

# Project Management

## Session Plan

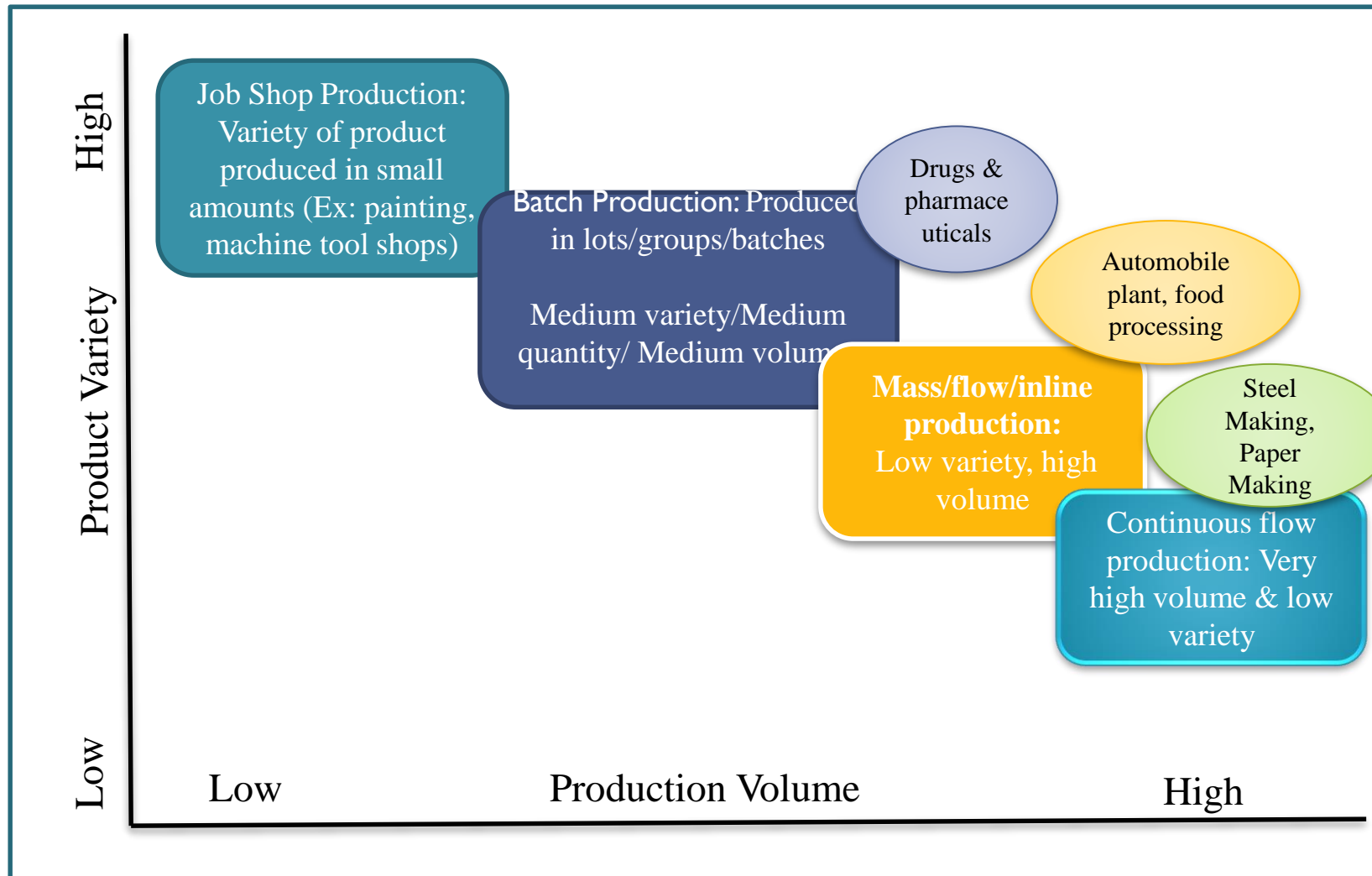
➤ Project Management: Definition

➤ [Link](#)

## Distinguishing features

- No expertise currently available
  - ✓ Areas of competency not yet demonstrated
- Product/Service Offered is Large Scale
  - ✓ Going from sub-system to total system (larger quantum of design, fabrication etc.)
  - ✓ Long-term period of operation (2 - 5 years)
- High Degree of Customization

# Type of Manufacturing Process



# Product – Process Matrix

Product-Process Matrix					
Process structure Process life cycle stage ↓	Product structure Product life cycle stage →	Low volume Unique (one of a kind)	Low volume Multiple Products	Higher volume Standardized product	Very high volume Commodity product
	(Project)				
Jumbled flow (job shop)		Job shop			
Disconnected line flow (batch)			Batch		
Connected line flow (assembly line)				Assembly line	
Continuous flow (continuous)					Continuous

**Project:** A series of related jobs, usually directed toward some major output and requiring a significant period of time to perform.

**Example:** Civil engineering contracts, aerospace programs & construction etc.

# Project

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## ➤ Major Characteristics of a Project

- ✓ Has a established objective
- ✓ Has a defined life span with a beginning and an end.
- ✓ Requires across-the-organizational participation.
- ✓ Involves doing something never been done before.
- ✓ Has specific time, cost, and performance requirements.

# Project Vs. Program

## ➤ **Program**

- ✓ A series of coordinated, related, multiple projects that continue over an extended time and are intended to achieve a goal.
- ✓ A higher level group of projects targeted at a common goal.

## ➤ **Example**

- ✓ **Project:** completion of a required course in project management.
- ✓ **Program:** completion of all courses required for a business major.

# Comparison of routine work with projects

Routine, Repetitive Work	Projects
<ul style="list-style-type: none"><li>• Taking class notes</li><li>• Daily entering sales receipts into the accounting ledger</li><li>• Responding to a supply-chain request</li><li>• Practicing scales on the piano</li><li>• Routine manufacture of an Apple iPod</li></ul>	<ul style="list-style-type: none"><li>• Writing a term paper</li><li>• Setting up a sales kiosk for a professional accounting meeting</li><li>• Developing a supply-chain information system</li><li>• Writing a new piano piece</li><li>• Designing an iPod that is approximately 2 X 4 inches, interfaces with PC, and stores 10,000 songs</li></ul>

# Project Management

- **Project Management:** Planning, directing, and controlling resources (people, equipment, material) to meet the technical, cost, and time constraints of the project.
- Although projects are often thought to be one-time occurrences, the fact is that many projects can be repeated or transferred to other settings or products. The result will be another project output.
- Project management, on the other hand, involves five process groups as identified
  - 1) Project Initiation
  - 2) Project planning
  - 3) Project Execution
  - 4) Project monitoring and control
  - 5) Project closure



# Project Management

## ➤ **Project Initiation:**

- Selection of the best project given resource limits
- Recognizing the benefits of the project
- Preparation of the documents to sanction the project
- Assigning of the project manager

## ➤ **Project Planning:**

- Definition of the work requirements
- Definition of the quality and quantity of work
- Definition of the resources needed
- Scheduling the activities
- Evaluation of the various risks

## ➤ **Project execution:**

- Negotiating for the project team members
- Directing and managing the work
- Working with the team members to help them improve

# Project Management

## ➤ **Project monitoring and control:**

- Tracking progress
- Comparing actual outcome to predicted outcome
- Analyzing variances and impacts
- Making adjustments

## ➤ **Project closure:**

- Verifying that all of the work has been accomplished
- Contractual closure of the contract
- Financial closure of the charge numbers
- Administrative closure of the paperwork

# Project Management: Successful

- **Successful project management can then be defined as having achieved the project objectives:**
  - Within time
  - Within cost
  - At the desired performance/technology level
  - While utilizing the assigned resources effectively and efficiently
  - Accepted by the customer
  
- **What are the Key Success Factors?**
  - Top-down commitment
  - Having a capable project manager
  - Having time to plan
  - Careful tracking and control
  - Good communications

# Project Management: Benefits

➤ **The potential benefits from project management are:**

- Identification of functional responsibilities to ensure that all activities are accounted for, regardless of personnel turnover.
- Minimizing the need for continuous reporting
- Identification of time limits for scheduling
- Identification of a methodology for trade-off analysis
- Measurement of accomplishment against plans
- Early identification of problems so that corrective action may follow
- Improved estimating capability for future planning
- Knowing when objectives cannot be met or will be exceeded

# Project Management

- Why is it used?
  - ✓ Special needs
  - ✓ Pressures for new or improves products or services
- What are the Key Metrics?
  - ✓ Time
  - ✓ Cost
  - ✓ Performance objectives

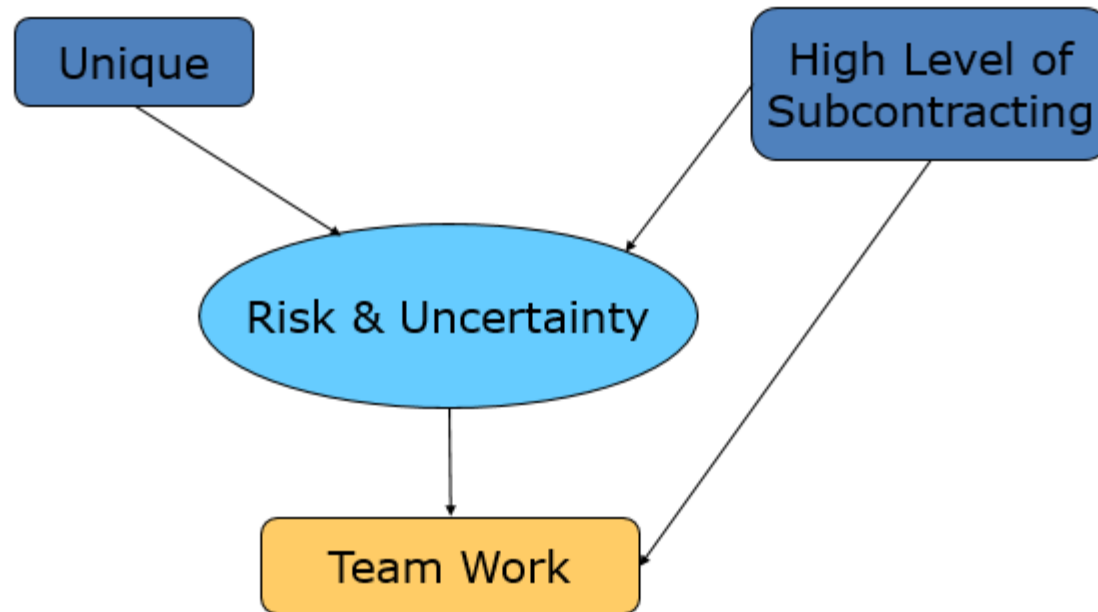
# Project Management

- What are the Major Administrative Issues?
  - ❖ Executive responsibilities
    - ✓ Project selection
    - ✓ Project manager selection
    - ✓ Organizational structure
  - ❖ Organizational alternatives
    - ✓ Manage within functional unit
    - ✓ Assign a coordinator
    - ✓ Use a matrix organization with a project leader

# Project Management Issue

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# Project Management Issue





# Project Management vs. System Engineering

- The project manager is responsible for all aspects of the project to include source and use of funds, contract, people, schedule, and ultimate delivery.
  - The system engineer should work under the project manager as the senior technical person responsible for all technical aspects of the system.
  - There may be a overlap of responsibility which may create confusion and tension between the rolls of project manager and the systems engineer.
- The three situations exist as shown in the following diagrams :
1. On some projects, there is no overlap in responsibility (fig.-a).
  2. On other projects, there may be shared responsibilities for planning and managing activities (fig-b).
  3. In some cases, particularly for smaller projects, the project manager may also be the lead technical member of the team performing both roles of project manager and systems engineer (fig.-c).

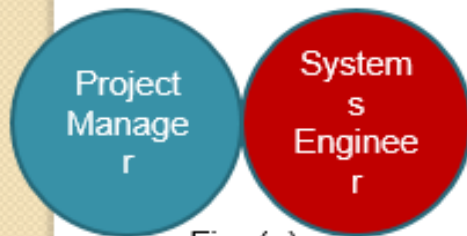


Fig.-a)

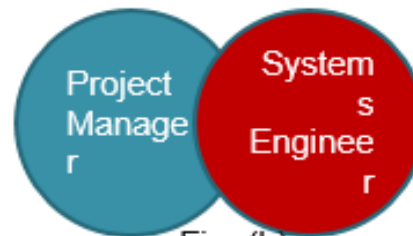


Fig.-b)

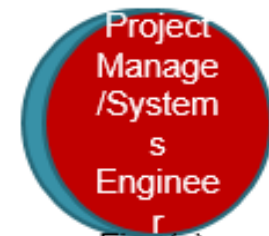
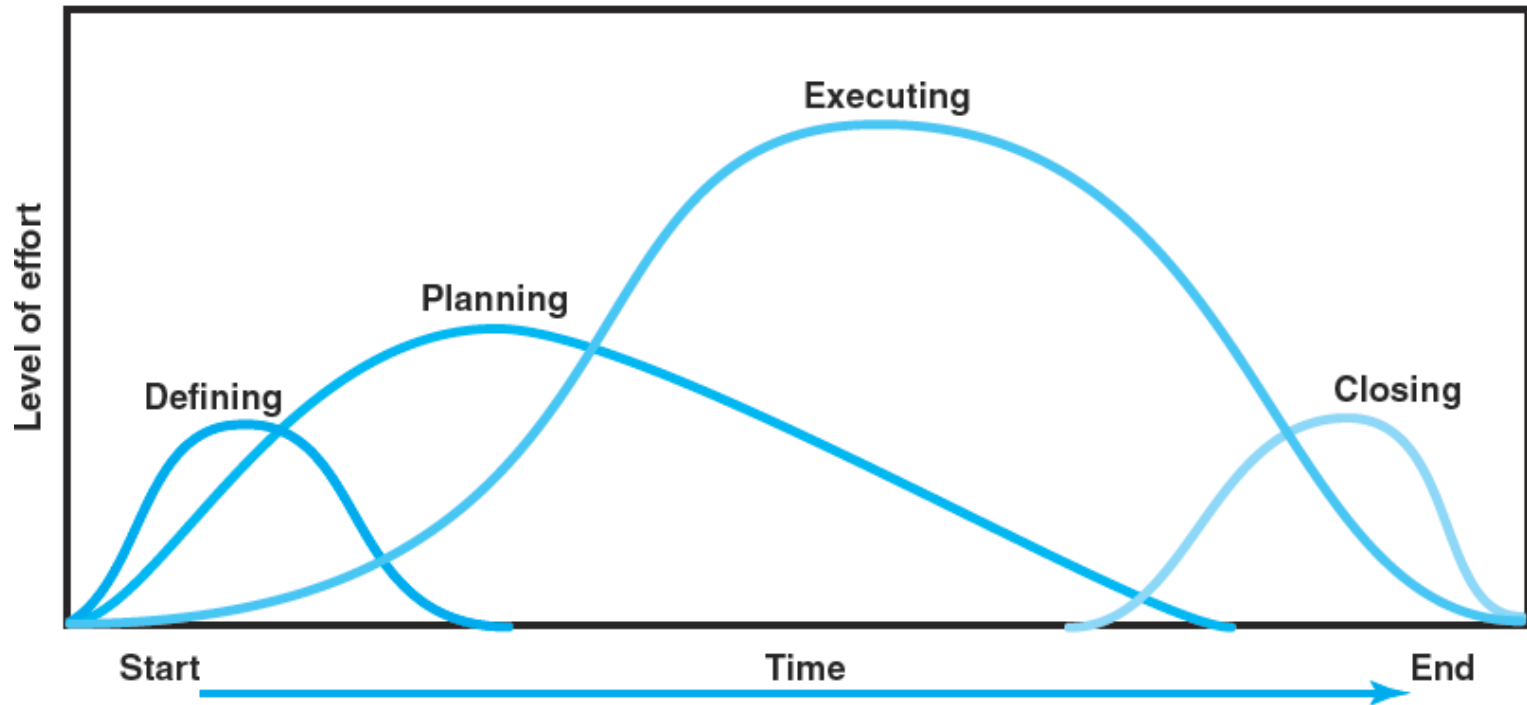


Fig.-c)

# Project Life Cycle

- Usually Project life cycle consists the following five phases:
  - ✓ **Defining:** At which point the organization recognizes the need for a project or responds to a request for a proposal from a potential customer or client.
  - ✓ **Planning:** Which spells out the details of the work and provides estimates of necessary human resources, time & cost.
  - ✓ **Execution:** During this phase the project itself is done. This phase often accounts for the majority of time and resources consumed by a project.
  - ✓ **Termination/closing:** During which closure is achieved. Termination can involve the reassigning the personnel and dealing with any leftover materials & equipment and any other resources associated with the project.

# Project Life Cycle



## Defining

1. Goals
2. Specifications
3. Tasks
4. Responsibilities

## Planning

1. Schedules
2. Budgets
3. Resources
4. Risks
5. Staffing

## Executing

1. Status reports
2. Changes
3. Quality
4. Forecasts

## Closing

1. Train customer
2. Transfer documents
3. Release resources
4. Evaluation
5. Lessons learned

# Current Drivers of Project Management

- **Factors leading to the increased use of project management:**
  - ✓ Compression of the product life cycle
  - ✓ Knowledge explosion
  - ✓ Triple bottom line (planet, people, profit)
  - ✓ Corporate downsizing
  - ✓ Increased customer focus
  - ✓ Small projects represent big problems

# Project Governance: An Integrative Approach

- **Integration (or centralization) of project management provides senior management with:**
  - ✓ An overview of all project management activities
  - ✓ A big picture of how organizational resources are used
  - ✓ A risk assessment of their portfolio of projects
  - ✓ A rough metric of the firm's improvement in managing projects relative to others in the industry
  - ✓ Linkages of senior management with actual project execution management

# Project Structure

## ➤ **Pure Project:**

- A Self contained team works full time on the project.

## ➤ **Functional Project:**

- Responsibility for the project lies within one functional area of the firm
- Employees from that area work on the project, usually only part-time

## ➤ **Matrix Project:**

- A blend of pure and functional project structures – people from different functional areas work on the project, possibly only part-time

# Pure Project Structure

## ➤ Advantages:

- The project manager has full authority
- Team members report to one boss
- Shortened communication lines
- Team pride, motivation, and commitment are high

## ➤ Disadvantages:

- Duplication of resources
- Organizational goals and policies are ignored
- Lack of technology transfer
- Team members have no functional area "home"

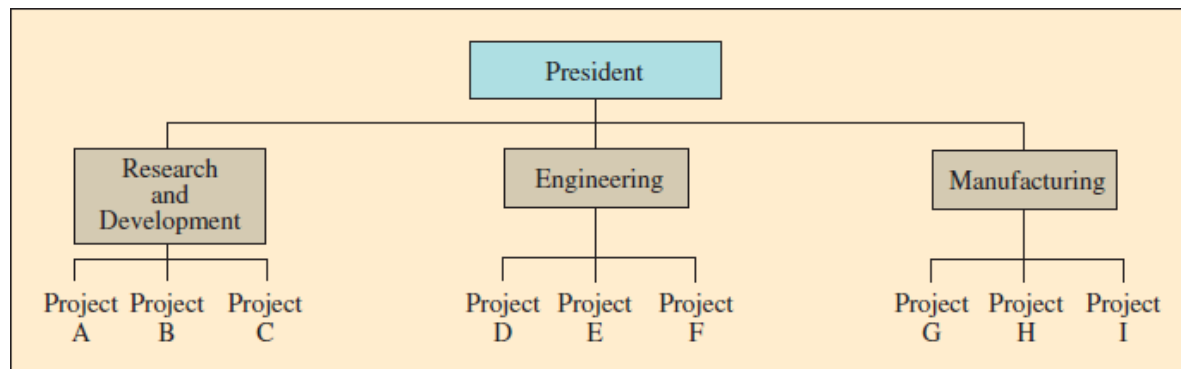
# Functional Project Structure

## ➤ Advantages:

- A team member can work on several projects
- Technical expertise maintained in functional area
- Functional area is “home” after project completed
- Critical mass of specialized knowledge

## ➤ Disadvantages:

- Aspects of the project that are not directly related to the functional area get short-changed
- Motivation of team members is often weak
- Needs of the client are secondary and are responded to slowly





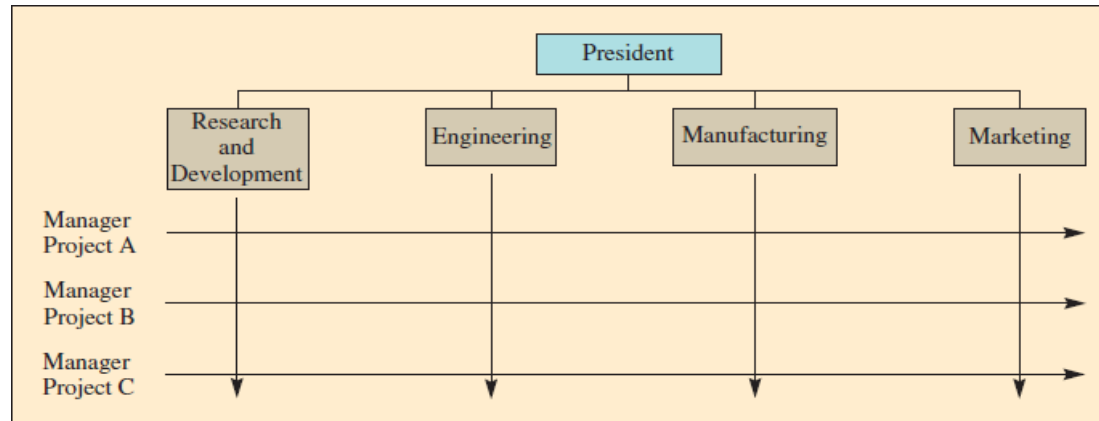
# Matrix Project Structure

## ➤ Advantages:

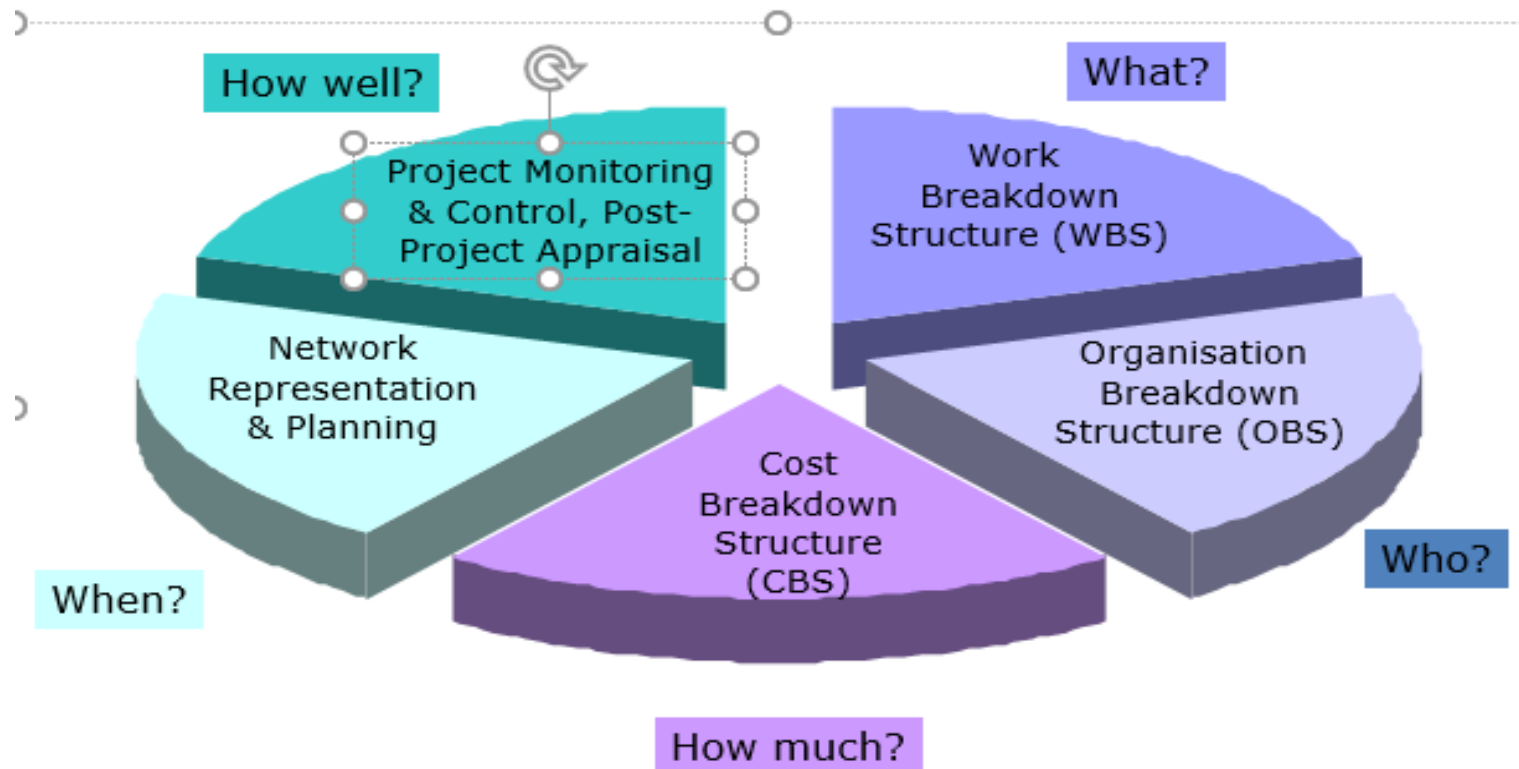
- Better communications between functional areas
- Project manager held responsible for success
- Duplication of resources is minimized
- Functional “home” for team members
- Policies of the parent organization are followed

## ➤ Disadvantages:

- Too many bosses
- Depends on project manager’s negotiating skills
- Potential for sub-optimization

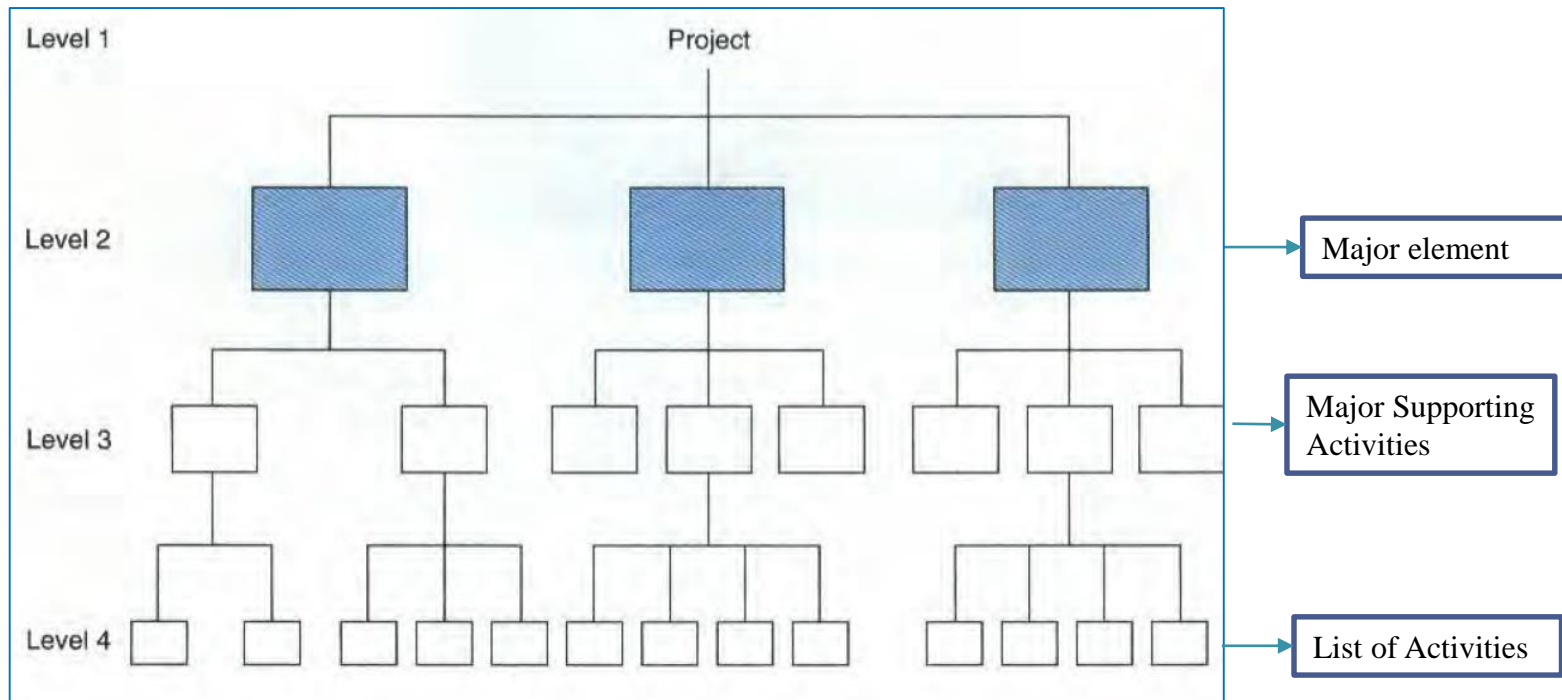


# Project Management Framework



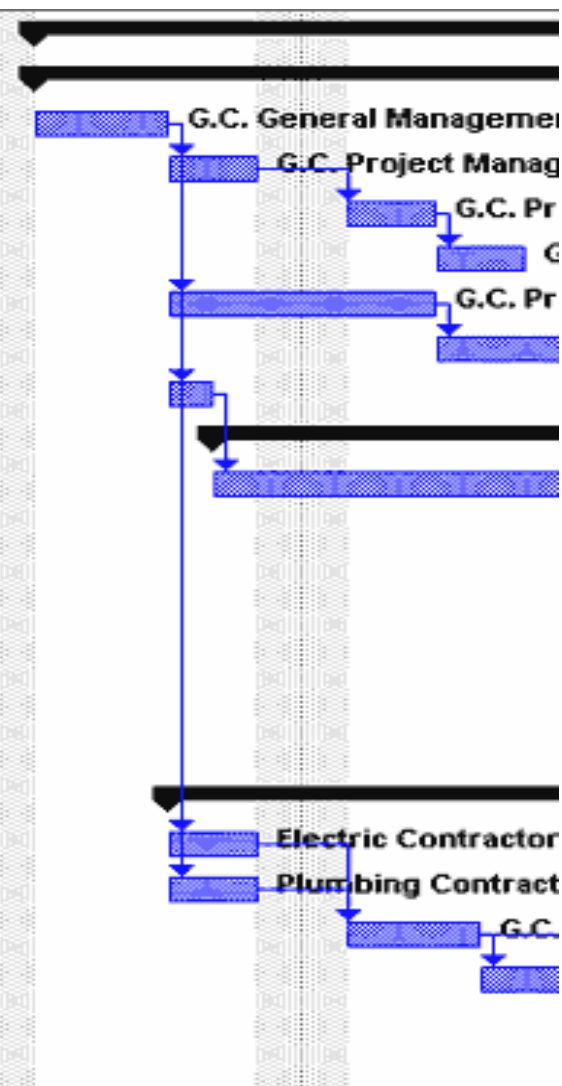
# Work breakdown structure

- It's a hierarchical listing of what must be done during the project
- This methodology establishes a logical framework for identifying the required activities for the project.



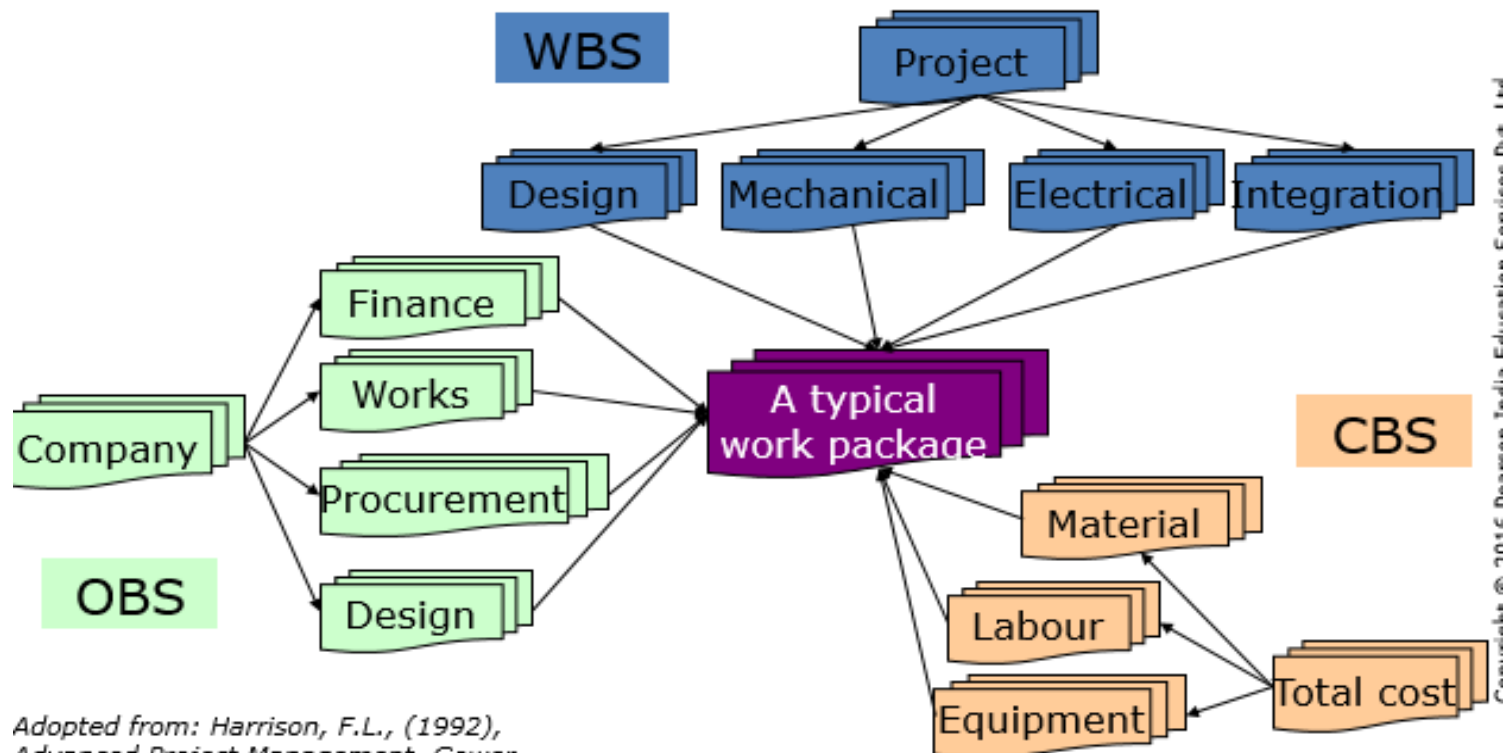
# An Illustration from a construction Project

<b>Three-story Office Building (76,000 square feet)</b>	<b>344 days</b>
<b>General Conditions</b>	<b>17 days</b>
Receive notice to proceed and sign contract	3 days
Submit bond and insurance documents	2 days
Prepare and submit project schedule	2 days
Prepare and submit schedule of values	2 days
Obtain building permits	4 days
Submit preliminary shop drawings	2 wks
Submit monthly requests for payment	1 day
<b>Long Lead Procurement</b>	<b>70 days</b>
Submit shop drawings and order long lead items	2 wks
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Submit shop drawings and order long lead items	2 wks
Submit shop drawings and order long lead items	2 wks
Detail, fabricate and deliver steel	12 wks
<b>Mobilize on Site</b>	<b>10 days</b>
Install temporary power	2 days
Install temporary water service	2 days
Set up site office	3 days
Set line and grade benchmarks	3 days
Prepare site - lay down yard and temporary fence	2 days
<b>Site Grading and Utilities</b>	<b>35 days</b>



# Project Framework

- **OBS:** An organization Breakdown Structure identifies an appropriate organizational structure to execute the tasks listed under each work package.
- **CBS:** Cost Breakdown Structure is a methodology to link the individual elements in a WBS to a dimension of cost.



Adopted from: Harrison, F.L., (1992),  
Advanced Project Management, Gower  
Publishing company, 3rd Edition.

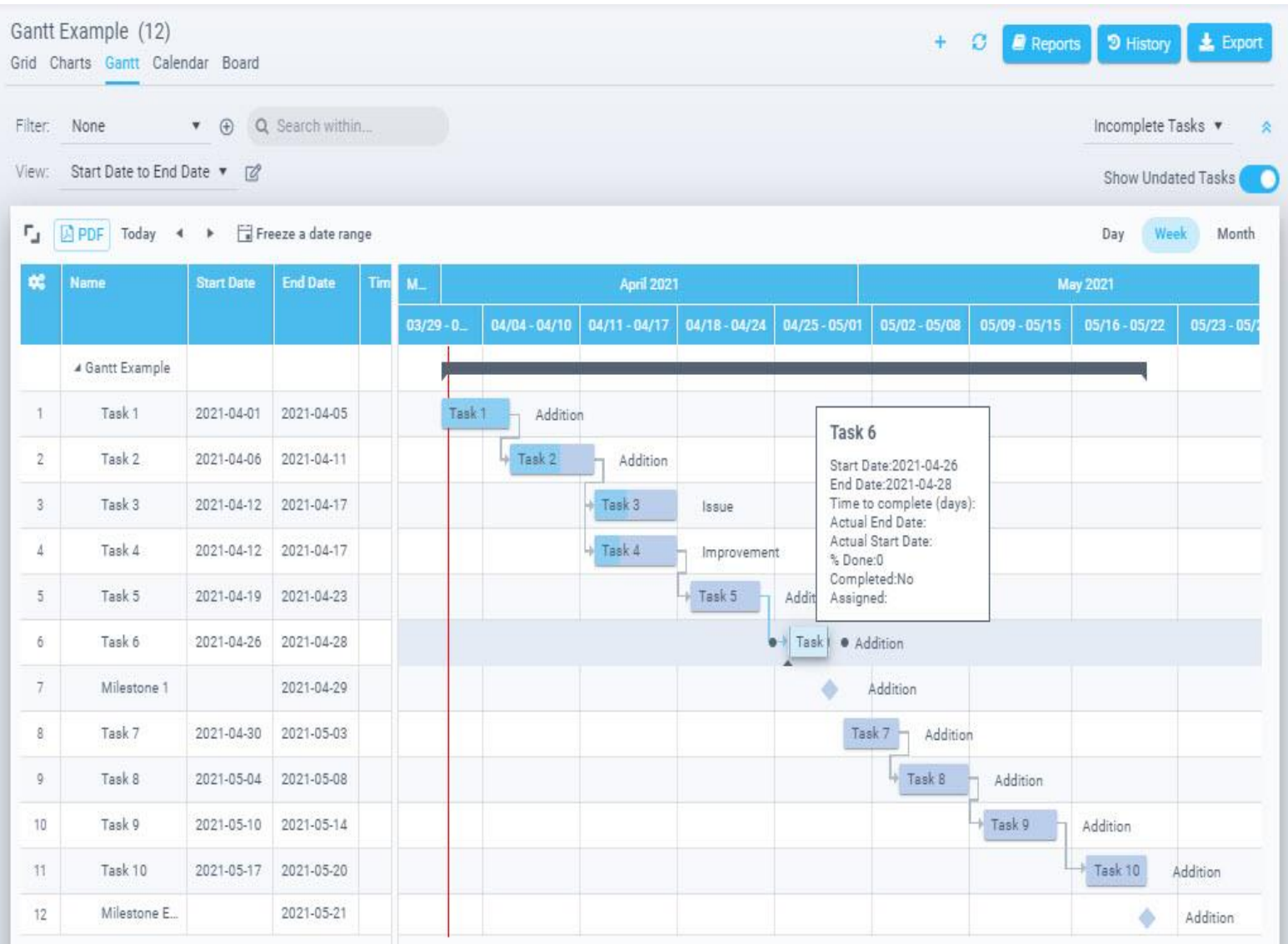
# Project Management Tools

- What are the tools?
  - ✓ Network diagram
  - ✓ Gantt charts
  - ✓ Risk management

# Gantt Chart: Planning & Scheduling

- Gantt Chart is a popular tool for planning & scheduling a simple projects
- It is showing both the amount of time involved and the sequence in which activities can be performed.
- It enables a manager to initial schedule the project activities and then to monitor progress over time by comparing the planned progress to actual progress. (Trello)

# Gantt Chart: Planning & Scheduling





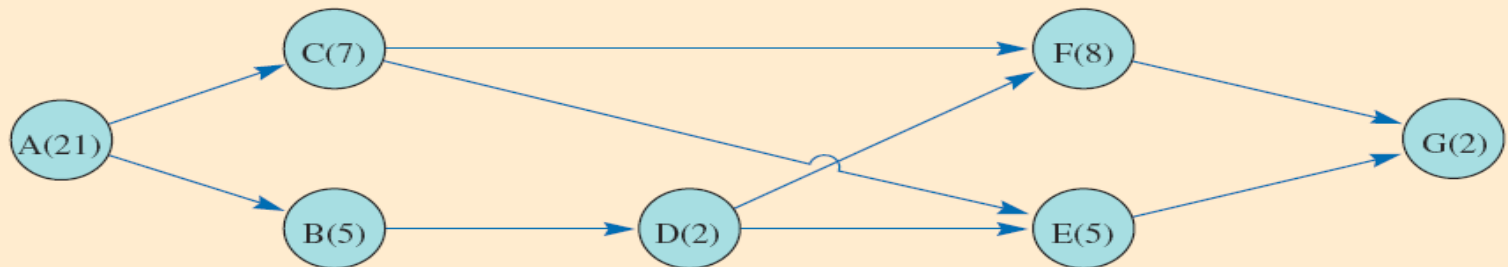
# Network Design: PERT & CPM

- PERT & CPM methods are two of the most widely used techniques for planning & coordinating the large scale projects. By using these, the managers are able to obtain the following:
  - ✓ Graphically displays project activities
  - ✓ Estimates how long the project will take
  - ✓ Indicates most critical activities
  - ✓ Show where delays will not affect project

# Identify Activities & Construct Network

CPM ACTIVITY DESIGNATIONS AND TIME ESTIMATES

ACTIVITY	DESIGNATION	IMMEDIATE PREDECESSORS	TIME (WEEKS)
Design	A	—	21
Build prototype	B	A	5
Evaluate equipment	C	A	7
Test prototype	D	B	2
Write equipment report	E	C, D	5
Write methods report	F	C, D	8
Write final report	G	E, F	2



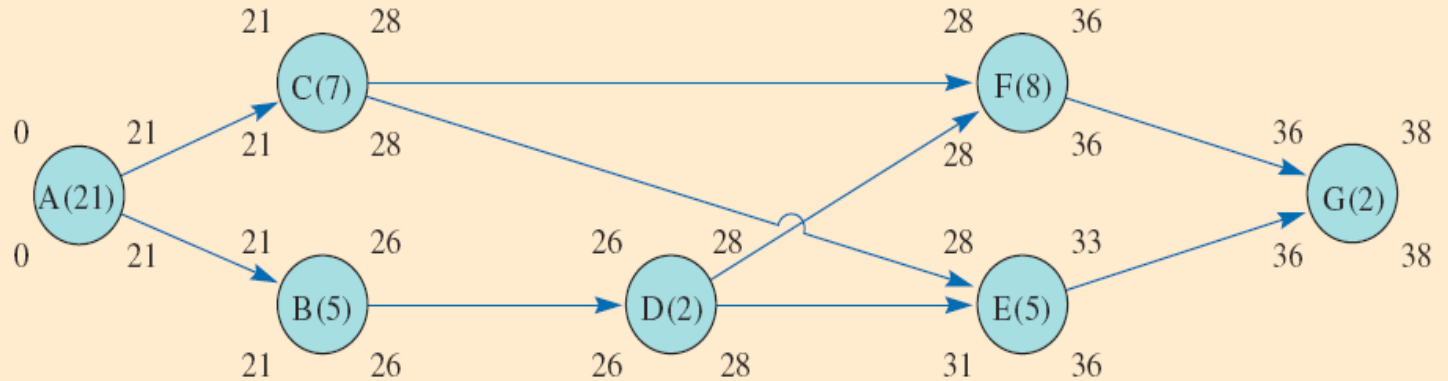
## ➤ Early Start:

- ✓ An early start schedule is one that lists all of the activities by their early start times.
- ✓ For activities not on the critical path, there is slack time between the completion of each activity and start of the next activity.
- ✓ The early start schedule completes the project and all its activities as soon as possible.



# CPM with Activity Time Estimates

# CPM with Activity Time Estimates



SLACK CALCULATIONS AND CRITICAL PATH DETERMINATIONS

ACTIVITY	LS-ES	SLACK	ON CRITICAL PATH
A	0-0	0	✓
B	21-21	0	✓
C	21-21	0	✓
D	26-26	0	✓
E	31-28	3	
F	28-28	0	✓
G	36-36	0	✓

# CPM with Activity Time Estimates

- When activity times vary, a single time estimate may not be reliable  
Instead, estimate three values
  - ✓ Minimum
  - ✓ Maximum
  - ✓ Most likely
- This allows calculation of a probability estimate of completion time
- This is the distinguishing characteristic of the PERT method

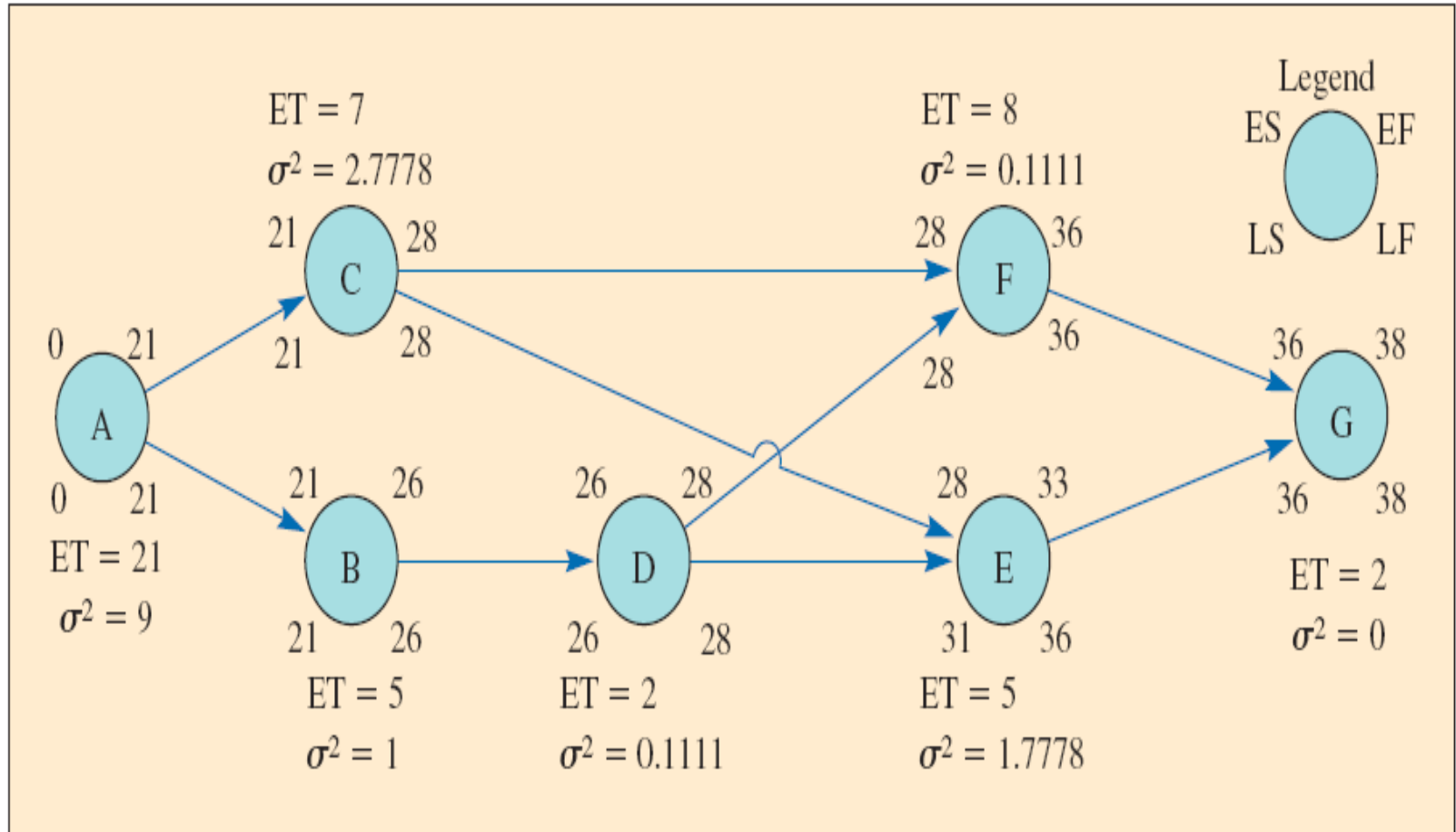
# PERT Method Calculations

- ✓ a = Optimistic time
- ✓ m = Most likely time
- ✓ b = Pessimistic time
- ✓ ET = Expected time  $ET = \frac{a+4m+b}{6}$
- ✓ The 4 and 6 are constants,  $\sigma^2 = \text{Variance } \sigma^2 = \left(\frac{b-a}{6}\right)^2$ ,

Activity	Activity Designation	Time Estimates			Expected Times (ET)	Activity Variance ( $\sigma^2$ )
		a	m	b	$\frac{a+4m+b}{6}$	$\left(\frac{b-a}{6}\right)^2$
Design	A	10	22	28	21	9
Build prototype	B	4	4	10	5	1
Evaluate equipment	C	4	6	14	7	2.7778
Test prototype	D	1	2	3	2	0.1111
Write report	E	1	5	9	5	1.7778
Write methods report	F	7	8	9	8	0.1111
Write final report	G	2	2	2	2	0

# CPM with Activity Time Estimates

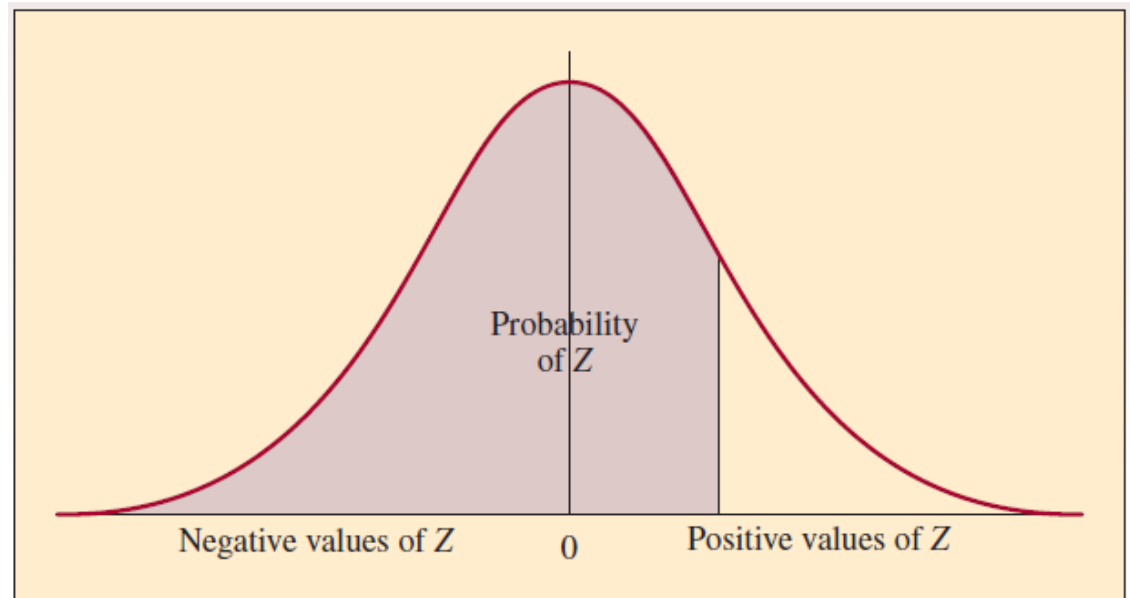
# PERT Method Calculations





## Example- Three Time Estimates

- Probability of finishing in 35 weeks (or less)
- $$Z = \frac{D - T_E}{\sqrt{\sum \sigma_{cp}^2}} = \frac{35 - 38}{\sqrt{11.8889}} = -0.87$$
- Yields probability of 19 percent of being completed in 35 weeks





# CPM with Activity Time Estimates



**Thank You**