Chapter 10

Reducing Project Duration

Contents

1. Why Reduce Project Duration?
2. Options for Reducing Project Duration
3. Project Cost-Duration Graph
4. Practical Considerations
   - ☞ Using the Cost-Duration Graph
   - ☞ Crash Times
   - ☞ Choice of Activities to Crash Revisited
   - ☞ Time Reduction Decisions and Sensitivity
   - ☞ Reduce Project Scope
   - ☞ Have Owner Take on More Responsibility
   - ☞ Outsourcing Project Activities or Entire Project
   - ☞ Brainstorming Cost Saving Options

Why Reduce Project Duration?

1. There is a need to complete the project before the planned date to respond **customers' demand** (imposed project duration date).

2. In recent years emphasis on time-to-market has taken on new importance because of intense **global competition** and rapid technological advances.

3. Reduce project duration so as to **minimize risks caused by unforeseen delays**—for example, adverse weather, design flaws, and equipment breakdowns etc.

4. There are **times for reassigning key equipment and/or people** to new projects. Under these circumstances, the cost of compressing the project can be compared with the costs of not releasing key equipment or people.

Options for Reducing Project Duration

Adding Resources: The most common method for shortening project time is to assign additional staff and equipment to activities. There are limits, as to how much speed can be gained by adding staff. Doubling the size of the workforce will not certainly reduce completion time by half.

Outsourcing Project Work: Sometimes the organization subcontract out the project activities to shorten the project time. The subcontractor may have access to superior technology or expertise that will accelerate the completion of the activity. Further, subcontracting also frees up resources that can be assigned to critical activity and will ideally result in a shorter project duration.

Options for Reducing …(Con't.)

Scheduling Overtime: The easiest way to add more labor to a project is not to add more people, but to schedule overtime. If a team work 50 hrs a week instead of 40, it might accomplish 20% more. By scheduling overtime you avoid the additional coordination and communication encountered when new people are added.

Establish a Core Project Team: One of the advantages of creating a dedicated core team to complete a project is speed. Assigning professionals full time to a project avoids the hidden cost of multi-tasking. This singular focus creates a shared goal that can bind a diverse set of professionals into a highly cohesive team capable of accelerating project completion.

Options for Reducing …(Con't.)

Do It Twice—Fast and Correctly: If you are in a hurry, try building a "**quick and dirty**" short-term solution , then go back and do it the right way. The additional costs of doing it twice are often more than compensated for by the benefits of satisfying the deadline.

Fast-Tracking: Sometimes it is possible to re-arrange the logic of the project network so that *critical activities are done in parallel rather than sequentially*. One of the most common methods for restructuring activities is to change a finish-to-start relationship to start-to-start relationship.

# Options for Reducing …(Con't.)

Reducing Project Scope: *Reducing* the project *scope may shorten the project time* but may lead to a reduction in functionality of the project. However, the question of whether the *customers still want* the product minus the feature.

Compromise Quality: Reducing quality is always an opinion, but it is rarely used or acceptable. If quality is sacrificed, it may be possible to reduce the time of an activity on the critical path.

Project Cost-Duration Graph

The challenge for the project manager is to use a quick, logical method to compare the benefits of *reducing project time with the cost*. The method requires gathering direct and **indirect costs** for specific project durations. Critical activities are searched to find the lowest **direct-cost** activities that will shorten the project duration. **Total cost** for specific project duration are computed and then compared with the benefits of reducing project time—before the project begin or while it is in progress.

Project Cost-Duration Graph
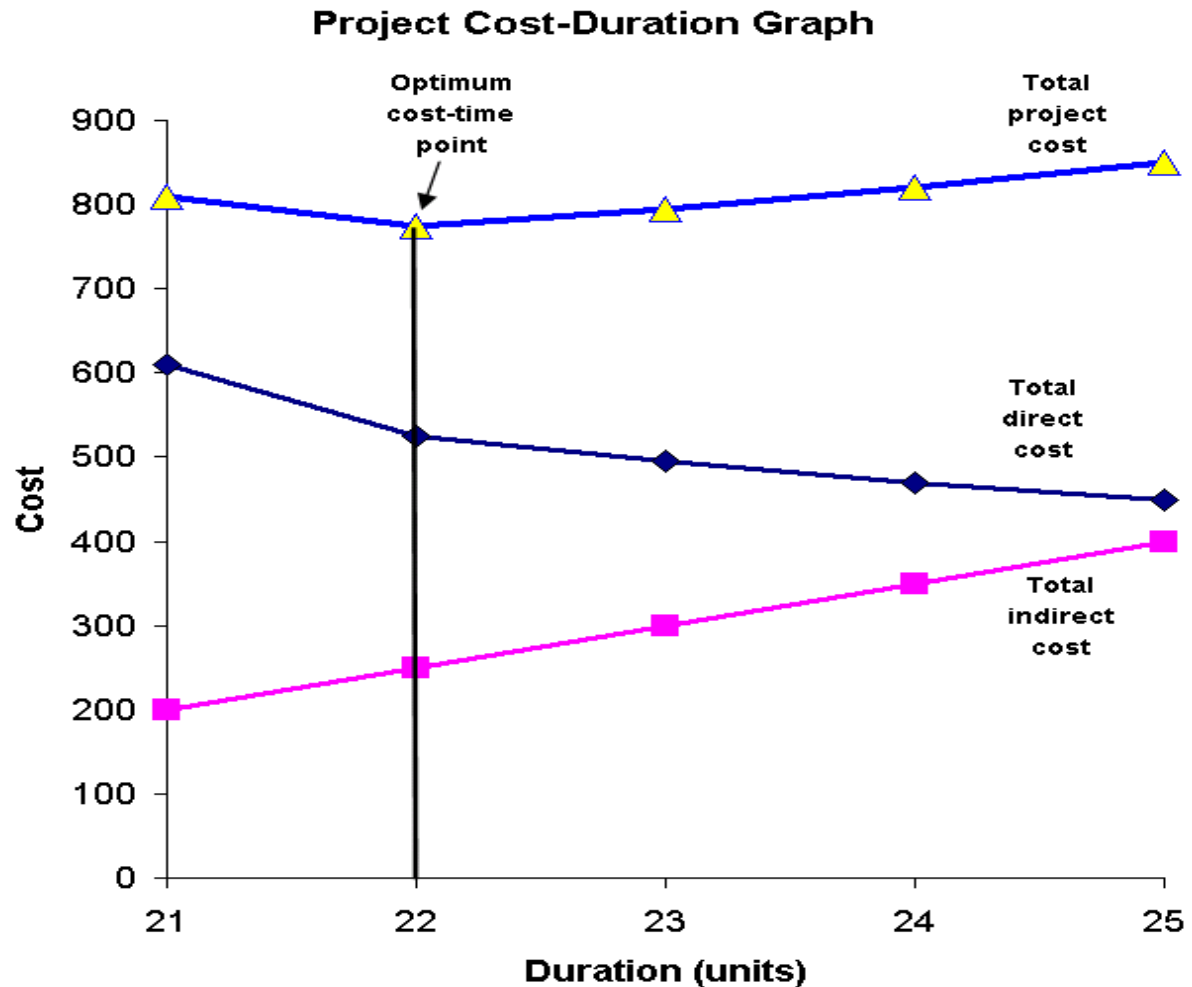
Project Cost-Duration …(Con't.)

Project Indirect Cost: Indirect cost represents overhead costs such as supervision, administration, consultants, and interest. Indirect costs vary directly with time. Any reduction in time, should result in a reduction of indirect costs. For example, if the daily cost for supervision and administration are $2,000, any reduction in project duration would represent a savings of $2,000 per day (assuming that the indirect resources can be utilized elsewhere).

Project Cost-Duration …(Con't.)

Project Direct Costs: *Direct costs commonly represent labors, materials, equipment, and sometimes subcontractors*. Direct cost are assigned to a work package and activity.

The ideal *assumption* is that direct cost for an activity time *represents normal costs*, which typically means *low-cost, efficient methods* for a normal time. When project durations are imposed, direct cost may no longer represent low-cost, efficient methods.

Costs for the imposed duration date will be higher than for a project duration developed from ideal normal times for activities. The *sum of the costs of all work packages* represents the *total direct costs* for the project.

Project Cost-Duration …(Con't.)

Constructing a Project-Cost Duration Graph. There are three major steps required to construct a project cost-duration graph:

1. Find total direct costs for selected project durations

2. Find total indirect costs for selected project durations

3. Sum direct and indirect costs for these selected durations

The graph is then used to compare additional cost alternative for benefits.

Project Cost-Duration …(Con't.)

Determining The Activities to Shorten. Basically, managers need to look for critical activities that can be shortened *with smallest increase in cost per unit of time*. *Normal time* for an activity represents low-cost, efficient methods for completing the activity under normal conditions. Shortening an activity is called *crashing*. The shortest time an activity can realistically be completed in is called **crash time**. The direct cost for completing the activity in its crash time is called **crash cost**. Both normal and crash times and costs are collected from personnel most familiar with completing the activity.

Project Cost-Duration …(Con't.)

The assumptions underlying the use of the cost-duration graph are as follow:

☞ The cost-time relationship is linear.

☞ Normal time assumes low-cost, efficient methods to complete the activity.

☞ Crash time represents a limit—the greatest time reduction possible under realistic conditions.

☞ Slope represents cost *per unit of time*.

☞ All accelerations must occur within the normal and crash times.

Project Cost-Duration …(Con't.)

Activity Graph
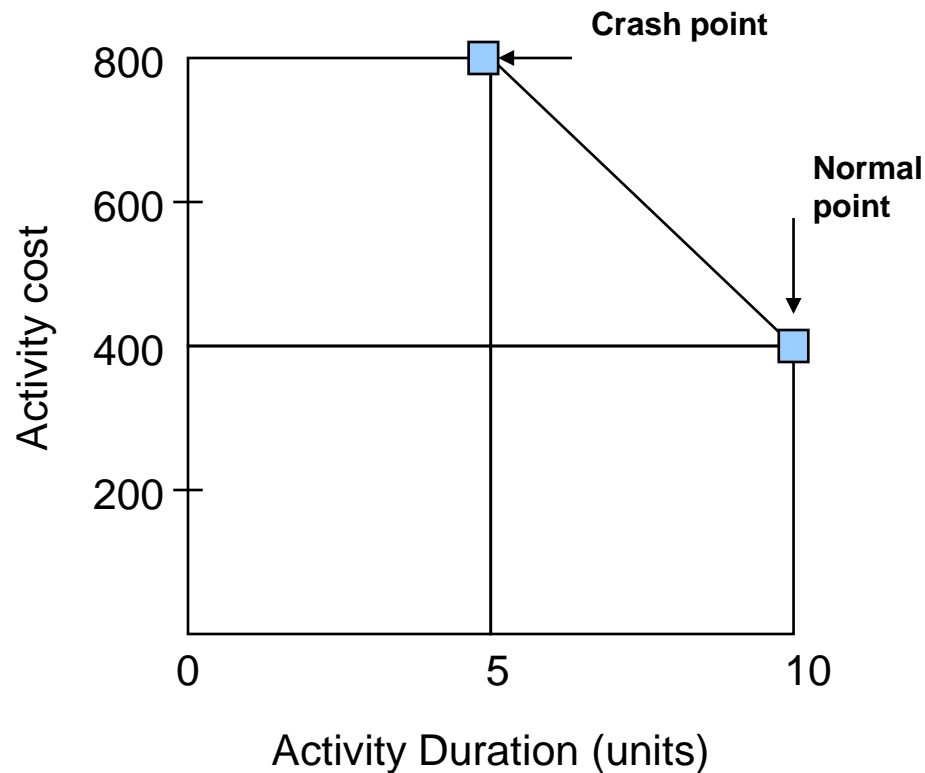
Knowing the slope of activities allows managers to compare which critical activities to shorten. The less steep the cost slope of an activity, the less it cost to shorten one time period; a steeper slope means it will cost more to shorten one time unit.
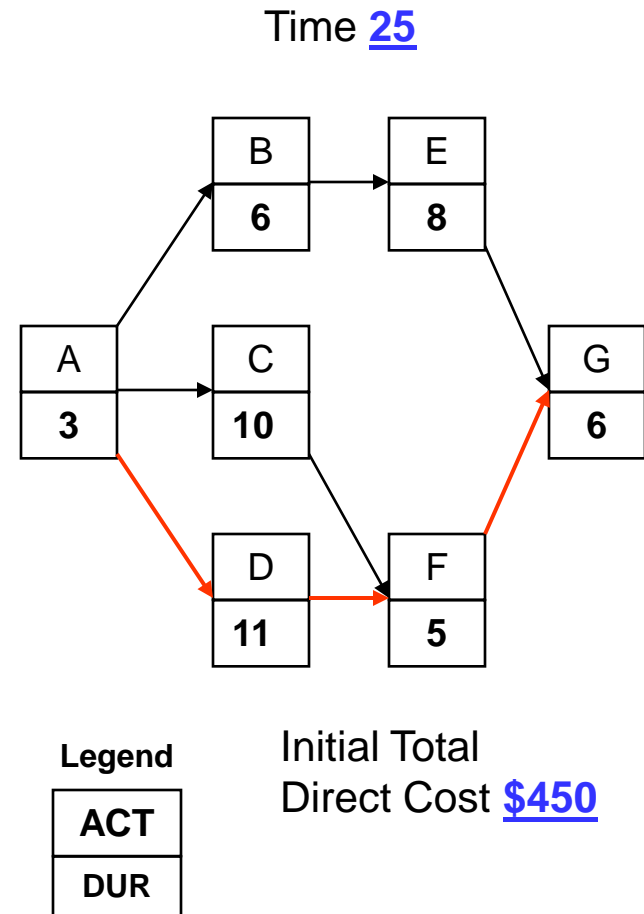
Project Cost-Duration …(Con't.)

The cost per unit of time or slope for any activity is computed by the following:

$$\textbf{Cost Slope} = \frac{\text{Crash cost} - \text{Normal cost}}{\text{Normal time} - \text{Crash time}}$$

$$= \frac{CC - NC}{NT - CT} = \frac{\$800 - \$400}{10 - 5}$$

$$= \frac{\$400}{5} = \textbf{\$ 80 per unit of time}$$
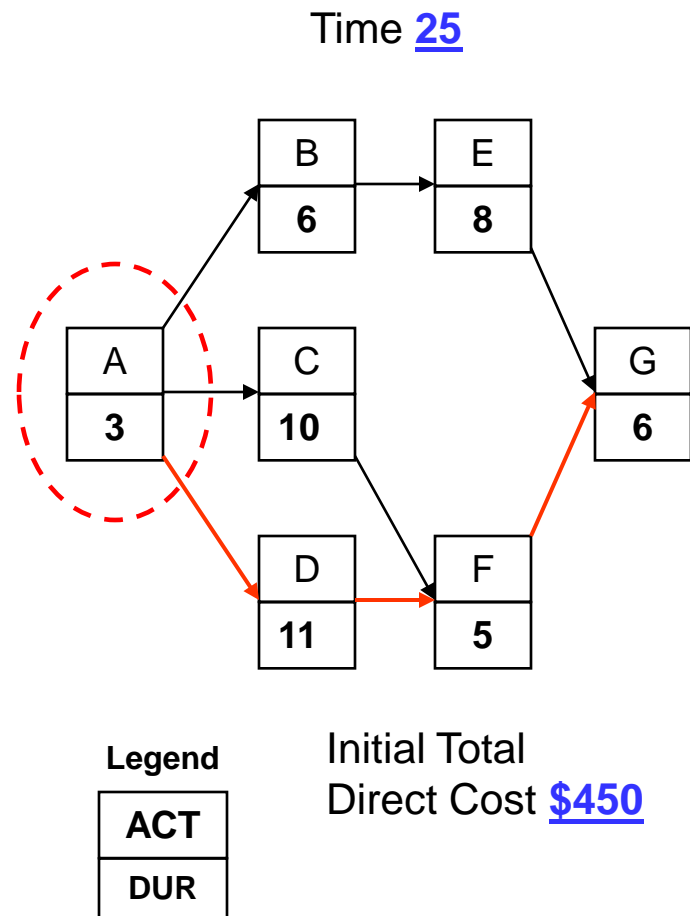
Project Cost-Duration ...(Con't.)

Example: Cost-Duration Trade-Off

Time **25**

Activity ID	Slope	Max. crash time	Direct Cost			
			Normal		Crash	
			Time	Cost	Time	Cost
A	**$20**	**1**	3	$50	2	70
B	**40**	**2**	6	80	4	160
C	**30**	**1**	10	60	9	90
D	**25**	**4**	11	50	7	150
E	**30**	**2**	8	100	6	160
F	**30**	**1**	5	40	4	70
G	**0**	**0**	6	70	6	70
Total Direct Cost				450		

B 6

E 8

A 3

C 10

G 6

D 11

F 5

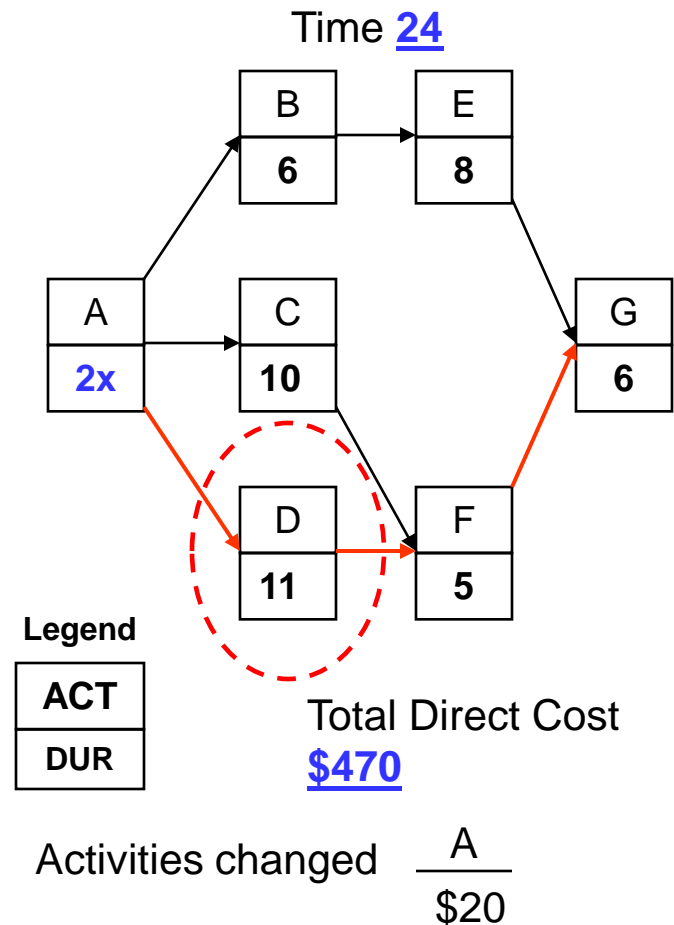**Legend**

ACT

DUR

Initial Total Direct Cost **$450**

Project Cost-Duration …(Con't.)

The network shows the critical path to be activities A, D, F, G. Because it is impossible to shorten activity G. Activity A is circle because it is the least cost candidate; that is, its slope ($20) is less than the slopes for activity D and F ($25 and $30). Reducing activity A one time unit to 24 time units but increase the total cost to $470 ($450 + $20 = $470)

Time **25**

B		E
6		8

A		C		G
3		10		6

D		F
11		5

Legend

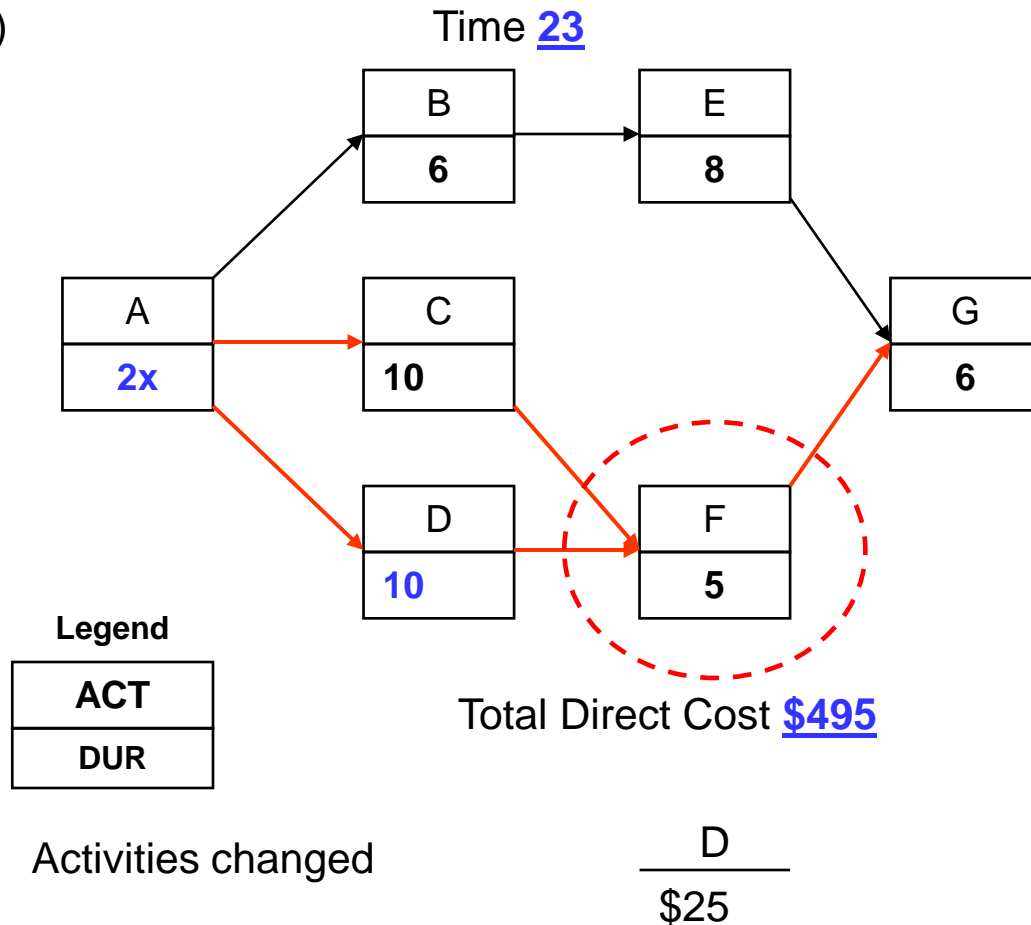| |
|---|
| **ACT** |
| **DUR** |

Initial Total
Direct Cost **$450**

Project Cost-Duration …(Con't.)

As activity D cost the least ($25) to shorten the project to 23 time units. Compare the cost of activity F. The total direct cost for a project duration of 23 time units is $495 (Network a). The project network now has two critical paths—A, C, F, G and A, D, F, G. Reducing the project to 22 time units will require that activity F be reduced; thus it is circled.
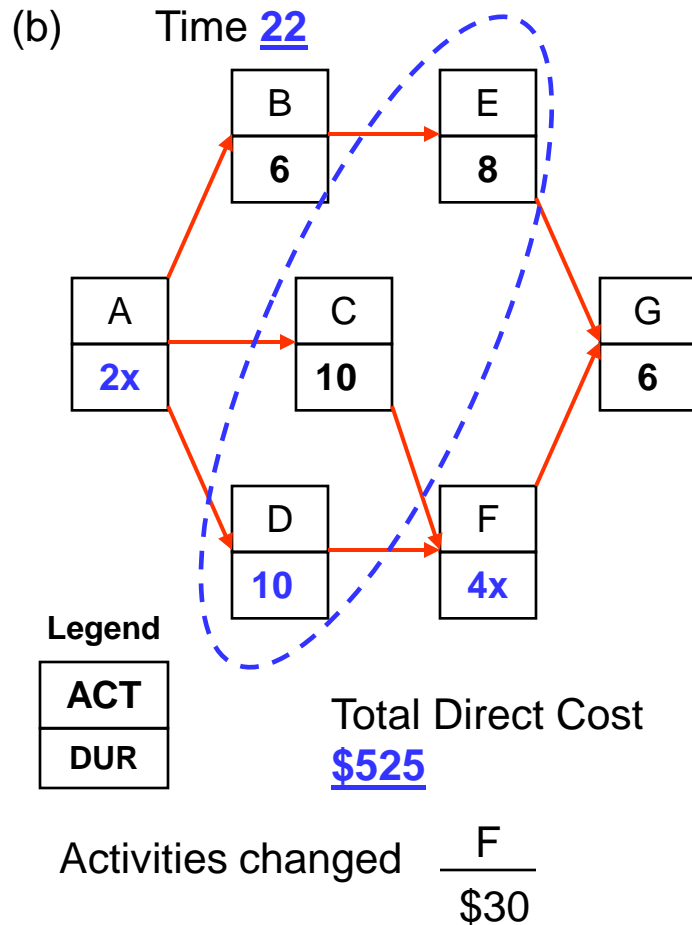
Time **24**

B	E
6	8

A	C	G
2x	10	6

D	F
11	5

Legend

ACT
DUR

Total Direct Cost
$470

Activities changed   A / $20

Project Cost-Duration …(Con't.)

(a)

Time **23**

By reducing activity F, the total direct cost for 22 time units is $ 525. This reduction has created a third critical path—A, B, E, G; all activities are critical (Network b).
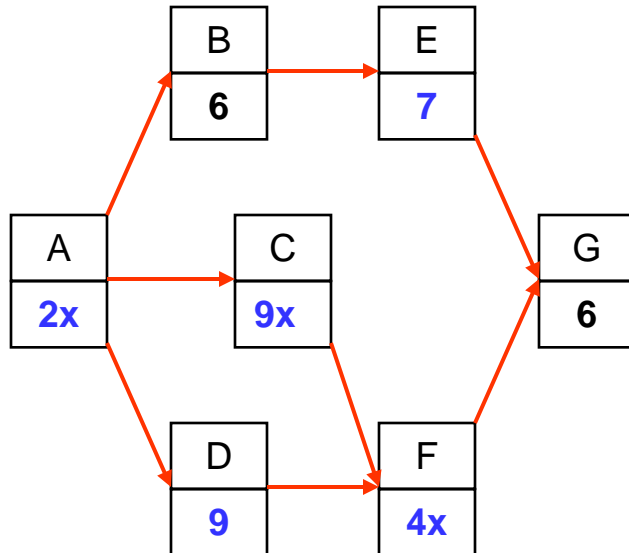
Project Cost-Duration …(Con't.)

(b) Time **22**

B
6

E
8

A
2x

C
10

G
6

D
10

F
4x

Legend

ACT
DUR

Total Direct Cost
$525

Activities changed $\dfrac{F}{\$30}$

The least cost method for reducing the project the project duration to 21 time units is the combination of the circled activities C, D, E which cost $30, $25, $30, respectively and increase total direct cost to $610 (Network c).

Project Cost-Duration …(Con't.)

(c)   Time **21**

Total Direct Cost
$610

Activities changed $\dfrac{C}{\$30}$ $\dfrac{D}{\$25}$ $\dfrac{E}{\$30}$

By reducing activity F, the total direct cost for 22 time units is $ 525. This reduction has created a third critical path—A, B, E, G; all activities are critical. The least cost method for reducing the project the project duration to 21 time units is the combination of the circled activities C, D, E which cost $30, $25, $30, respectively and increase total direct cost to $610 (Network c).
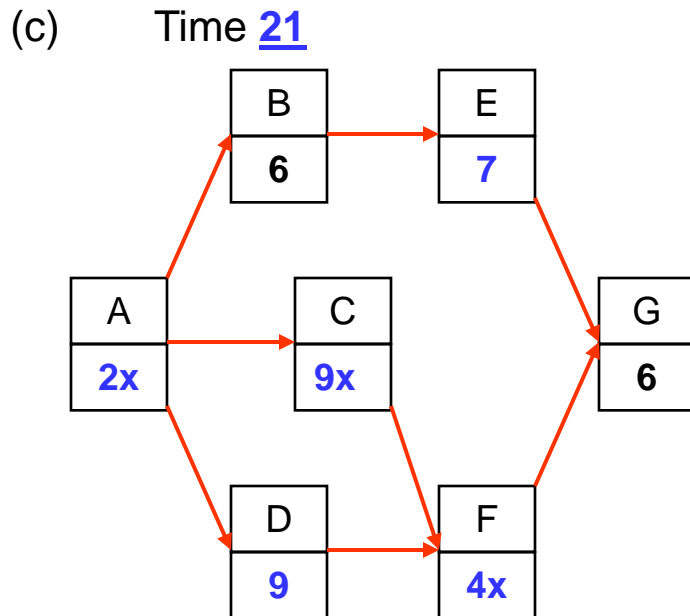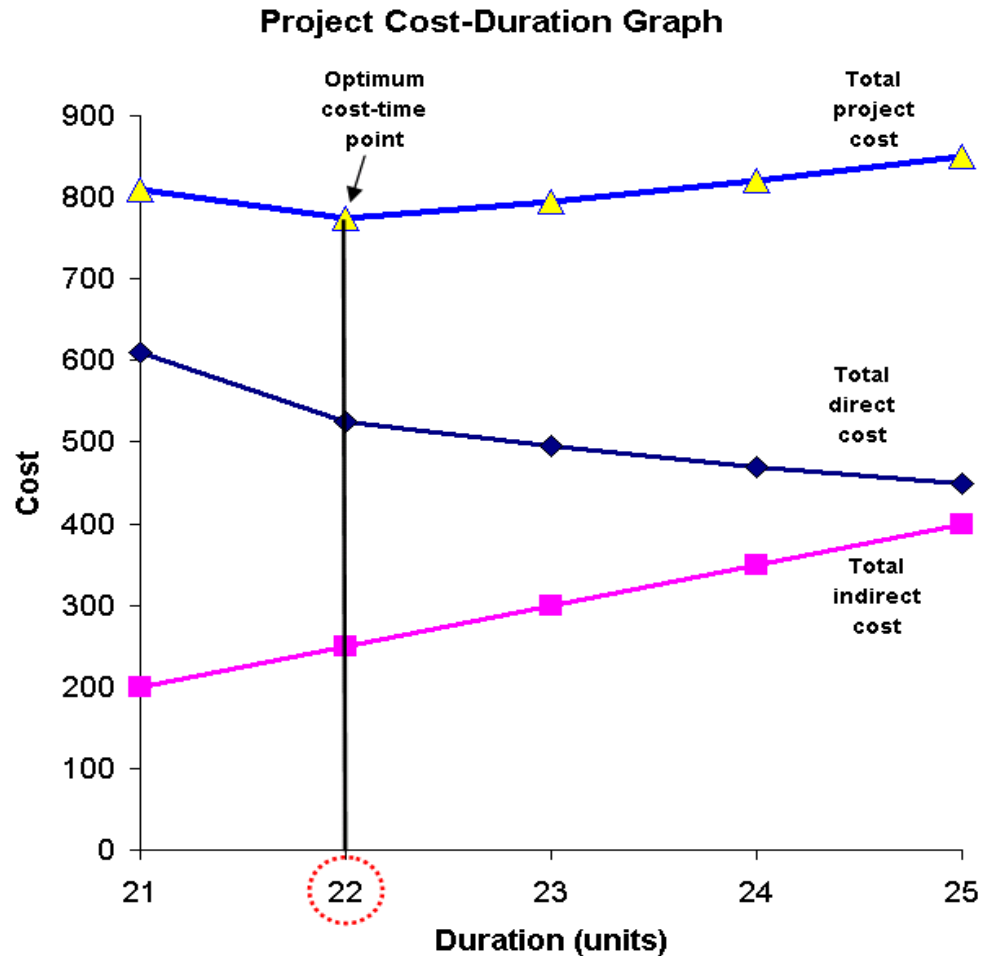
Project Cost-Duration …(Con't.)

(c) Time **21**

B
6

E
7

A
2x

C
9x

G
6

D
9

F
4x

Total Direct Cost
$610

Activities changed

	C	D	E
	$30	$25	$30

Although some activities (B, D, E) can still be reduced, no activity or combination of activities will result in a reduction in project duration. The indirect costs are typically a rate per day and are easily obtained from the accounting department. So from the direct and indirect costs of each project time you can develop the project cost-duration graph.

Project Cost-Duration …(Con't.)

Project Duration	Dir. Cost +	Indir. Cost =	Total Cost
25	450	400	$850
24	470	350	820
23	495	300	795
22	**525**	**250**	**775**
21	610	200	810

This graph shows that the optimum cost-time duration is 22 time units and $775.

Project Cost-Duration Graph

Practical Considerations

Using the Project Cost-Duration Graph. This graph is valuable to compare any proposed alternative or change with optimum cost and time. More importantly, the creation of such a graph keeps the importance of indirect costs in the forefront of decision making. Further this graph can be used before the project begins or while the project in progress.

Crash Times. Collecting crash times for even a moderate-size project can be difficult. The meaning of crash time is difficult to communicate. What is meant when you define crash times as "the shortest time you can realistically complete an activity"?

Practical Considerations (Con't.)

Choice of Activities to Crashed Revisited. The cost-time crashing method relies on choosing the cheapest method for reducing the project duration. There are other factors that should be assessed beyond simply cost.

☑ The **impact of crashing** would have on the moral and motivation of the project team. If the least-cost method repeatedly signals a subgroup to accelerate progress, fatigue and resentment may set in. Conversely, if overtime pay is involved, other team members may resent not having access to this benefit.

Practical Considerations (Con't.)

- ☑ The **timing** of activities needs to be considered. Crashing a critical activity early in the project may result in wasted money if some other critical activity is finished early or some non-critical paths becomes the new critical paths.
- ☑ The inherent **risks** involved in crashing particular activities need also to be considered as every activity has different magnitude of risk..

The Reduction Decision and Sensitivity. As you can see that the logic of cost-time procedure suggests managers should reduce project duration to the lowest total cost point and duration. However, reducing critical activities requires spending money, or increase critical paths and activities, and reduce slack. Slack reduction increase the risk of being late.

Practical Considerations (Con't.)

What If Cost, Not Time, Is the Issue?. Organizations do not only emphasize on getting thing done quickly but also cheaply. The common options for cutting costs are:

Reduce Project Scope. Just as scaling back or reducing the scope of the project can gain time, delivering less than what was originally planned also produces significant savings. Calculating the savings for reduced project scope begins with WBS.

Have Owner Take on More Responsibility. One way of reducing project costs is identifying tasks that customers can do themselves. Naturally, this arrangement should be negotiated before the project begin.

Practical Considerations (Con't.)

Outsource Project Activities or Entire Project . Perhaps instead of relying on internal resources, it would be more cost effective to outsource segments or even the entire project, opening up work to external price competition. Specialized subcontractors often enjoy unique advantages, such as material discount for large quantities, as well as equipment that not only get work done more quickly but also less expensively.

Brainstorm Cost Saving Options. Sometimes project team members can offer ways for reducing project costs. Project managers should not underestimate the value of simply asking if there is a cheaper, better way.

Review Questions

1. Describe main reasons for reducing project duration.

2. Present at least 6 options of how to reduce project duration.

3. Why scheduling overtime a popular choice for getting projects back on schedule? What are the potential problems for relying on this option?

4. How can a cost-duration graph be used by the project manager? Explain.

5. Reducing the project duration increases the risk of being late. Explain.