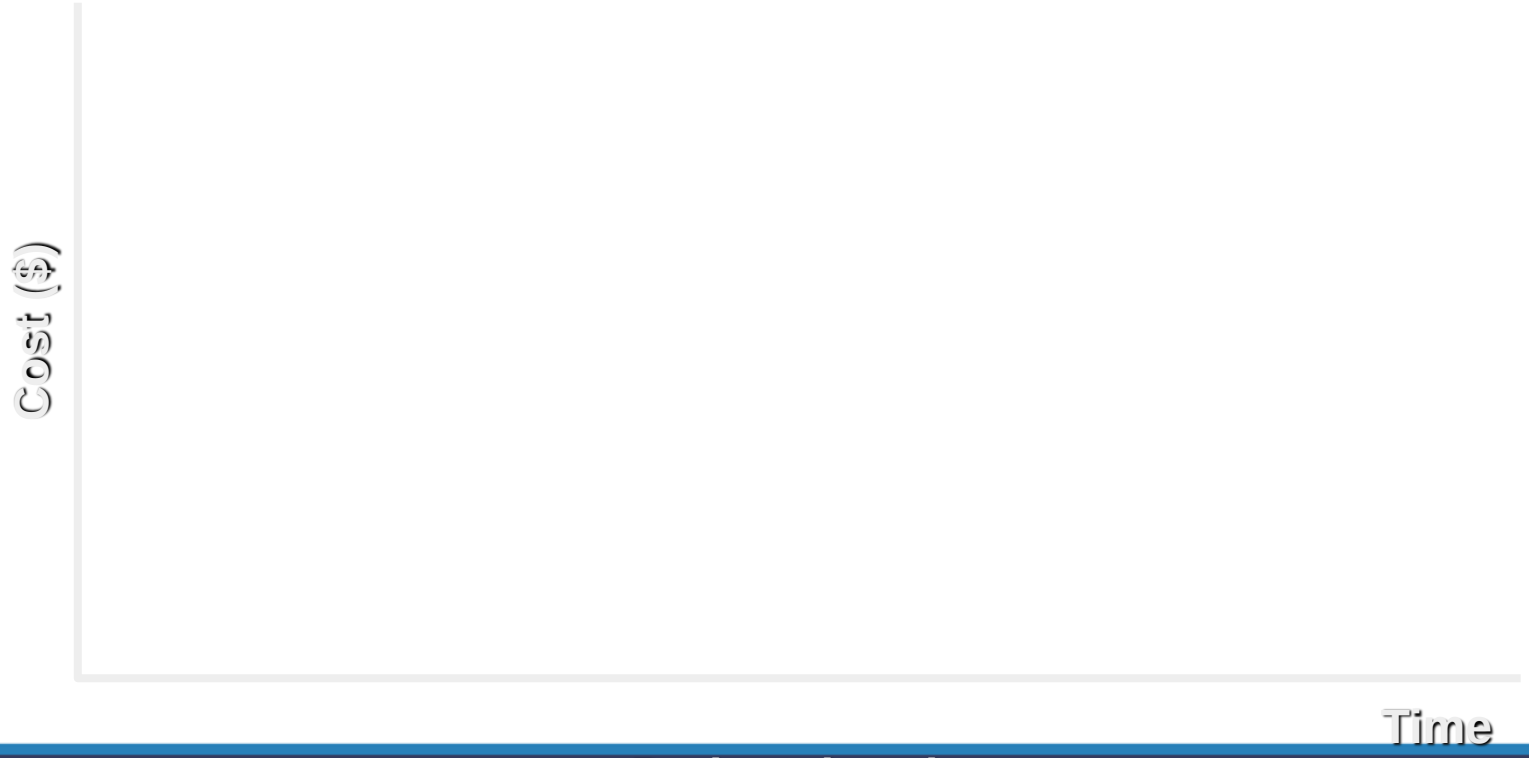


Time-Cost Relationship

- ✓ *Direct costs increase as project duration decreases*
- ✓ *Indirect costs increase as project duration increases and vice versa*
- ✓ *Reduce project length as long as crashing costs are less than indirect costs*

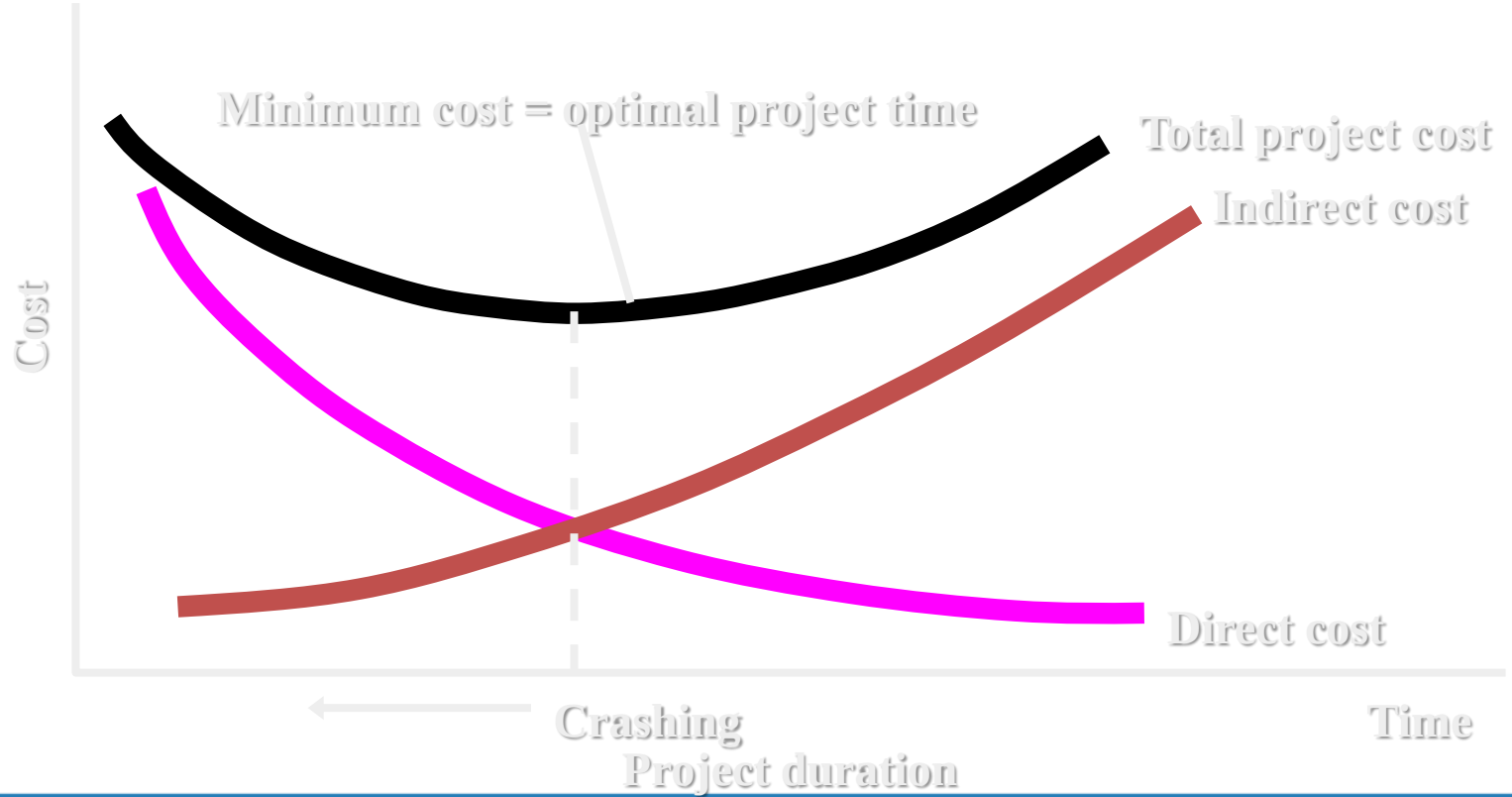


Time-Cost Tradeoff



Project duration

Time-Cost Tradeoff



Rule 1: Crash only those activities whose **slope** (increased direct cost/unit time) is more than **indirect cost per unit time**. Now suppose **painting** is not a critical activity. Then the overall project duration would not decrease by decreasing activity time for painting as project duration is the sum total of duration of critical activities.

So, we reach the second rule for crashing.

Rule 2: Crash only those activities which **are on critical path**. There are many activities which are critical in a project, which qualify the second rule. There may many of them which follow the first rule as well. Now the question arises which activity should be preferred for crashing. This is given by third rule. Rule 3: Preference should be given to the activity with the **least slope**.

There may be situations where two or more critical activities have the **same** slope.

Then we should use a subsidiary rule.

Subsidiary rule 1: Preference should be given to the activity with the **least additional** cost in the situation when there is a tie between slopes of critical activities.

Another situation can be seen when there **is more than one critical path**. Then we can use another subsidiary rule. Subsidiary rule 2: Preference should be given to **common activity** on the critical path if there is more than one critical path.

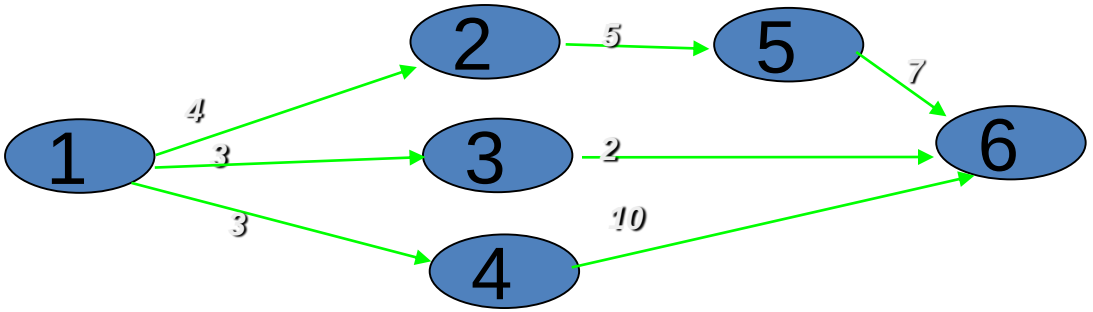
In the absence of any qualifying activity, which is common to all the critical paths, we should stick to the rule **of lowest slope** amongst all critical activities

Example: Find optimum schedule.

Activity	Normal		Crash	
	Time	Cost	Time	Cost
1-2	4	100	1 (up to 1 day)	130
1-3	3	140	1	160
1-4	3	200	1	240
2-5	5	100	2	200
3-6	2	50	1	80
4-6	10	150	9	180
5-6	7	200	5	250

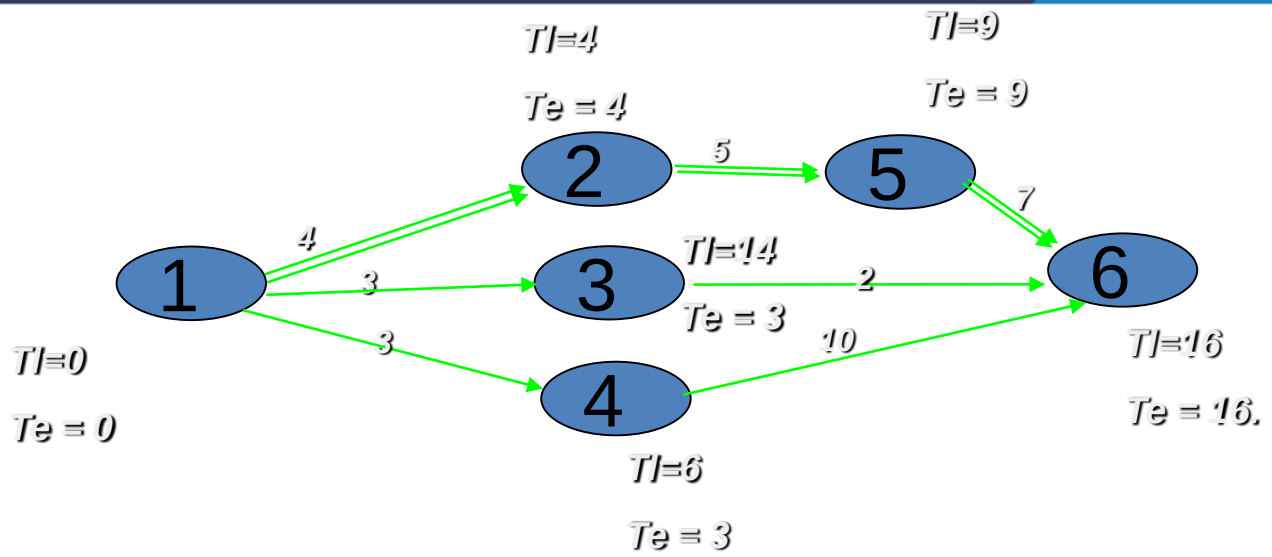
Indirect cost = 50 per day.

Activity	Time
1-2	4
1-3	3
1-4	3
2-5	5
3-6	2
4-6	10
5-6	7



Activity	Normal		Crash		Slope = (Crash cost – Normal cost) / (Normal time-Crash time)		
	Time	Cost	Time	Cost	Δt	Δc	Δc/Δt
1-2	4	100	1	130	3	30	10
1-3	3	140	1	160	2	20	10
1-4	3	200	1	240	2	40	20
2-5	5	100	2	200	3	100	34
3-6	2	50	1	80	1	30	30
4-6	10	150	9	180	1	30	30
5-6	7	200	5	250	2	50	25
		940					

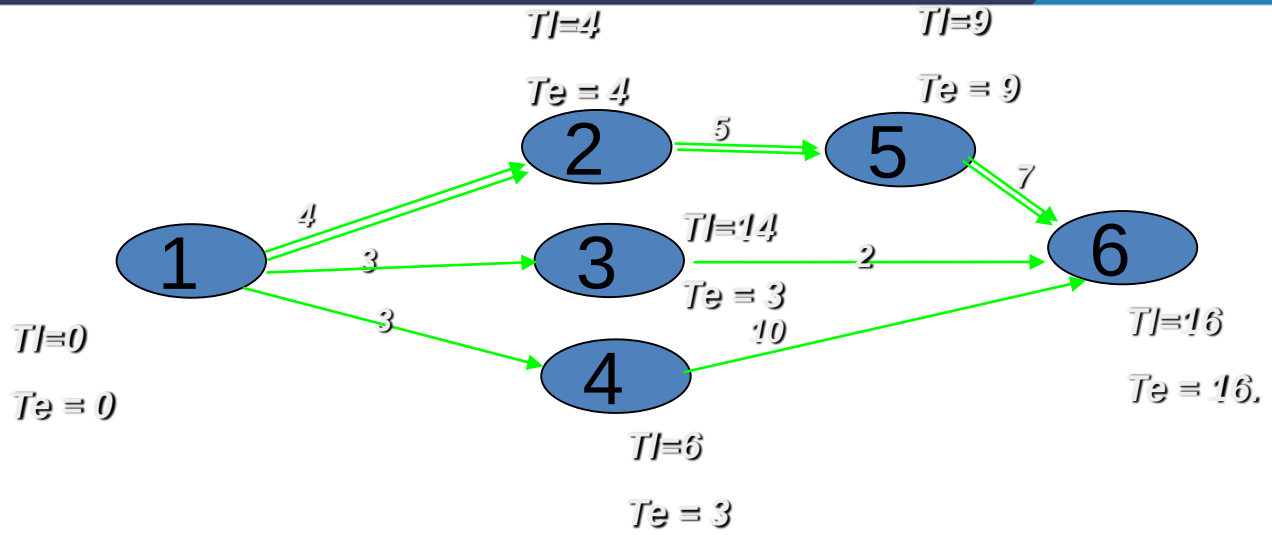
Indirect cost = 50 per day.



Critical path: 1-2-5-6

Direct Cost = ???, Indirect cost =????

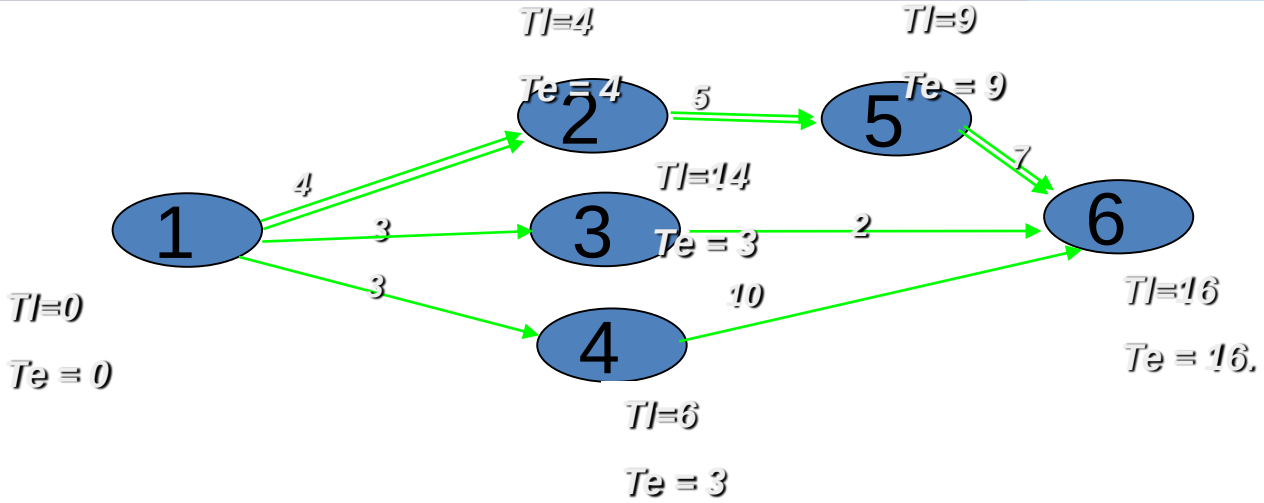
Total time = 16



Critical path: 1-2-5-6

Direct Cost = 940, Indirect cost = 50*16 =800

Total time = 16

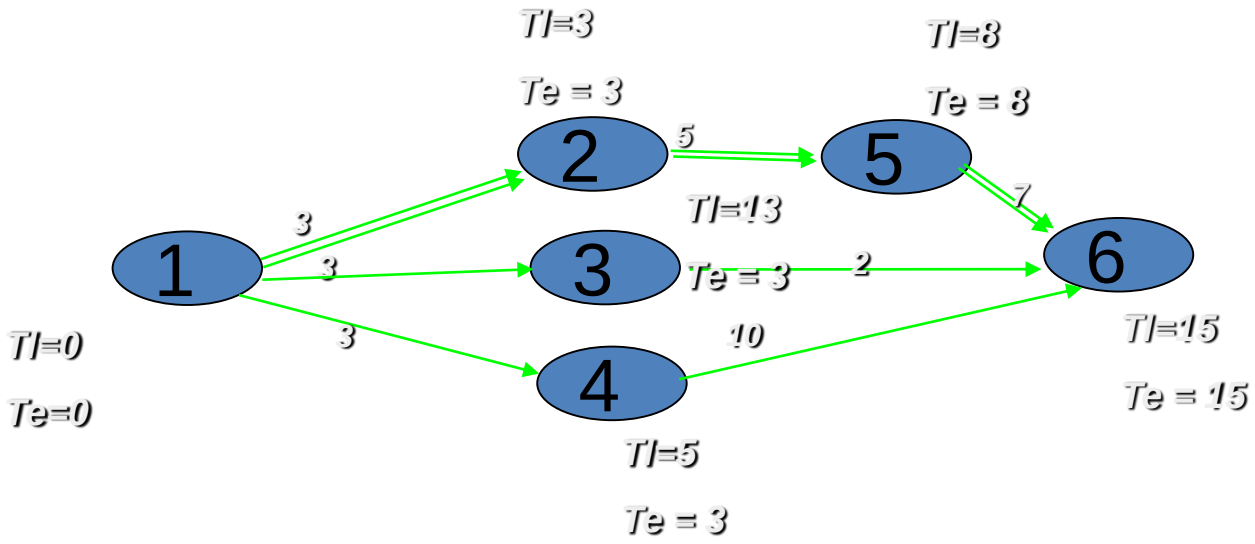


To reduce the duration of the project, reduce critical activities by one time unit. Select that critical activity which has the <u>least</u> slope.

Critical path : 1 2 5 6

Cost slope : <u>10</u> 34 25

Crash Limit : 3 3 2



Critical path: 1-2-5-6

Direct Cost : 940+10=950

Total time = 15