ENGR3450 – Project Management

Week 1

Introduction

About Me - About The Course

What is Project? – Project Initiation

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YAŞAR ÜNİVERSİTESİ
Mühendislik Fakültesi

2019, İzmir

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- Graduated from METU -1978
- MBA – Planning & Org. DEU -1995
- IT Manager Tarişbank -2000
- IT Coordinator – Smart Ticketing System 2000-2010
- Part time instructor in IUE 2003-2014
- IT Consultancy training – Meta-USA, Germany
- Solar system design training – SMA Germany 2010
- Part time instructor in YU 2017 - ?

Agenda today

- Aim of the Course
- What is Project?
- Why Projects – Ideal systems
- Project Initiation Context
- Importance of Project Management
- Relationship of Projects, Program, Portfolio, and Operations Management
- Project Life Cycle
- Project Management Process
- PM Process Groups
- PM Knowledge areas

- Course resources – Load Software – Teams for Projects

Aim Of The Course

- Making you accustomed to PMI exams

- Teaching mathematical models-algorithms for PM
  - How to solve them too using
    - Formulas (spreadsheet)
    - Algorithms (Pert – CPM)

- Making you accustomed to PM-Software
  - MS-Project https://products.office.com/en-us/project/project-and-portfolio-management-software
  - Smartsheet https://www.smartsheet.com/

- Making you able to Interview with projectized organizations.

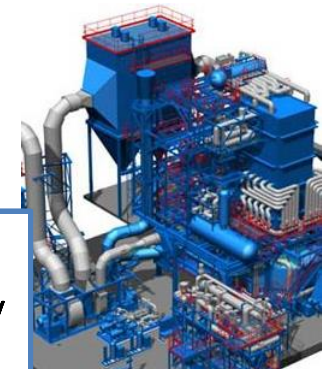
  (Most locate in CA. – Usually innovative and result oriented – Gaining popularity over 70 countries including TURKEY)

  (Without learning PMBOK® terminology it is impossible to interview)

What is Project

From new Bridge on Bosporus
to your new kitchen

Design of a new design
of "hydrogen to electricity
power production unit"



From Uber competitor Europewide
to your company web site

From new production line
to your U shaped Lean workplace

What is Project

Historical perspective

Examples

- Pyramids of Giza,
- Olympic games,
- Great Wall of China,
- Taj Mahal,
- Publication of a children's book,
- Panama Canal,
- Development of commercial jet airplanes,
- Polio vaccine,
- Human beings landing on the moon,
- Commercial software applications,
- Portable devices to use the global positioning system (GPS), and Placement of the International Space Station into Earth's orbit.

PMBOK® Guide – Sixth Edition

What is Project

1. Creates a unique product, service or result.
    - Developing a new pharmaceutical compound for market,
    - Expanding a tour guide service,
    - Merging two organizations,
    - Improving a business process within an organization,
    - Acquiring and installing a new computer hardware system for use in an organization,
    - Exploring for oil in a region,
    - Modifying a computer software program used in an organization,
    - Conducting research to develop a new manufacturing process,
    - Constructing a building.

PMBOK®

What is Project

2. Temporary endeavor - Has a definite beginning or end.

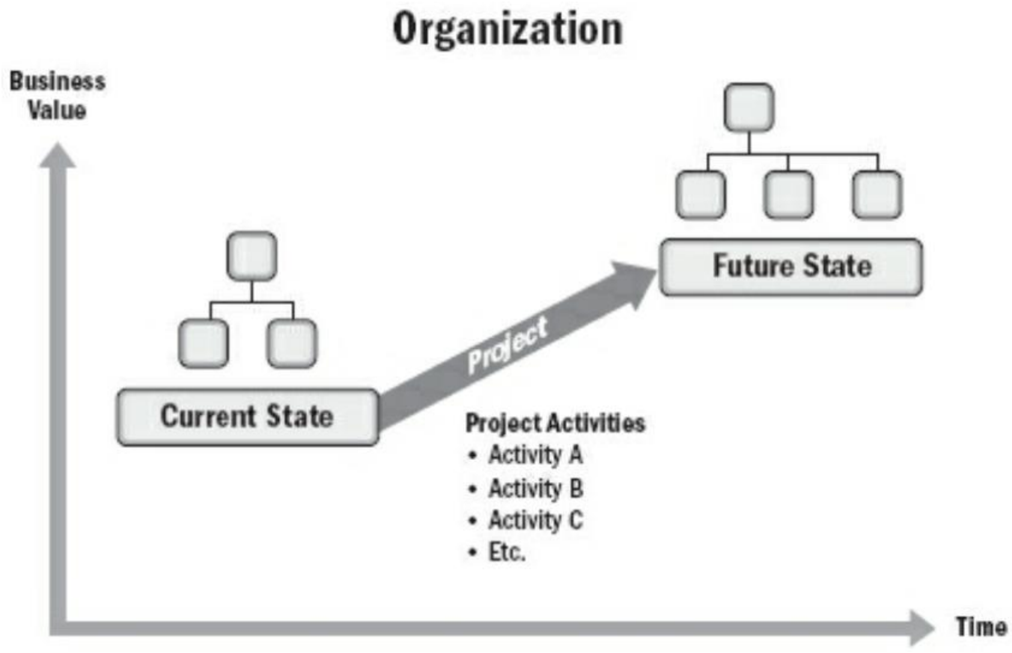
End is reached when:

- The project's objectives have been achieved;
- The objectives will not or cannot be met;
- Funding is exhausted or no longer available for allocation to the project;
- The need for the project no longer exists (e.g., the customer no longer wants the project completed, a change in strategy or priority ends the project, the organizational management provides direction to end the project);
- The human or physical resources are no longer available;
- The project is terminated for legal cause or convenience.

PMBOK®

What is Project

3. Projects drive change over time because of strategy change



PMBOK®

What is Project

4. Projects enable business value creation

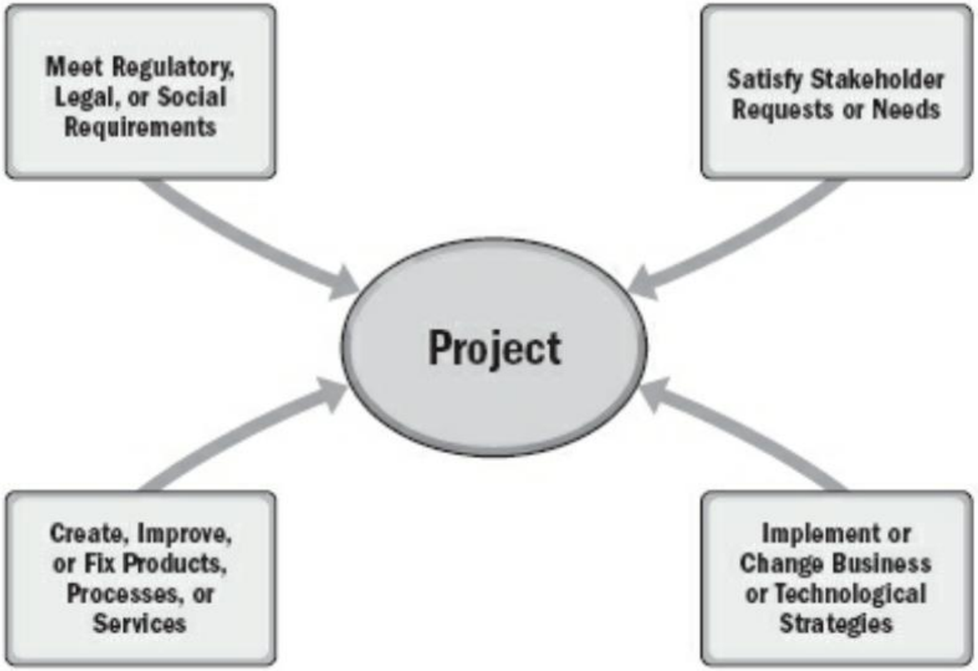
Business value in projects refers to the benefit that the results of a specific project provide to its stakeholders both tangible or intangible.

- Monetary assets,
- Stockholder equity,
- Utility,
- Fixtures,
- Tools,
- Market share.

- Goodwill,
- Brand recognition,
- Public benefit,
- Trademarks,
- Strategic alignment,
- Reputation.

Project Initiation Context

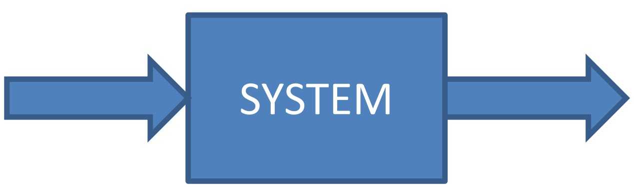
5. Project Initiation



Why Projects
IDEAL System - Can It Be Real

AVAILABLE SYSTEM

- Some Cost
- Some Production
- Some Service



IDEAL SYSTEM

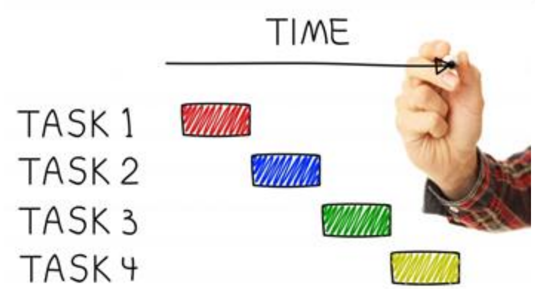
- Zero Cost
- Infinite Production
- Infinite Satisfaction

We need BRIGHT IDEAS

AND

MONEY to invest

Approach to Ideal
By means of Projects



What is Project Management

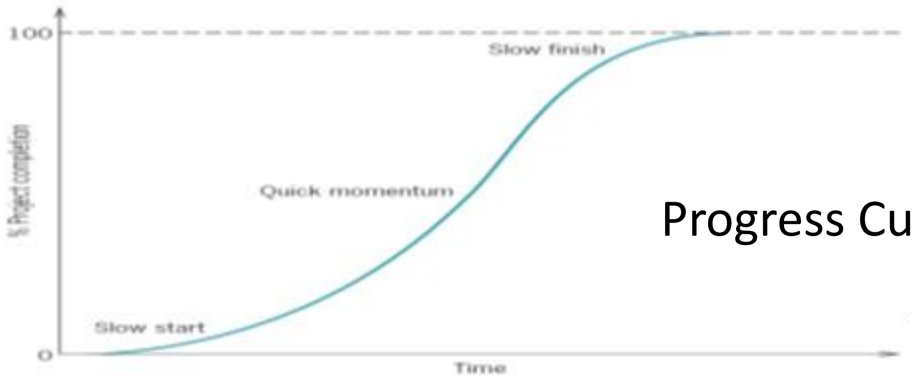
The application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. Project management is accomplished through the appropriate application and integration project management processes identified for the project. It enables organizations to execute projects effectively and efficiently.

Importance of Project Management

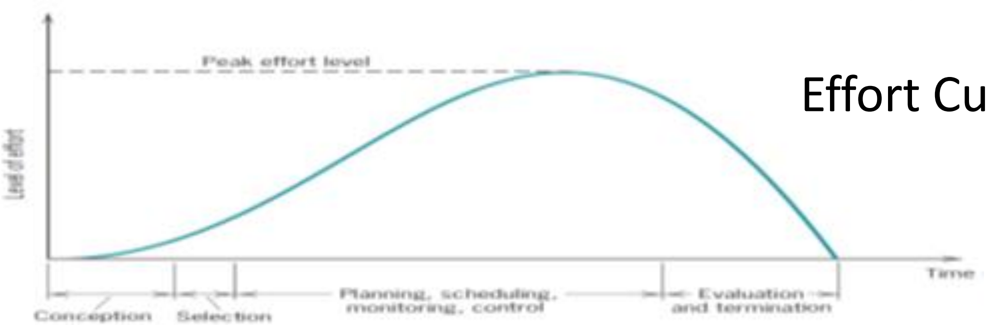
Effective PM

- Meet business objectives;
- Satisfy stakeholder expectations;
- Be more predictable;
- Increase chances of success;
- Deliver the right products at the right time;
- Resolve problems and issues;
- Respond to risks in a timely manner;
- Optimize the use of organizational resources;
- Identify, recover, or terminate failing projects;
- Manage constraints (e.g., scope, quality, schedule, costs, resources);
- Balance the influence of constraints on the project (e.g., increased scope may increase cost or schedule);
- Manage change in a better manner.

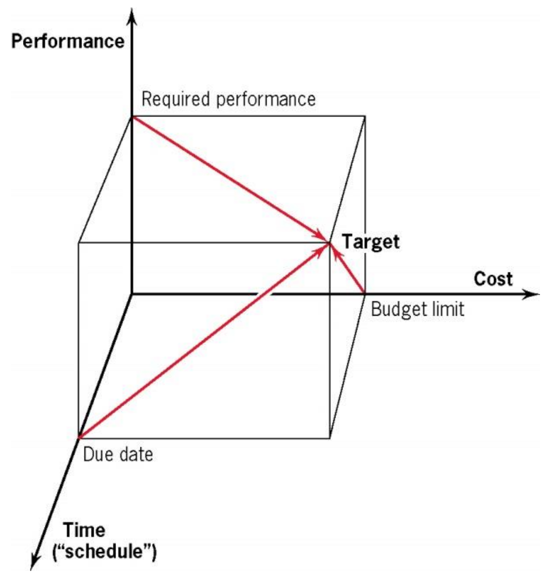
Effective Project Management



Progress Curve



Effort Curve



Importance of Project Management

Effective PM – Strategic Competency

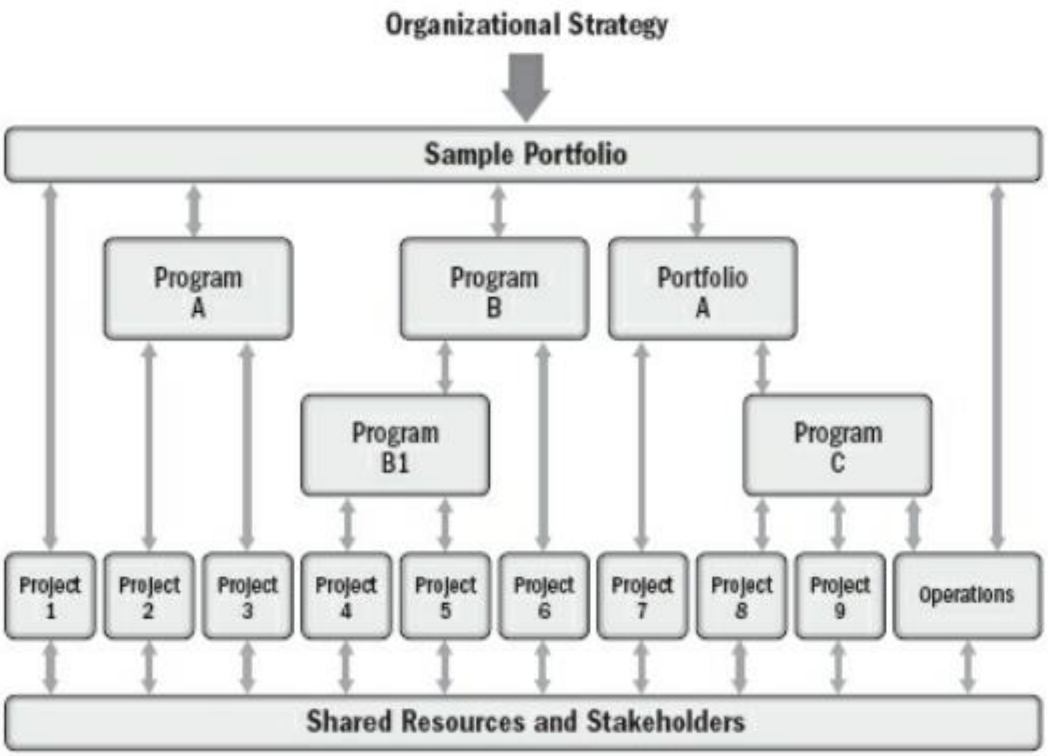
- Tie project results to business goals,
- Compete more effectively in their markets,
- Sustain the organization,
- Respond to the impact of business environment changes on projects by appropriately adjusting project management plans

Importance of Project Management

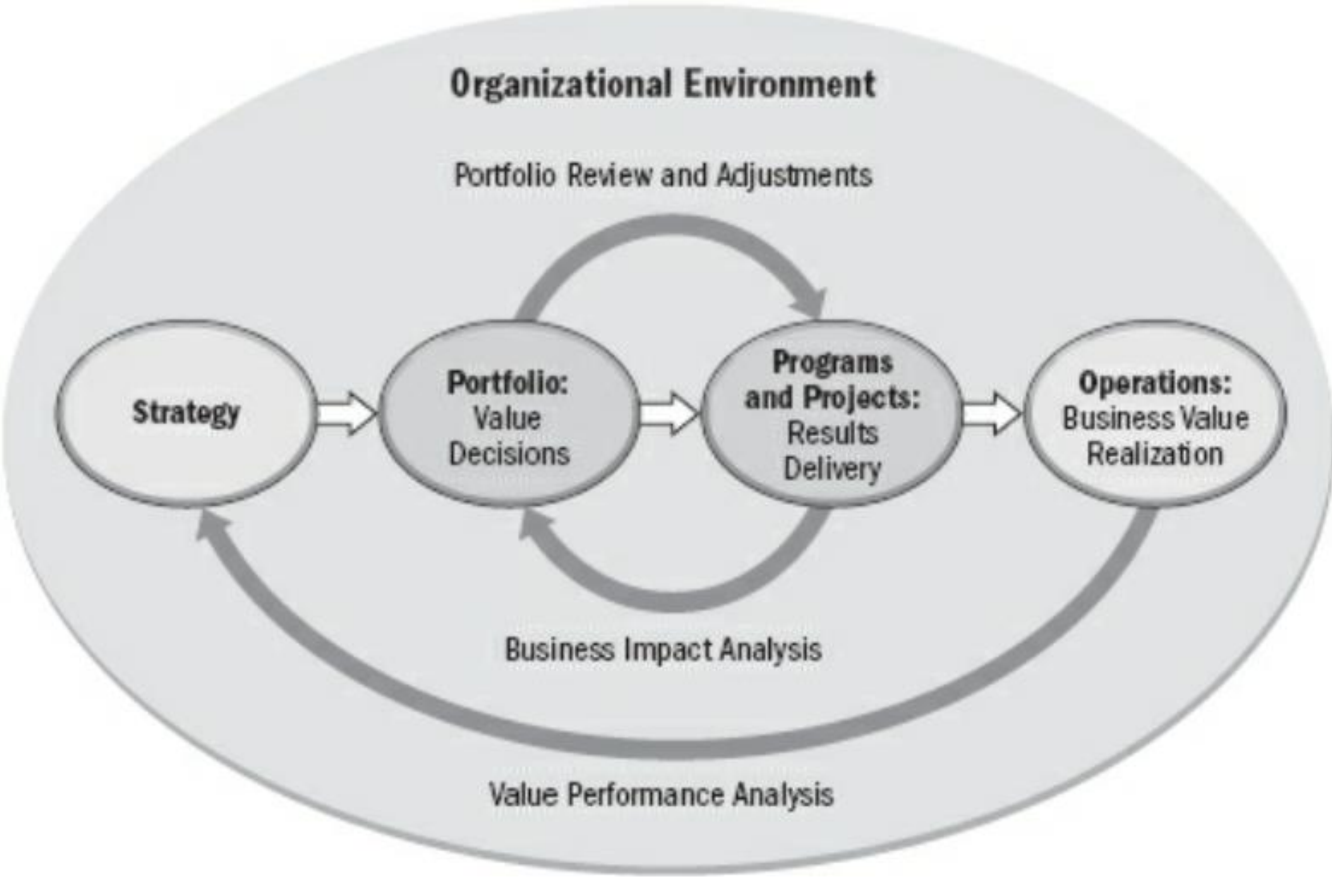
Poor PM

- Missed deadlines,
- Cost overruns,
- Poor quality,
- Rework,
- Uncontrolled expansion of the project,
- Loss of reputation for the organization,
- Unsatisfied stakeholders,
- Failure in achieving the objectives for which the project was undertaken.

Portfolio – Programs – Projects - Operations



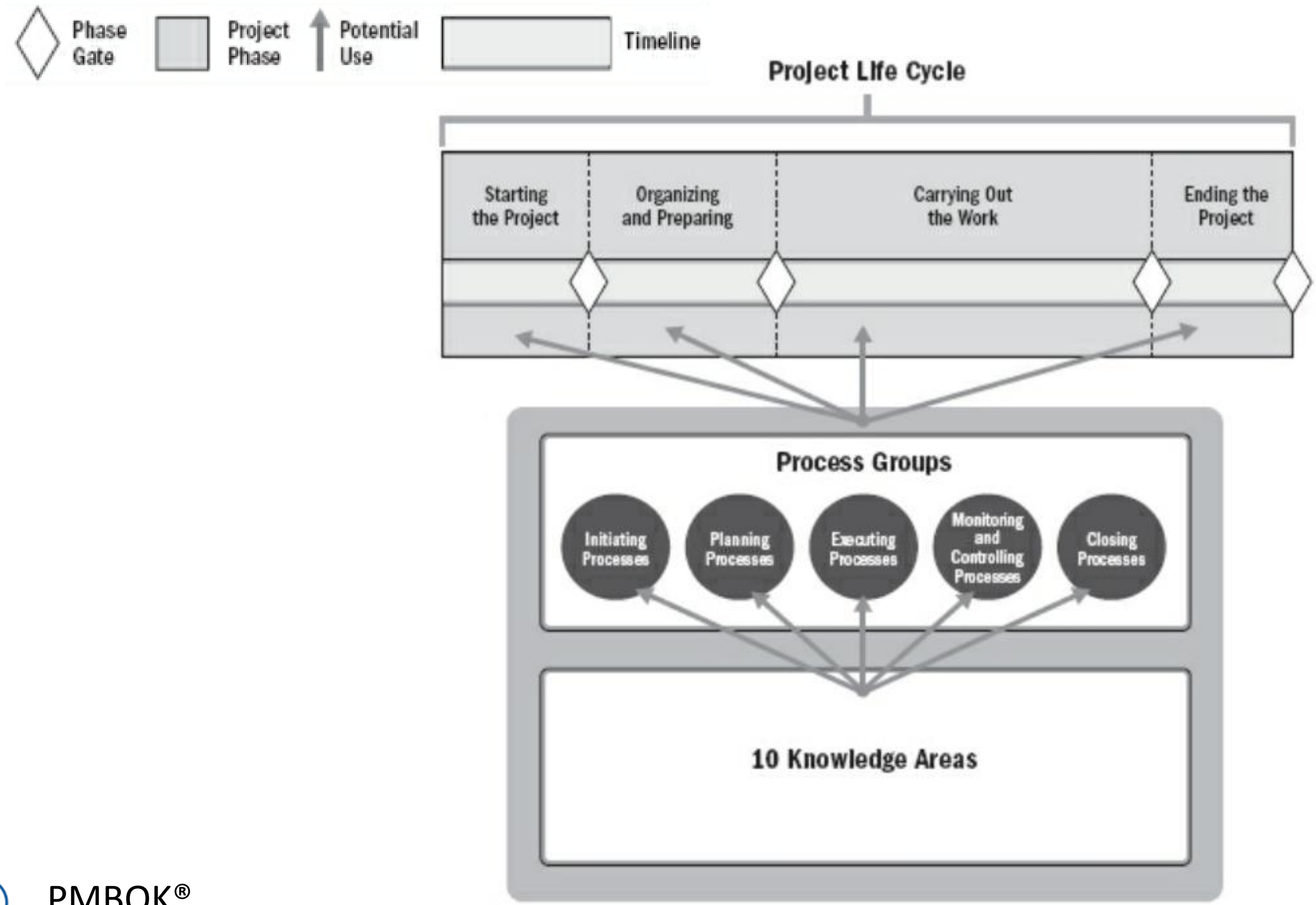
Portfolio – Programs – Projects - Operations



Key Components of a Project

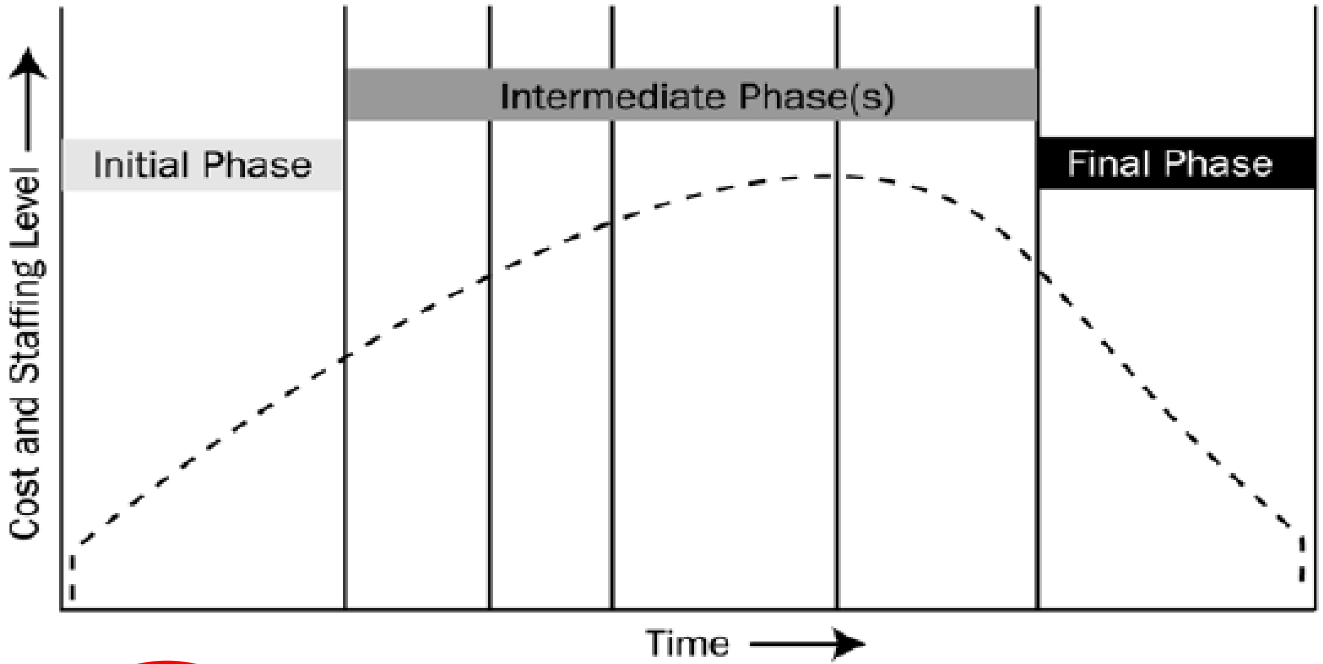
- Project Life Cycle
- Project Phase
- Phase Gate
- Project Management Processes
- Project Management Process Groups
- Project Management Knowledge Areas

Project Life Cycle



PMBOK®

Project Life Cycle



1. Project Initiation, Selection and Definition

2. Project Planning, Modeling and Scheduling

3. Project Implementation and Control

4. Project Evaluation and Termination

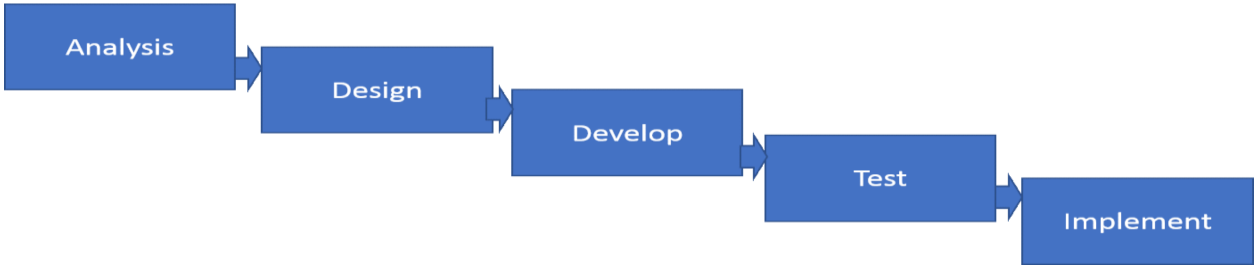
PMBOK®

Project and Development Life Cycles
Predictive Life Cycle

- In a predictive life cycle, the project scope, time, and cost are determined in the early phases of the life cycle.

- Any changes to the scope are carefully managed.

- Predictive life cycles may also be referred to as waterfall life cycles.



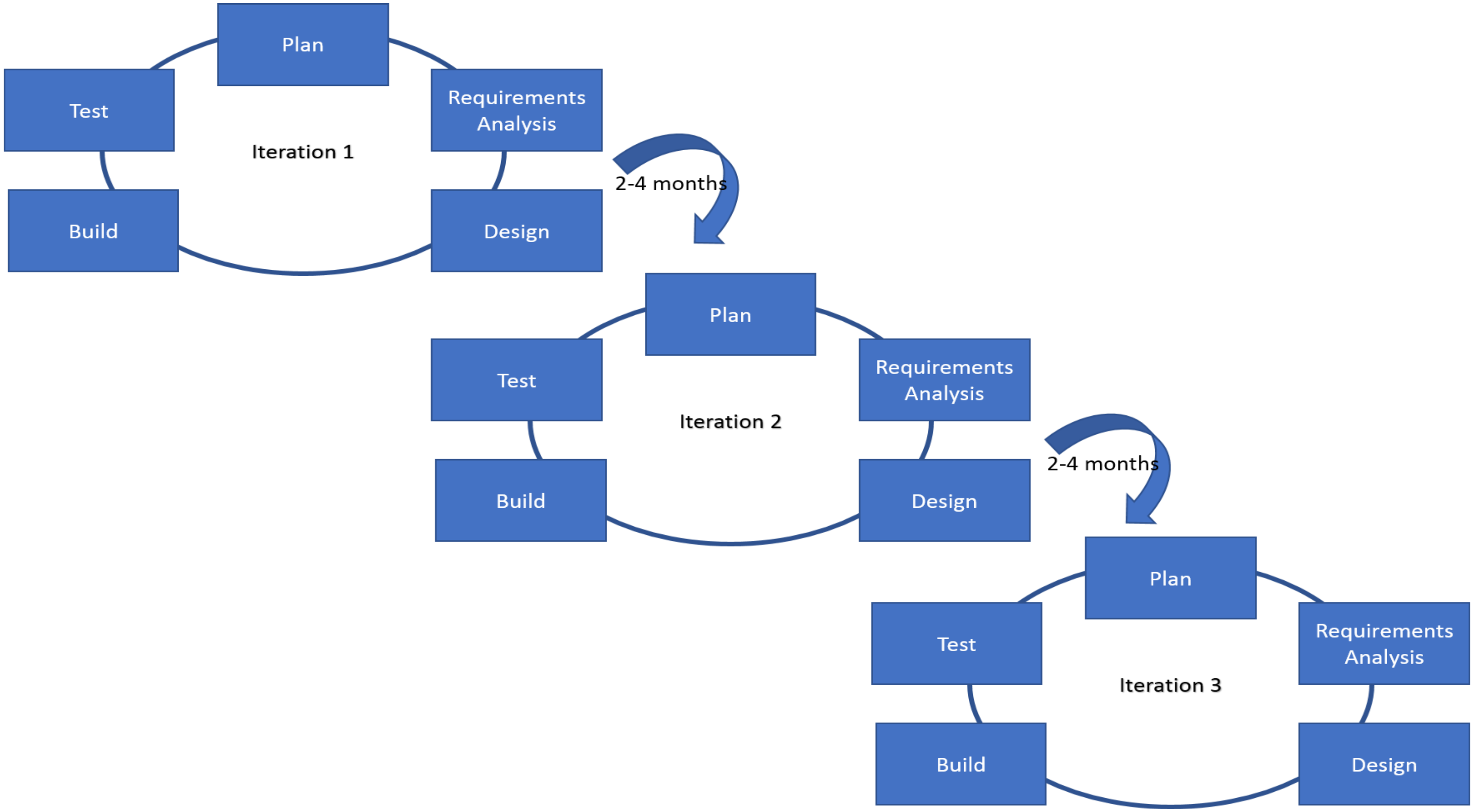
Project and Development Life Cycles
Iterative Life Cycle

- The project scope is generally determined early in the project life cycle,

- Time and cost estimates are routinely modified as the project team's understanding of the product increases.

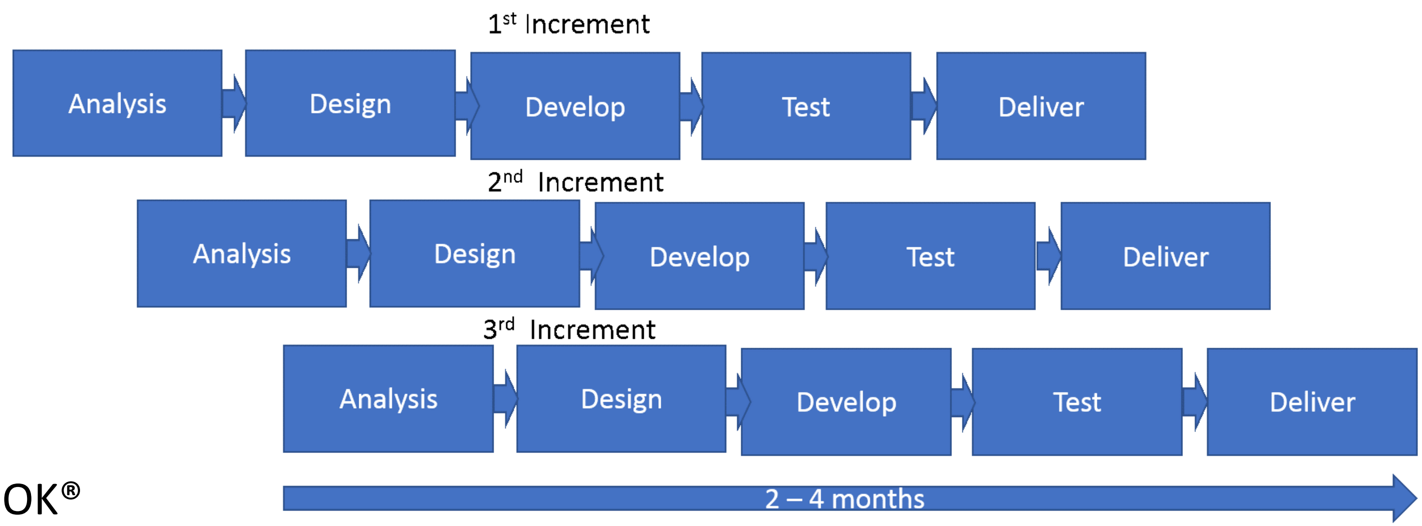
- Iterations develop the product through a series of repeated cycles, while increments successively add to the functionality of the product.

Project and Development Life Cycles
Iterative Life Cycle



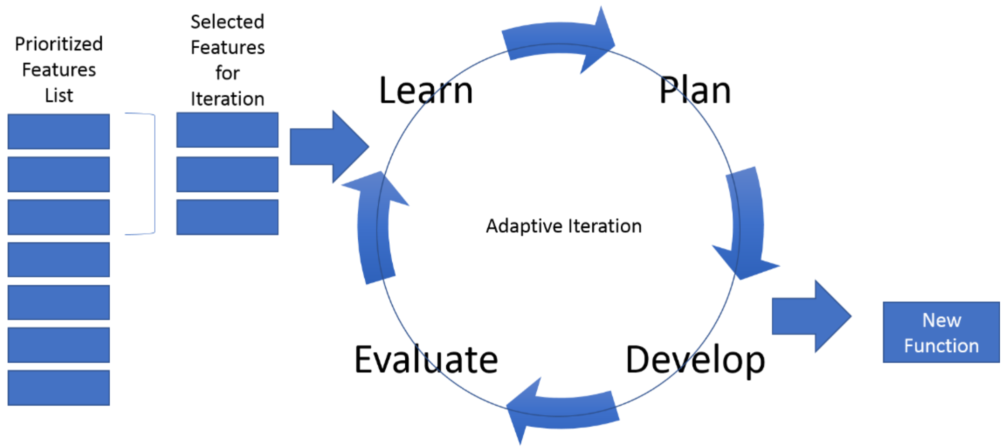
Project and Development Life Cycles
Incremental Life Cycle

- The deliverable is produced through a series of iterations that successively add functionality within a predetermined time frame.
- The deliverable contains the necessary and sufficient capability to be considered complete only after the final iteration.



Project and Development Life Cycles
Adaptive Life Cycle

- Adaptive life cycles are agile, iterative, or incremental.
- The detailed scope is defined and approved before the start of an iteration.
- Adaptive life cycles are also referred to as agile or change-driven life cycles.



Project and Development Life Cycles
Hybrid Life Cycle

- A hybrid life cycle is a combination of a predictive and an adaptive life cycle.

- Those elements of the project that are well known or have fixed requirements follow a predictive development life cycle, and those elements that are still evolving follow an adaptive development life cycle.

Project Phase

- A project phase is a collection of logically related project activities that culminates in the completion of one or more deliverables.

- The phases in a life cycle can be described by a variety of attributes.

- Attributes may be measurable and unique to a specific phase. Attributes may include but are not limited to:

Phase Attributes

- Name (e.g., Phase A, Phase B, Phase 1, Phase 2, proposal phase),
- Number (e.g., three phases in the project, five phases in the project),
- Duration (e.g., 1 week, 1 month, 1 quarter),
- Resource requirements (e.g., people, buildings, equipment),
- Entrance criteria for a project to move into that phase (e.g., specified approvals documented, specified documents completed),
- Exit criteria for a project to complete a phase (e.g., documented approvals, completed documents, completed deliverables).

Project Phases and Establish Bases

- Concept development,
- Feasibility study,
- Customer requirements,
- Solution development,
- Design,
- Prototype,
- Build,
- Test,
- Transition,
- Commissioning,
- Milestone review,
- Lessons learned.

Management needs;

Nature of the project;

Unique characteristics of the organization, industry, or technology;

Project elements including, but not limited to, technology, engineering, business, process, or legal;

Decision points (e.g., funding, project go/no-go, and milestone review).

Phase Gate

A phase gate, is held at the end of a phase. The project's performance and progress are compared to project and business documents including but not limited to:

- Project business case
- Project charter
- Project management plan
- Benefits management plan

A decision (e.g., go/no-go decision) is made as a result of this comparison to:

- Continue to the next phase,
- Continue to the next phase with modification,
- End the project,
- Remain in the phase,
- Repeat the phase or elements of it.

Project Management Process

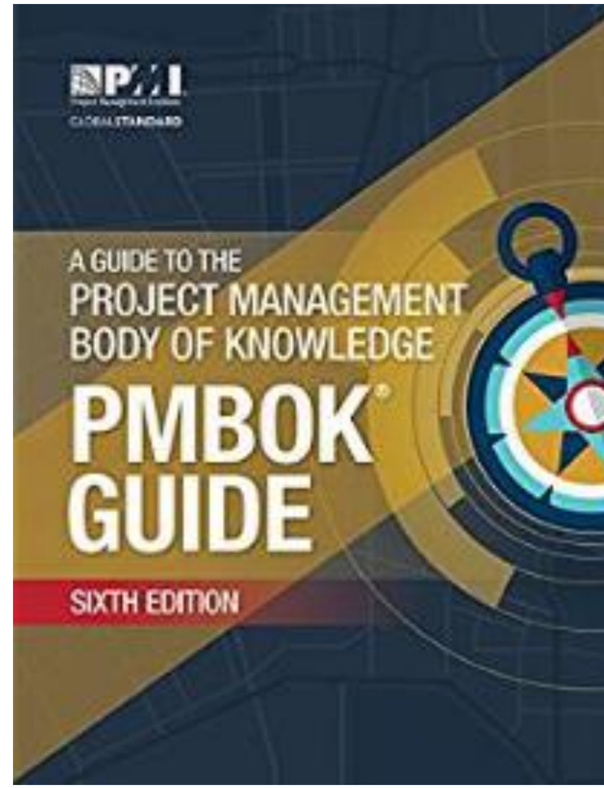
PM Process Groups

- Initiating Process Group.
- Planning Process Group.
- Executing Process Group.
- Monitoring and Controlling Process Group.
- Closing Process Group.

PM Knowledge Areas

- Project Integration Management.
- Project Scope Management.
- Project Schedule Management.
- Project Cost Management.
- Project Quality Management.
- Project Resource Management.
- Project Communications Management.
- Project Risk Management.
- Project Procurement Management.
- Project Stakeholder Management.

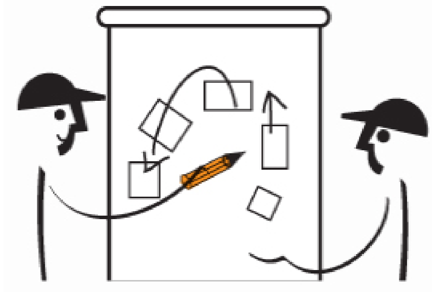
Course resources



Teams for your projects

Teams preferably can be the same of your project course

- Teams of 3 to 5
  - 3 or 5 is better
  - (you will have free software for each computer)
- Team should be of the same section.
- But from Different Departments

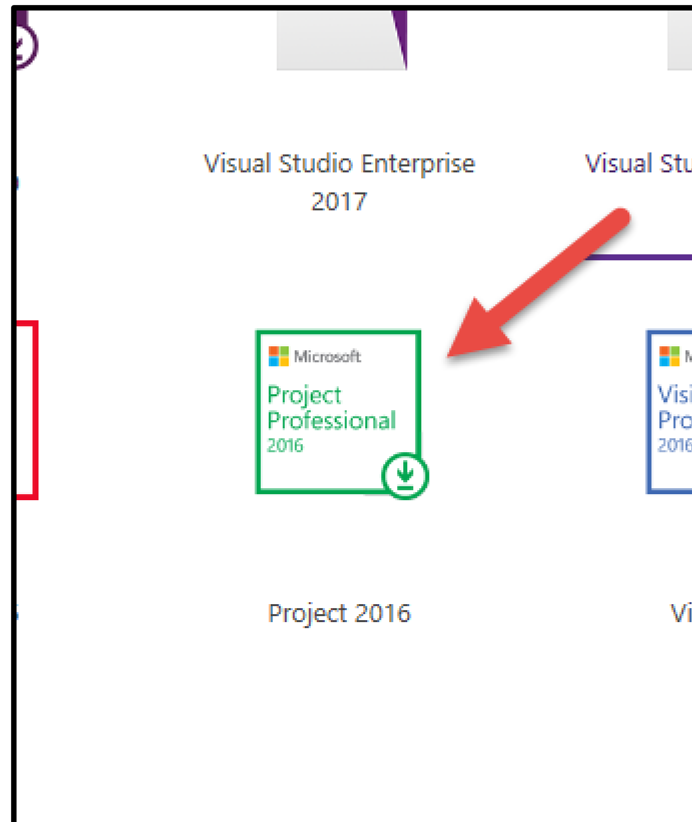


Workshop & Assignment

Load MS Project

https://e5.onthehub.com/WebStore/ProductsByMajorVersionList.aspx?ws=44b496ae-799b-e011-969d-0030487d8897&vsro=8

- Go to the address at top
- Select the software
- Select English version
- Add to basket
- Login by your e-mail of @yasar.edu and load.
- If you cannot, connect to Admin C H ??.



Questions

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NEXT WEEK: Project Environment

Project Selection Models

Exam problems - solutions

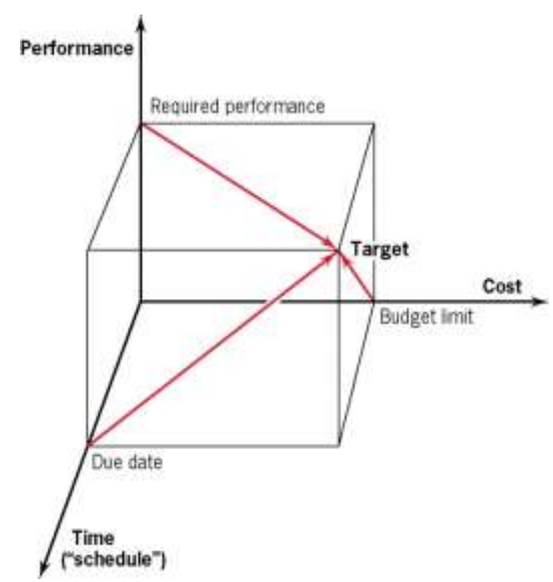
Workshop & quiz

ENGR3450 – Project Management

Lecture 2

Project Environment

Project Selection Models



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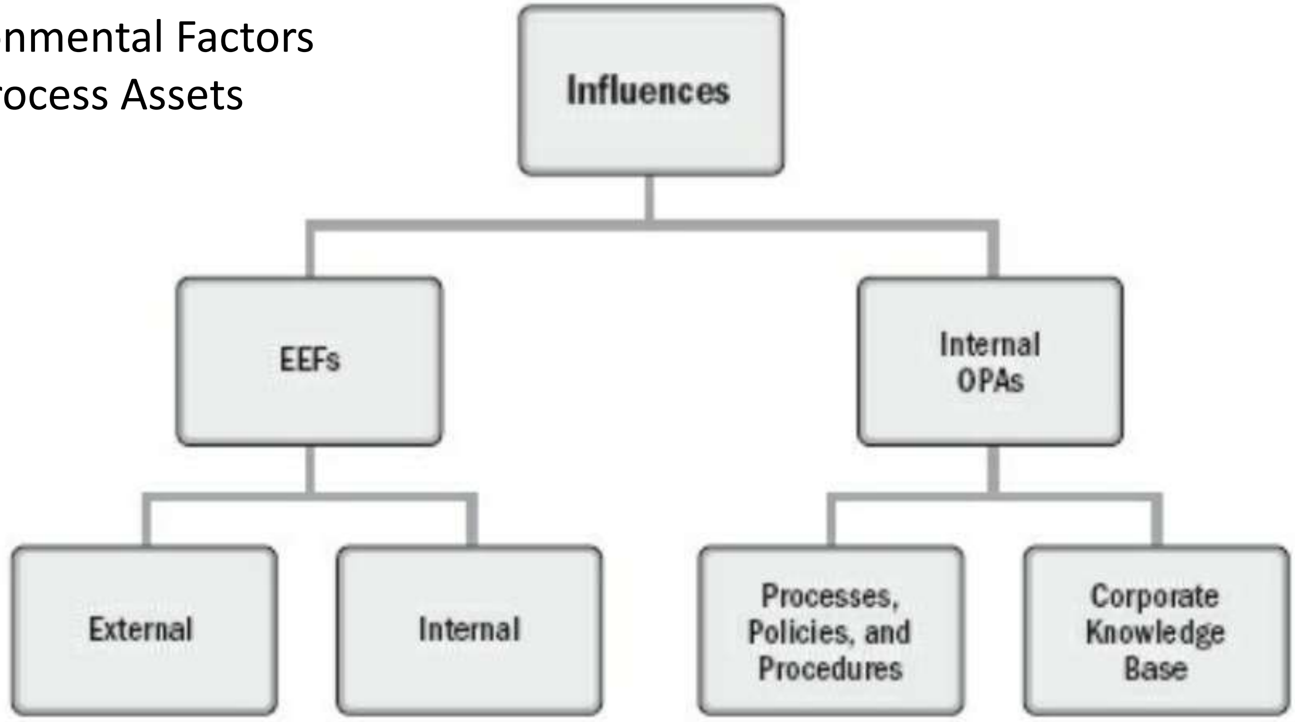
Agenda today

- Environmental factors
  - Organizational Process Assets
  - Organizational Systems
  - Project Initiation Context
- Project Selection Models
  - Non Numeric Models
  - Numeric Models
- Problem solutions

- Workshop & quiz

Environmental Factors

- Enterprise Environmental Factors
- Organizational Process Assets



EEFs

Internal to the organization

- Organizational culture, structure, and governance.
- Geographic distribution of facilities and resources.
- Infrastructure.
- Information technology software.
- Resource availability.
- Employee capability.

EEFs

External to the organization

- Marketplace conditions.
- Social and cultural influences and issues.
- Legal restrictions.
- Commercial databases.
- Academic research.
- Government or industry standards.
- Financial considerations.
- Physical environmental elements.

Organizational Process Assets

Internal

- Processes, policies, and procedures;
- Organizational knowledge bases.

If your organization do not have them;
You should write them as Policies or guides and send a summary to Board Of Directors for approval.
They may call you for presentation too.

(It is a hard job but you will be great at the end)

Organizational Process Assets

Processes – Policies – Procedures (Includes but are not limited to)

- Initiating Planning Phase
  - Guidelines and criteria for tailoring the organization's set of standard processes and procedures to satisfy the specific needs of the project;
  - Specific organizational standards such as policies
  - Product and project life cycles, and methods and procedures
  - Templates
  - Preapproved supplier lists and various types of contractual agreements

Organizational Process Assets

Processes – Policies – Procedures (Includes but are not limited to)

- Executing Monitoring and Controlling
  - Change control procedures, including the steps by which performing organization standards, policies, plans, and procedures or any project documents will be modified, and how any changes will be approved and validated;
  - Traceability matrices;
  - Financial controls procedures;
  - Issue and defect management procedures;
  - Resource availability control and assignment management;
  - Organizational communication requirements;
  - Procedures for prioritizing, approving, and issuing work authorizations;
  - Templates;
  - Standardized guidelines, work instructions, proposal evaluation criteria, and performance measurement criteria;
  - Product, service, or result verification and validation procedures.

Organizational Process Assets

Processes – Policies – Procedures (Includes but are not limited to)

- Close Up
  - Closing. Project closure guidelines or requirements (e.g., final project audits, project evaluations, deliverable acceptance, contract closure, resource reassignment, and knowledge transfer to production and/or operations).

Organizational Process Assets

Organizational knowledge bases

- Organizational knowledge bases
  - Configuration Management Knowledge Base
  - Finanical Data Base
  - Historical Information and Lessons Learned Knowledge Base
  - Issue and Defect Management Data Base
  - Project Files from Previous Projects

Organizational Systems

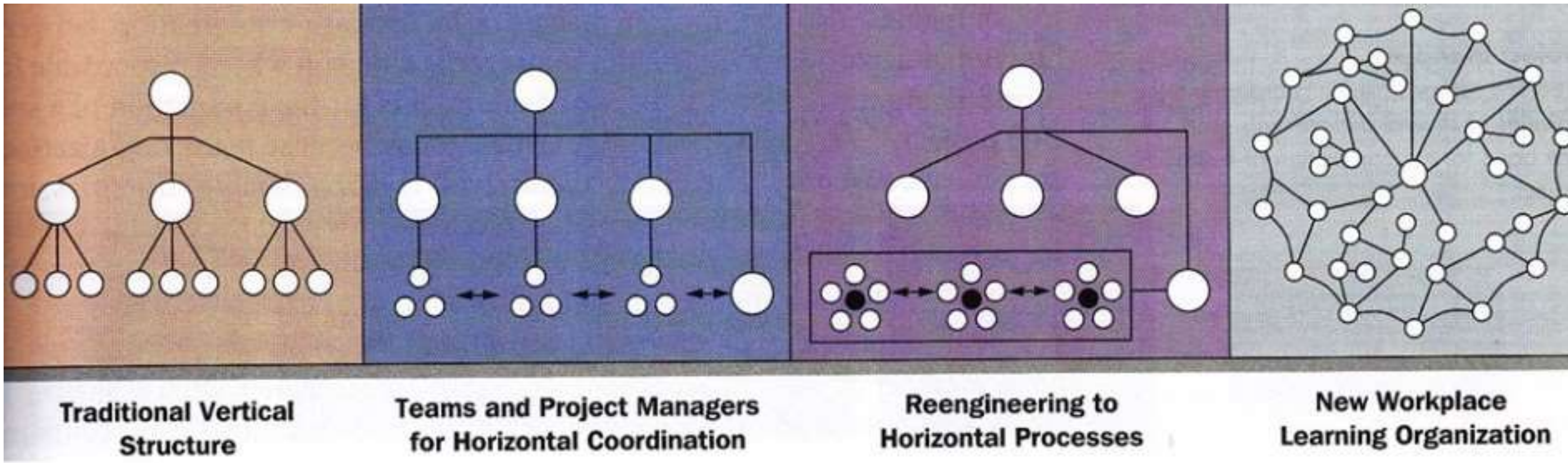
- Systems are dynamic,
- Systems can be optimized,
- System components can be optimized,
- Systems and their components cannot be optimized at the same time, and Systems are nonlinear in responsiveness
  - A change in the input does not produce a predictable change in the output.

Organizational Systems

- Organizational Structure Types
- Governance Frameworks
- Management Elements

Organizational Systems

Structure



Organizational Systems
Governance Framework

- Rules,
- Policies,
- Procedures,
- Norms,
- Relationships,
- Systems,
- Processes.

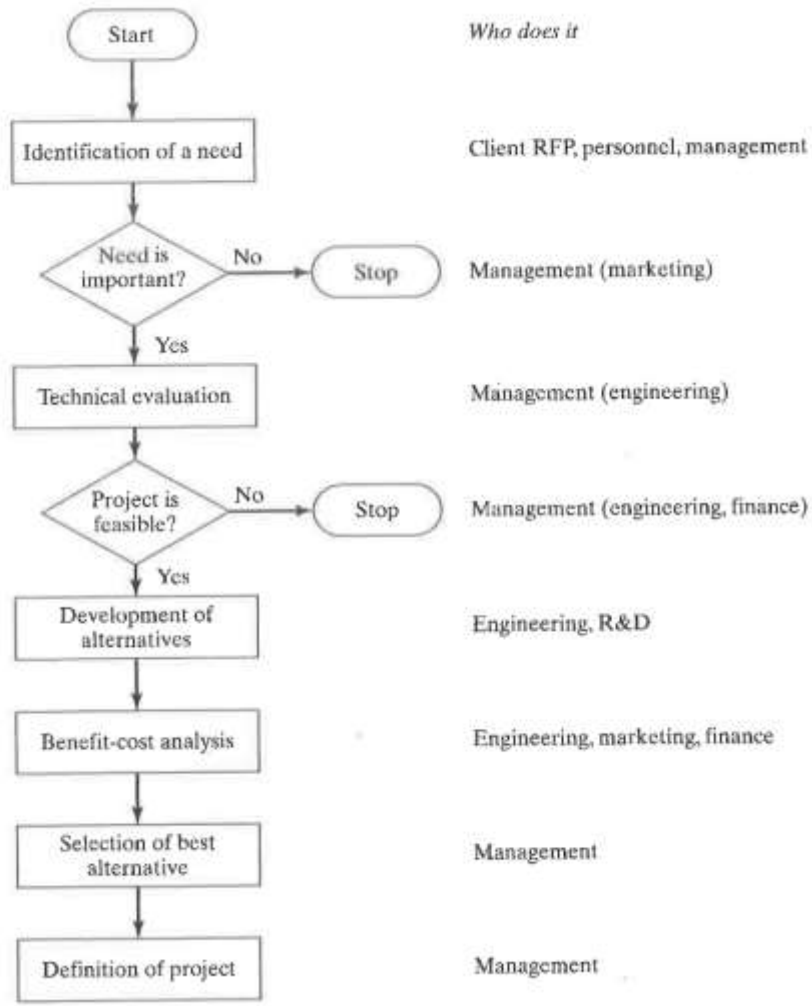
This framework influences how:
Objectives of the organization are set and achieved,
Risk is monitored and assessed,
and Performance is optimized.

Organizational Systems

Management Elements

- Division of work using specialized skills and availability to perform work;
- Authority given to perform work;
- Responsibility to perform work appropriately assigned based on such attributes as skill and experience;
- Discipline of action (e.g., respect for authority, people, and rules);
- Unity of command (e.g., only one person gives orders for any action or activity);
- Unity of direction (e.g., one plan and one head for a group of activities)
- General goals of the organization take precedence over individual goals;
- Paid fairly for work performed;
- Optimal use of resources;
- Clear communication channels;
- Right materials to the right person for the right job at the right time;
- Fair and equal treatment of people in the workplace;
- Clear security of work positions;
- Safety of people in the workplace;
- Open contribution to planning and execution by each person;
- Optimal morale.

Project Initiation Context



Need is translated into technical specifications

Feasibility Analysis
(Market, economic, technical, environmental,... appraisal)

- Estimation of costs and returns
- Project Selection
- Keep the scope under control!

Project Initiation Context

How to Make Boss(es) Believe

- Good analysis of present situation
- Being analytical with numbers
  - Show opportunities first threads later
- Presenting the future idea
  - In less than 20 minutes (best is one second)
  - In half page summary with full analysis document
- Use of tools like
  - Spreadsheet – presentation – etc.

Project Selection Models

- Nonnumeric models
- Numeric models

Project Selection Models

Non Numeric Models

- Sacred Cow
  - A project, often suggested **by top management**,
- Operating Necessity
  - To keep the company in operation.
- Competitive Necessity
  - To maintain the company’s position in the marketplace.
- Product Line Extension
  - A new product in the same product line of an existing brand.
- Comparative Benefit
  - Projects are subjectively rank ordered based on their perceived benefit.
- Sustainability
  - Carbon footprint is a measurable fact in some countries.

Project Selection Models

Scoring

1. Profit/profitability
2. Scoring

Project Selection Models

Profit /Profitability Models

- Models that look at costs and revenues
    1. Payback period
    2. Discounted cash flow (NPV)
    3. Internal rate of return (IRR)
    4. Profitability index

- NPV and IRR are the most common ones

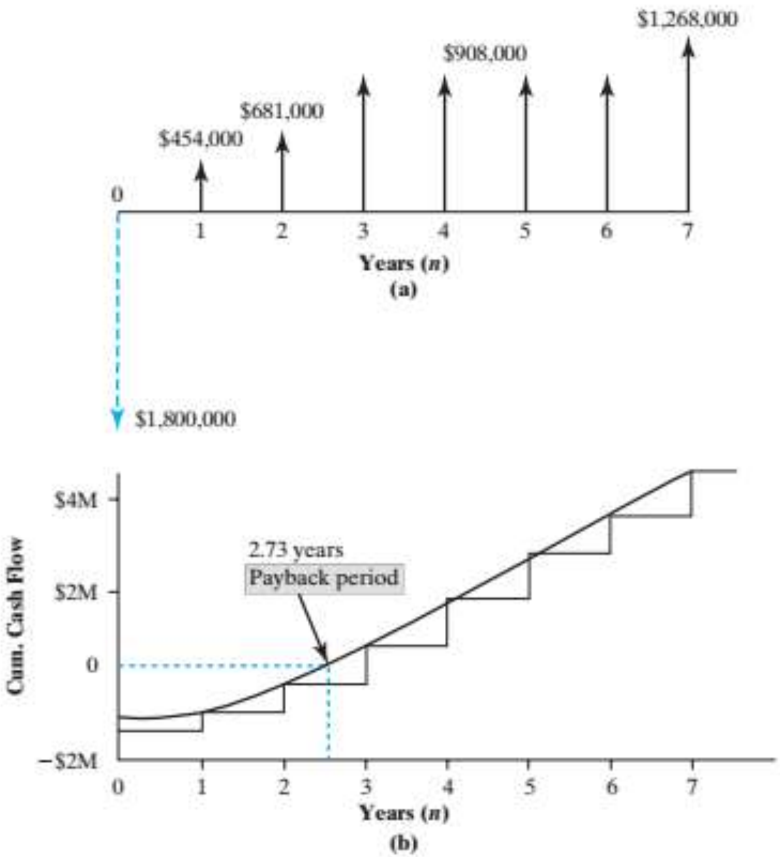
(Engineering Economics)

Project Selection Models

Payback Period (Rough but fast calculation)

Period	Cash Flow	Cumulative Cash Flow
0	–$1,800,000	–$1,800,000
1	454,000	–1,346,000
2	681,000	–665,000
3	908,000	243,000
4	908,000	1,151,000
5	908,000	2,059,000
6	908,000	2,967,000
7	1,268,000	4,235,000

	Current Cost (% Saved)	Savings
Setup	$335,000 (70%)	$234,500
Scrap/Rework	58,530 (85%)	49,750
Operators	220,000 (100%)	220,000
Fixturing	185,000 (85%)	157,250
Programming Time	80,000 (60%)	48,000
Floor Space	35,000 (65%)	22,750
Maintenance	45,000 (60%)	27,000
Coolant	15,000 (50%)	7,500
Inspection	120,000 (100%)	120,000
Documentation	5,000 (50%)	2,500
Expediting	25,000 (75%)	18,750
	Total Annual Savings	**$908,000**



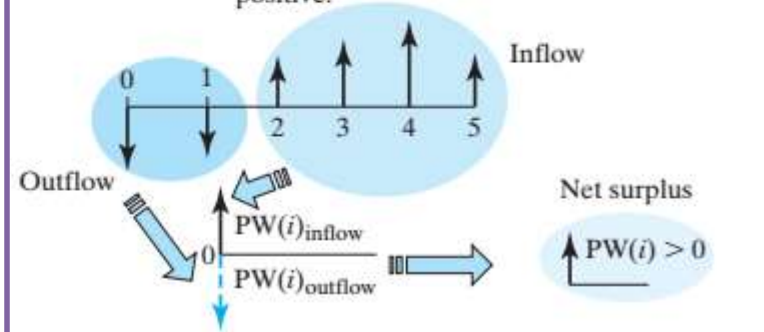
Project Selection Models

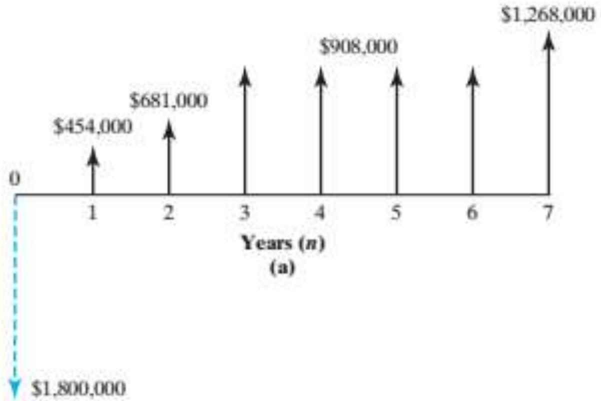
Profit/Profitability - NPV Method

$$\begin{aligned}\mathrm{PW}(i) &= \frac{A_0}{(1+i)^0} + \frac{A_1}{(1+i)^1} + \frac{A_2}{(1+i)^2} + \cdots + \frac{A_N}{(1+i)^N} \\ &= \sum_{n=0}^{N} \frac{A_n}{(1+i)^n} \\ &= \sum_{n=0}^{N} A_n(P/F, i, n),\end{aligned}$$

Principle: Compute the equivalent net surplus at $n = 0$ for a given interest rate of i.

Decision Rule: Accept the project if the net surplus is positive.





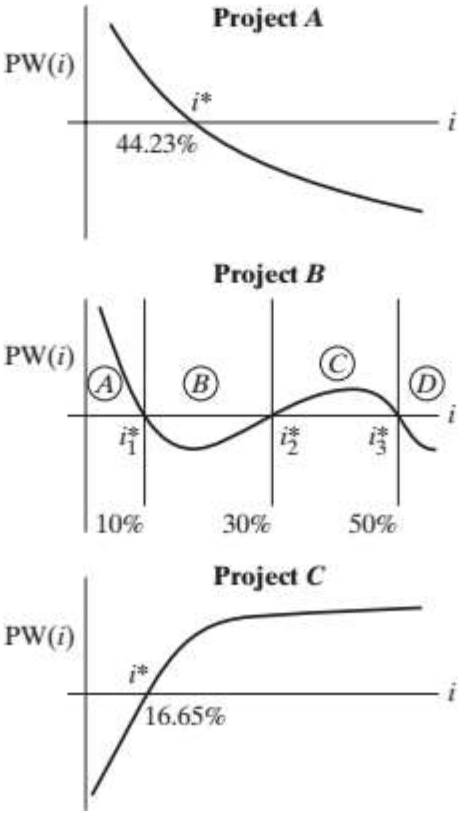
$$\begin{aligned}\mathrm{PW}(15\%) = & -\$1{,}800{,}000 + \$454{,}000(P/F, 15\%, 1) \\ & + \$681{,}000(P/F, 15\%, 2) \\ & + \$908{,}000(P/A, 15\%, 4)(P/F, 15\%, 2) \\ & + \$1{,}268{,}000(P/F, 15\%, 7) \\ = & \ \$1{,}546{,}571.\end{aligned}$$

Project Selection Models

Profit/Profitability - IRR Method

$$PW(i^*) = \frac{A_0}{(1+i^*)^0} + \frac{A_1}{(1+i^*)^1} + \cdots + \frac{A_N}{(1+i^*)^N} = 0$$

Solve for NPV=0



You may need to use trial-error for i sometimes

Sign change in cash flow may cause complex

Project Selection Models

Profit/Profitability - IRR Method

- **Direct-solution** method from the formula (not so easy over second degree)
- **Trial-and-error** method (you may use simulation if you are a good SW guy)
- **Excel** method (Best but may not work correctly over complex cash flows)

You may do comparison of projects too but you may need to get an **Engineering Economics** class.

	A	B	C	D
1	Example 7.10 - Comparing Unequal-Service-Life Problems			
2				
3		Option 1	Option 2	Incremental
4		Conveyor Systems	Lift Trucks	Option 1 – Option 2
5				
6	0	$ (68,000)	$ (40,000)	$ (28,000)
7	1	$ (13,000)	$ (15,000)	$ 2,000
8	2	$ (13,000)	$ (15,000)	$ 2,000
9	3	$ (13,000)	$ (15,000)	$ 2,000
10	4	$ (13,000)	$ (15,000)	$ 2,000
11	5	$ (13,000)	$ (15,000)	$ 2,000
12	6	$ (13,000)	$ (19,000)	$ 6,000
13	7	$ (13,000)	$ (23,000)	$ 10,000
14	8	$ (31,000)	$ (23,000)	$ (8,000)
15	9	$ (13,000)	$ (23,000)	$ 10,000
16	10	$ (7,000)	$ (15,000)	$ 8,000
17				
18			Incremental IRR	3.90%
21				

=IRR(D6:D16,15%)

=NPV is available in Excel too.

Project Selection Models

Profability Index

Also known as the benefit–cost ratio, the profitability index is the net present value of all future expected cash flows divided by the initial cash investment.
(Some firms do not discount the cash flows in making this calculation.) If this ratio is greater than 1.0, the project may be accepted.

Project Selection Models

Scoring

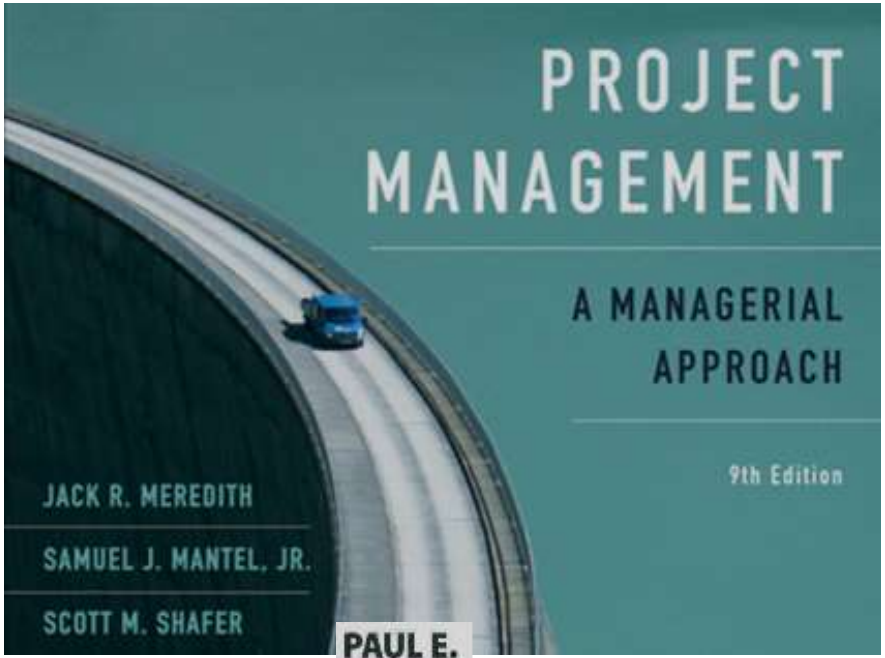
- Mimics how managers actually evaluate investments
- Uses multiple criteria
  - Can utilize both monetary and qualitative factor
- Weighted factor scoring model

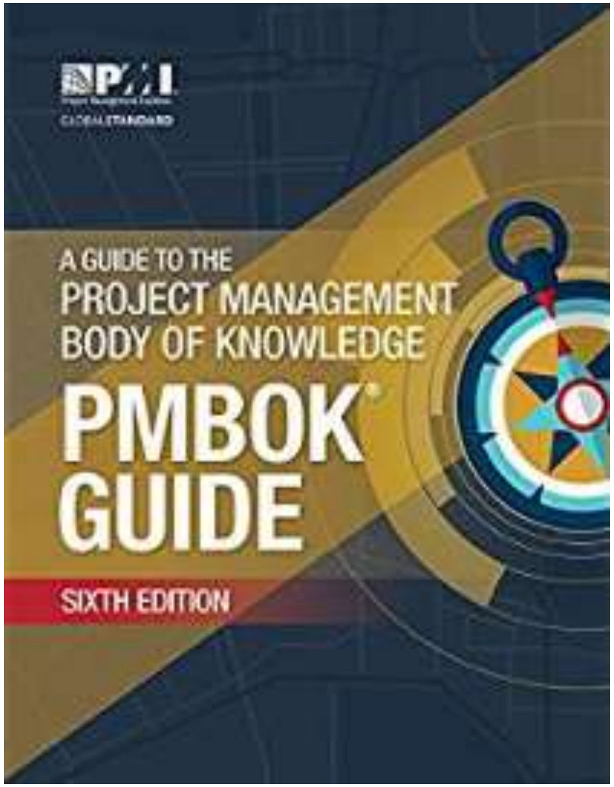
Project Selection Models

Weighted Factor Scoring Model

- Each factor is weighted relative to its importance
  - Weighting allows important factors to stand out
- A good way to include nonnumeric data in the analysis
- Factors need to sum to one
- All weights must be set up, so higher values mean more desirable
- Small differences in totals are not meaningful

Course resources





Solve Questions For the exam

PROBLEMS

1. Two new Internet site projects are proposed to a young start-up company. Project A will cost $250,000 to implement and is expected to have annual net cash flows of $75,000. Project B will cost $150,000 to implement and should generate annual net cash flows of $52,000. The company is very concerned about their cash flow. Using the payback period, which project is better, from a cash flow standpoint?
2. Sean, a new graduate at a telecommunications firm, faces the following problem his first day at the firm: What is the average rate of return for a project that costs $200,000 to implement and has an average annual profit of $30,000?
3. A four-year financial project has net cash flows of $20,000; $25,000; $30,000; and $50,000 in the next 4 years. It will cost $75,000 to implement the project. If the required rate of return is 0.2, conduct a discounted cash flow calculation to determine the NPV.
4. What would happen to the NPV of the above project if the inflation rate was expected to be 4 percent in each of the next 4 years?
5. Calculate the profitability index for Problem 3. For Problem 4.
6. A 4-year financial project has estimates of net cash flows shown in the following table:

Year	Net Cash Flow
1	$20,000
2	25,000
3	30,000
4	35,000

It will cost $65,000 to implement the project, all of which must be invested at the beginning of the project. After the fourth year, the project will have no residual value.

Using the most likely estimates of cash flows, conduct a discounted cash flow calculation assuming a 20 percent hurdle rate with no inflation. (You may use either Excel® or a paper-and-pencil calculation.) What is the discounted profitability index of the project?

7. Use a weighted score model to choose between three methods (A, B, C) of financing the acquisition of a major competitor. The relative weights for each criterion are shown in the following table as are the scores for each location on each criterion. A score of 1 represents unfavorable, 2 satisfactory, and 3 favorable.

		Method		
Category	**Weight**	**A**	**B**	**C**
Consulting costs	20	1	2	3
Acquisition time	20	2	3	1
Disruption	10	2	1	3
Cultural differences	10	3	3	2
Skill redundancies	10	2	1	1
Implementation risks	25	1	2	3
Infrastructure	10	2	2	2

End Of Chapter: Problems 1 to 7

Available on Palme bookstore

Workshop and quiz

Download pdf format of WorkShop01 from Lectures. No Grade

This work shop is only to prepare your MS-Project for future works.

Do the quiz on-line from lectures.yasar.edu.tr 5pts.

Questions

hp@quiztechnology.com

NEXT WEEK:	The Project Manager	Ch 3
	Managing Conflicts	Ch 4
	Integration Management	PMBOK Ch 4
	The Project in Organizational Structures	Ch 5

Workshop	5 pts
On-Line quiz	5 pts

LAST SLIDE

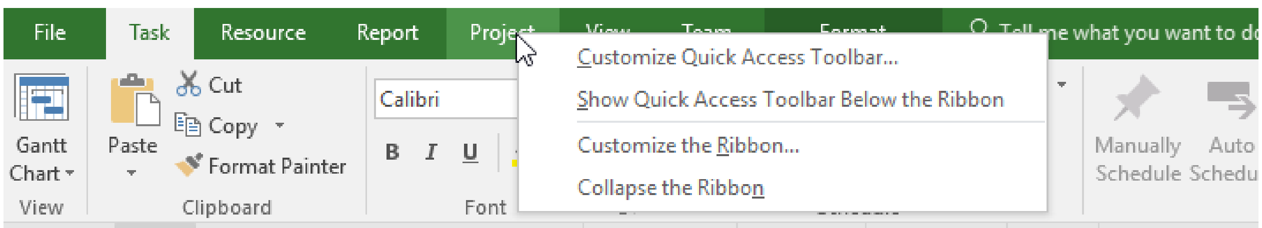
Workshop 1 – Navigation and Setting Your Project Options Background

In this workshop you will practice navigating around the screen, set the options to allow durations to be entered in days, ensure that a useful date format is displayed and ensure other options are set so the software operates in a simpler mode than the standard defaults.

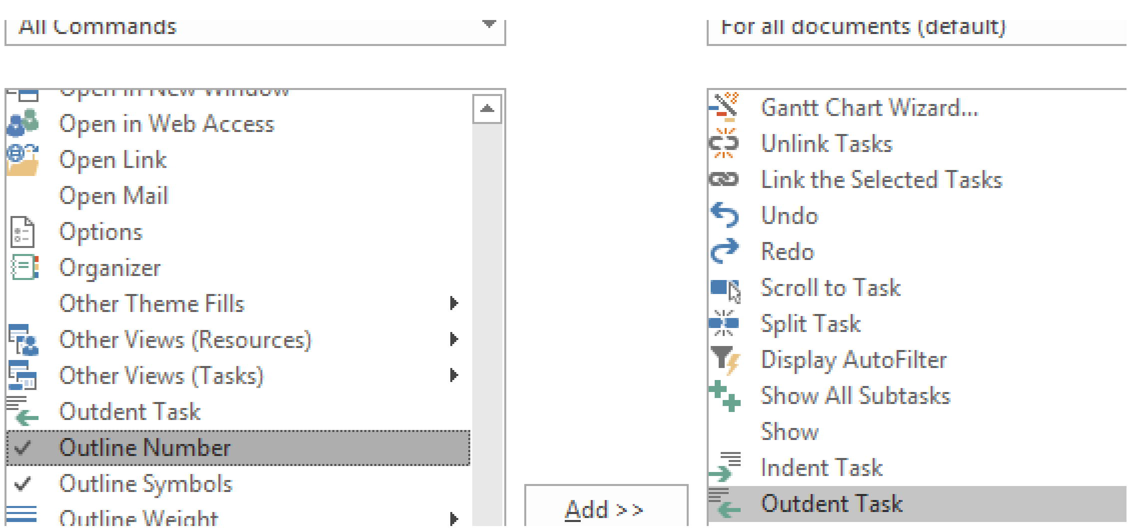
Navigation practice

1. Click on the Ribbon Toolbar menu at the top of the screen, work your way through the tabs and observe what commands are located on each tab, the toolbars in Project 2013 and 2016 are slightly different: Microsoft Project 2016 Microsoft Project 2013

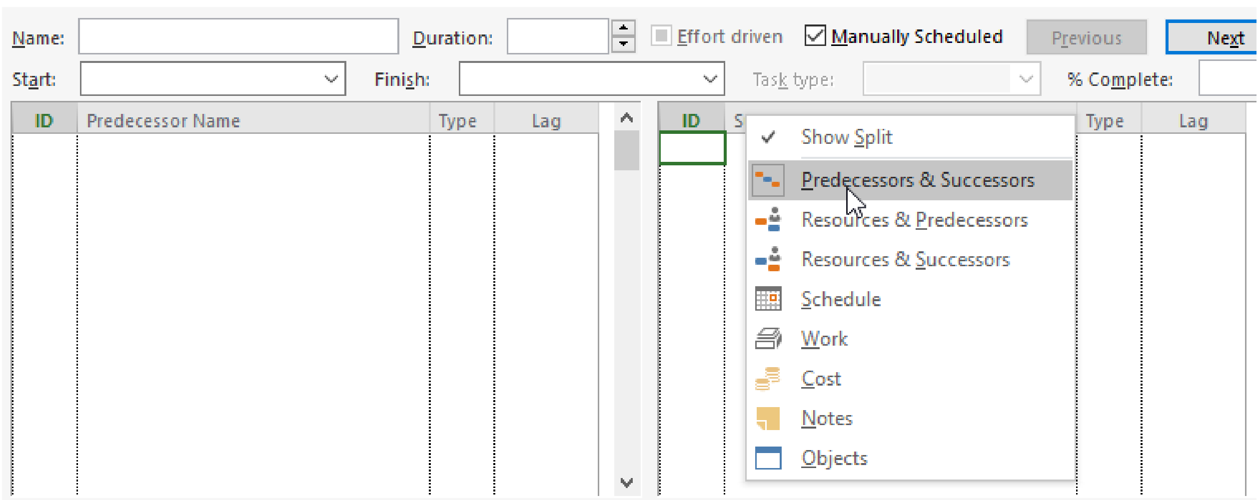
2. Right-click on the Ribbon Toolbar and display the Ribbon Toolbar Menu:



3. To allow more buttons to be displayed on the Quick Access Toolbar, click on the Show Quick Access Toolbar below the Ribbon to move the Quick Access Toolbar below the Ribbon Toolbar.
4. From the same menu, click on the Customize Quick Access Toolbar… to open the “Project Options” form. This form may also be opened by selecting File, Options. Now explore the tabs on the left-hand side of the Project Options form.
5. With the Project Options form open, click on the Quick Access Toolbar tab and add the following frequently used buttons to the Quick Access Toolbar, if they not already displayed:



6. Click on the Customize Ribbon tab in the File, Options to open the Project options form, ensure that Developer tab is checked. The Developer tab will now be displayed on the Ribbon to allow access the Organizer form more easily, and then close the form.
7. Right-click on the Ribbon Toolbar and display the Ribbon Toolbar Menu. Click on Collapse the Ribbon to hide the Ribbon Toolbar. When you click in the Gantt-Chart area the Ribbon will minimize and more work area will be available allowing you to see more tasks. This is useful when you have a small screen.
8. Right-click in the Gantt-Chart, select Show Split to split the window and this will show the Task form in the bottom window.
9. Make the bottom window active by clicking in it.
10. Note the text on the left-hand side of the screen is highlighted, when moving from the top pane to the bottom pane. The active pane has the highlighted text. This may be quite hard to see with some screen colors.
11. Right-click in the bottom pane and select the different menu options to see how the Task Details form changes with the different options. Leave this form with the Predecessors and Successors option displayed.



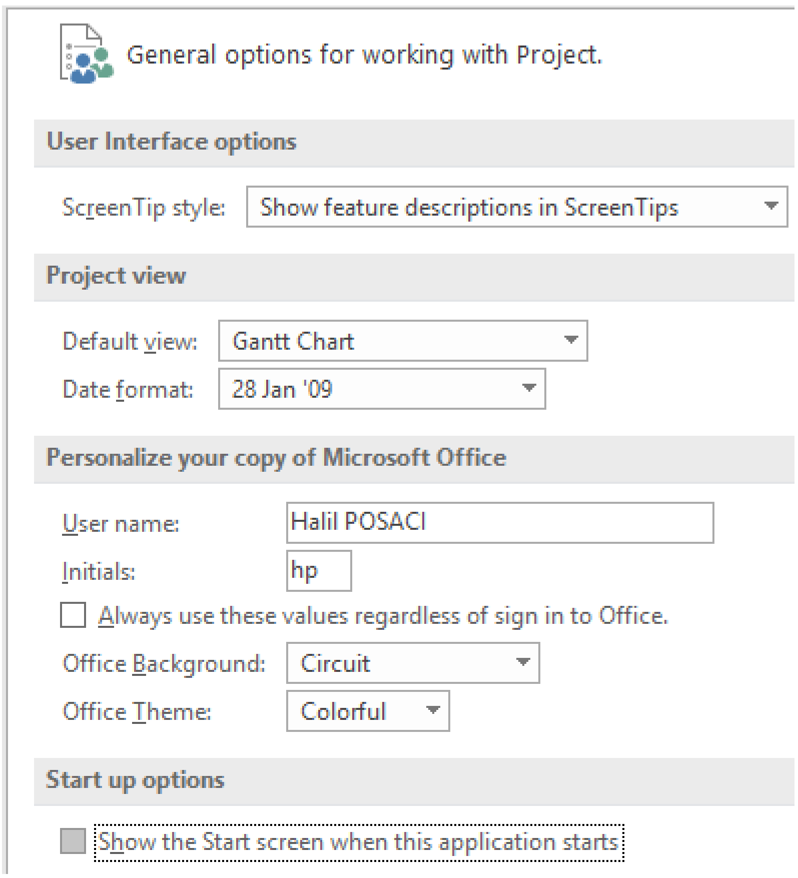
12. Activate the upper pane, by clicking in it.
13. Resize the panes by dragging the Split screen bar.
14. Close the Split screen by double-clicking on the horizontal dividing line.
15. Split the screen by double-clicking on the small bar in the bottom right-hand corner of the screen.

Assignment – Set the Options

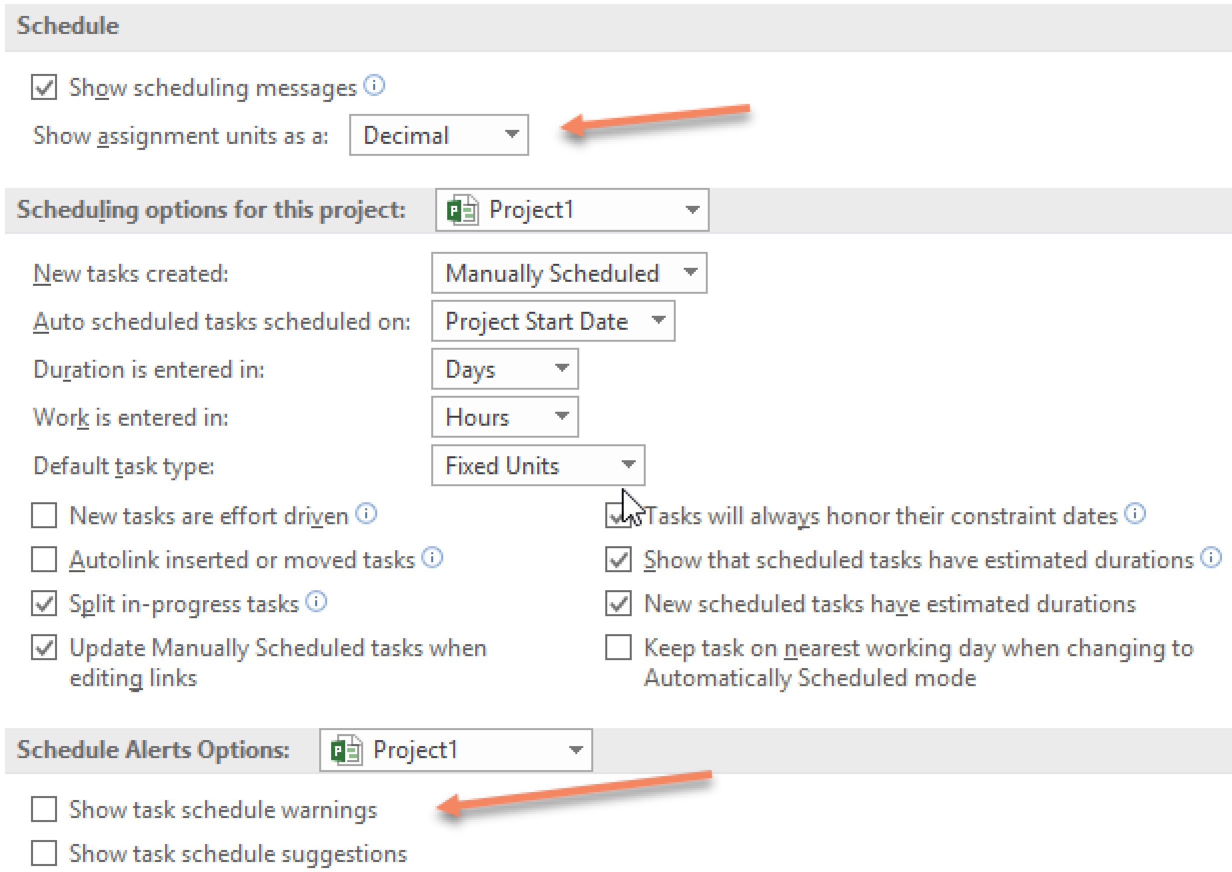
1. Close your project by selecting File, Close and do not save any changes, you should have Microsoft Project open, but no projects in view and a blank screen.
2. Select File, Options to open the Project Options form.
3. Select General tab and set the Default View to Gantt-Chart.
4. Set the Date format: to either: “ddmmmyy” i.e., 28 Jan ’09, or “mmmddyy” i.e., Jan 28 ’09.

NOTE: The available date format will depend on your system settings, set in the system Control Panel, Region and Language Options. If you wish to show the time in 24 hour format then there is more information in the OPTIONS chapter, para 22.1.2 Project view.

5. Enter your name and initials.
6. If you uncheck the Start-up options, Show the Start screen when this application starts then the Start Screen will not be displayed when you start Microsoft Project and you will be taken straight to the Gantt Chart View.

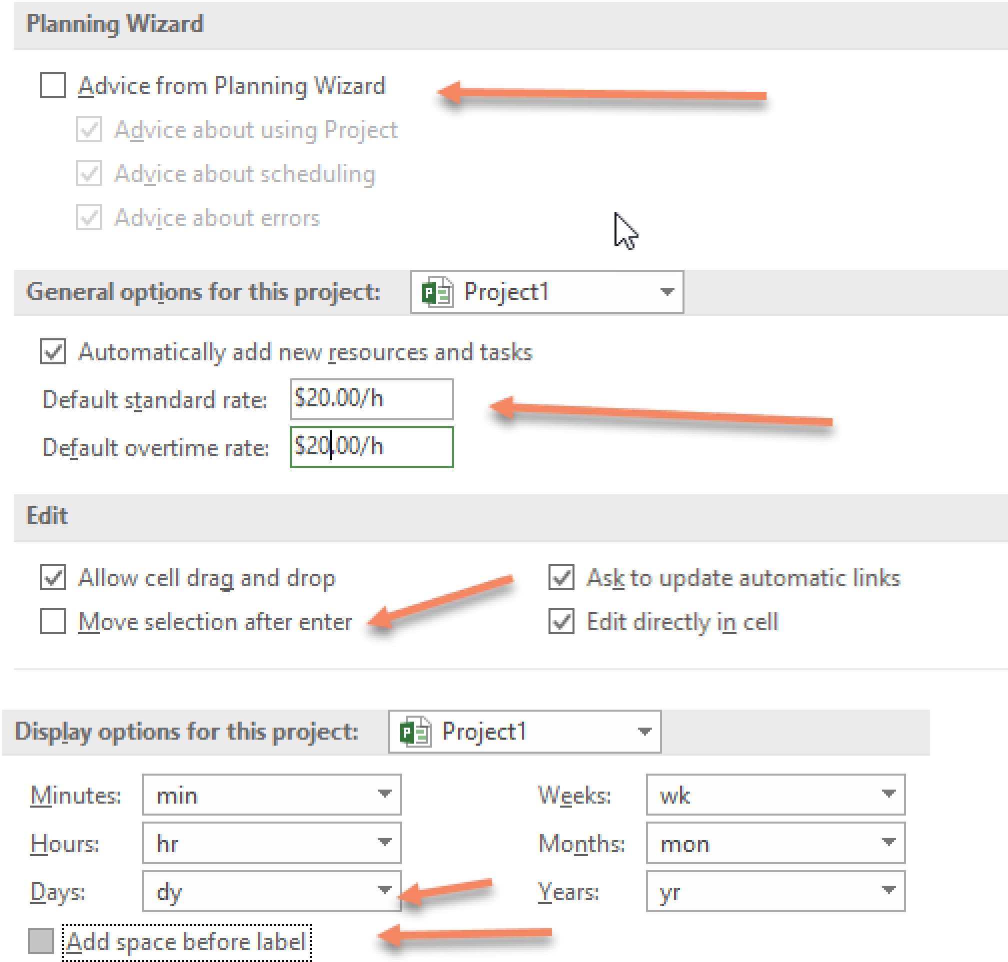


7. Select the Display tab and check that ALL check boxes are checked.
8. Select the Schedule tab and set the Schedule Options for your project as per the picture below:

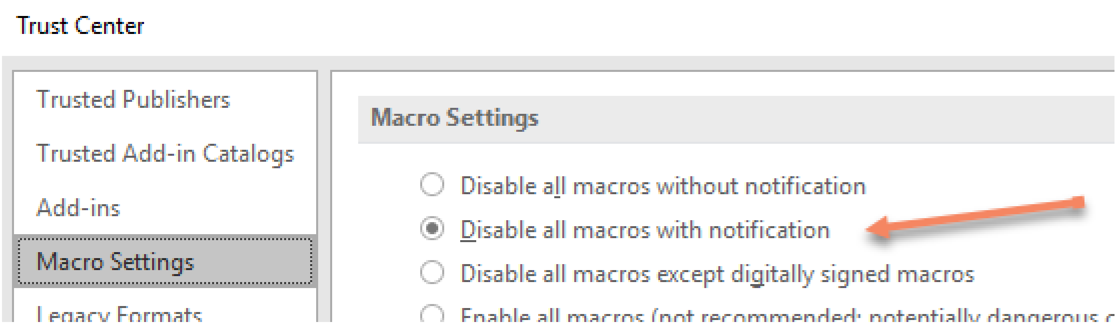


NOTE: The picture above shows the time in 24 hour format, if you wish to show the time in 24 hour format then you will need to change your system setting in Control Panel, Region and Language Options.

9. Select the Advanced tab and set options as per the diagram below:



10. Go to the Trust Center, Trust Center Settings -> Legacy-Formats and select Prompt when loading files with legacy or non-default file format. This option will allow you to open files created in earlier versions of Microsoft Project but will warn you that it is not a Microsoft Project 2010 to 2016 file format.



11. Select **OK** twice to close the Project Options form.

ENGR3450 – Project Management

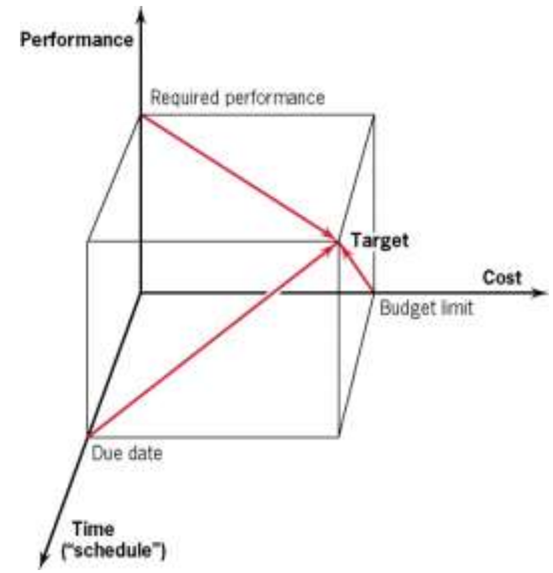
Week 3

The Project Manager and the Role of PM

Organizational Structures

Managing Conflicts and Art Of Negotiation

Integration Management



2019, İzmir

YAŞAR ÜNİVERSİTESİ
Mühendislik Fakültesi

Agenda today

- The Project Manager
  - Responsibilities
  - Attributes and Abilities
    - Quiz A
- Managing Conflict and Art of Negotiation
  - Analyzing stakeholders
    - Quiz B
- Project Integration Management
  - Phases of Integration (PMBOK)
  - Projects in Organizational structures
    - Quiz C

- Workshop

The Project Manager

- The project manager is responsible that *proper knowledge* and *resources* are available where and when needed, and that the project is completed *on-time* and *within budget*.

- The rapid growth of project-oriented organizations leads to a “project manager” career path.

Project Manager

- Communication abilities
- Executive support
- Multidisciplinary background
- Usually an engineer
- On the job from the first phase
  - Analysis and design

Project Manager

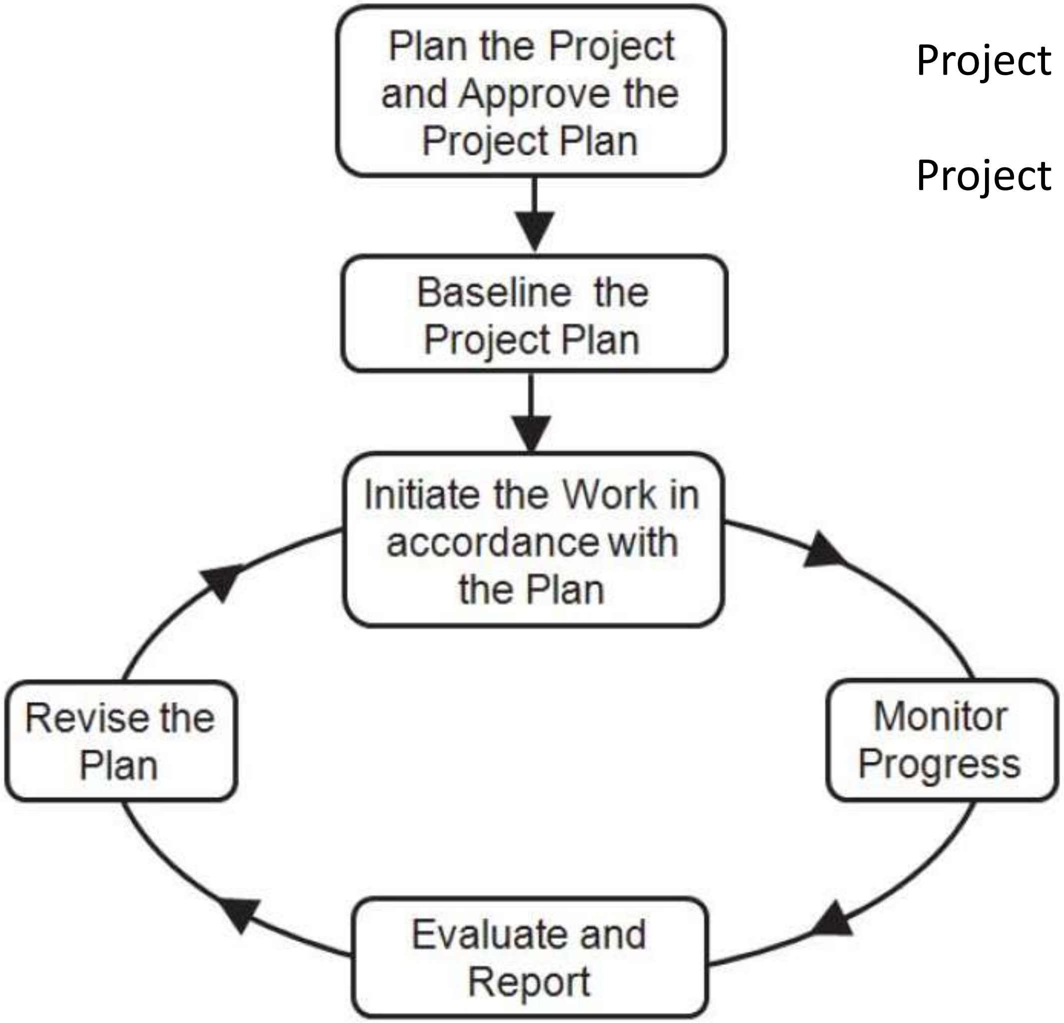
DILBERT: © Scott Adams/Dist. by United Feature Syndicate, Inc.

Firing- Hiring ability
Expense Approval ability

Figure 3-1 Project management organization showing typical responsibilities of a project manager.

Above all, the PM must never allow senior management to be surprised!

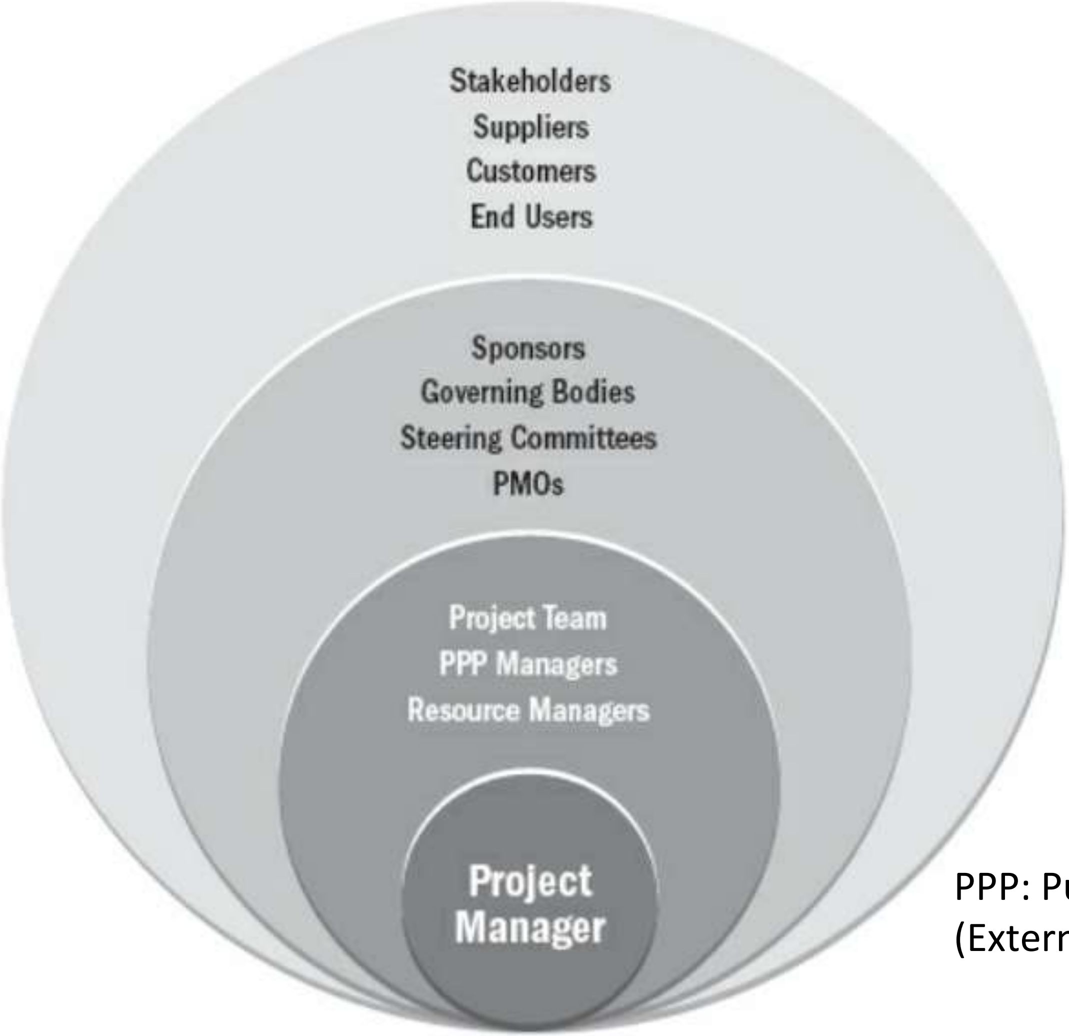
Responsibilities of PM



Project Charter

Project Management Plan

Responsibilities of PM

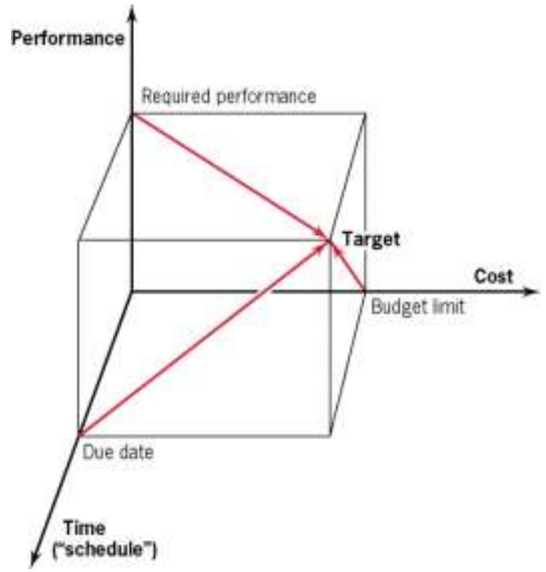


PPP: Public Private Partnership
(External stakeholder managers)

Responsibilities of PM

- Acquiring Adequate Resources
- Acquiring Motivated Personnel
- Dealing with obstacles
- Making project goal tradeoffs
- Maintaining a positive balanced outlook
- Breadth of communication
- Negotiation

> "What I need is a list of specific unknown problems that we will encounter."*
>
> Anonymous manager



Attributes of Effective PM

- A strong technical background
- A hard-nosed manager
- A mature individual
- Someone who is currently available
- Someone on good terms with senior executives
- A person who can keep the project team happy
- One who has worked in several different departments
- A person who can walk on (or part) the waters

Should be Leader more than Manager

Management	Leadership
Direct using positional power	Guide, influence, and collaborate using relational power
Maintain	Develop
Administrate	Innovate
Focus on systems and structure	Focus on relationships with people
Rely on control	Inspire trust
Focus on near-term goals	Focus on long-range vision
Ask how and when	Ask what and why
Focus on bottom line	Focus on the horizon
Accept status quo	Challenge status quo
Do things right	Do the right things
Focus on operational issues and problem solving	Focus on vision, alignment, motivation, and inspiration

Attributes of Effective PM

Table 3-2 Three Aspects of Leadership and Fifteen Leadership Competencies. (Dulewicz et al., 2003)

Area of Competence	*Competency*
Intellectual (IQ)	1. Critical analysis and judgment
	2. Vision and imagination
	3. Strategic perspective
Managerial (MQ)	4. Engaging communication
	5. Managing resources
	6. Empowering
	7. Developing
	8. Achieving
Emotional (EQ)	9. Self-awareness
	10. Emotional resilience
	11. Motivation
	12. Sensitivity
	13. Influence
	14. Intuitiveness
	15. Conscientiousness

quiz A about Ch 3 of Meredith and PMBOK

ENGR3450-03AQz

You will get three quizzes of 5 pts. – Highest grade will be accepted.

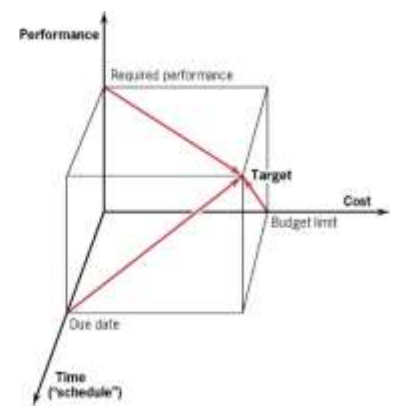
Conflicts – Art of Negotiation

Project Management in Practice

Quickly Building a Kindergarten through Negotiation

© Xinhua/ZUMAPress.com

If you are back of
- Time
- Budget
- Resources



If financers and constructors are of different
- Culture
- Region
- Educational background

Negotiation – Aligning goals of stakeholders

"Power – Interest grid" of stakeholders

Level of Commitment	Stakeholder Groups: Cardiologists	Test Technicians	Administration	Patients/ Families	Radiologists
Strongly Support	X	O			O
Support	O		X O	X O	
Neutral		X			
Opposed					X
Strongly Opposed					

X = current level of commitment
O = desired level of commitment

Commitment Assessment Matrix

Negotiation – Aligning engagement of stakeholders

- Obtaining and confirming stakeholders’ commitment to the project’s success at the appropriate stages in the project.
- Communicating with stakeholders to manage their expectations.
- Proactively addressing stakeholder concerns before they become major issues.
- Resolving issues in a timely fashion once they have been identified.

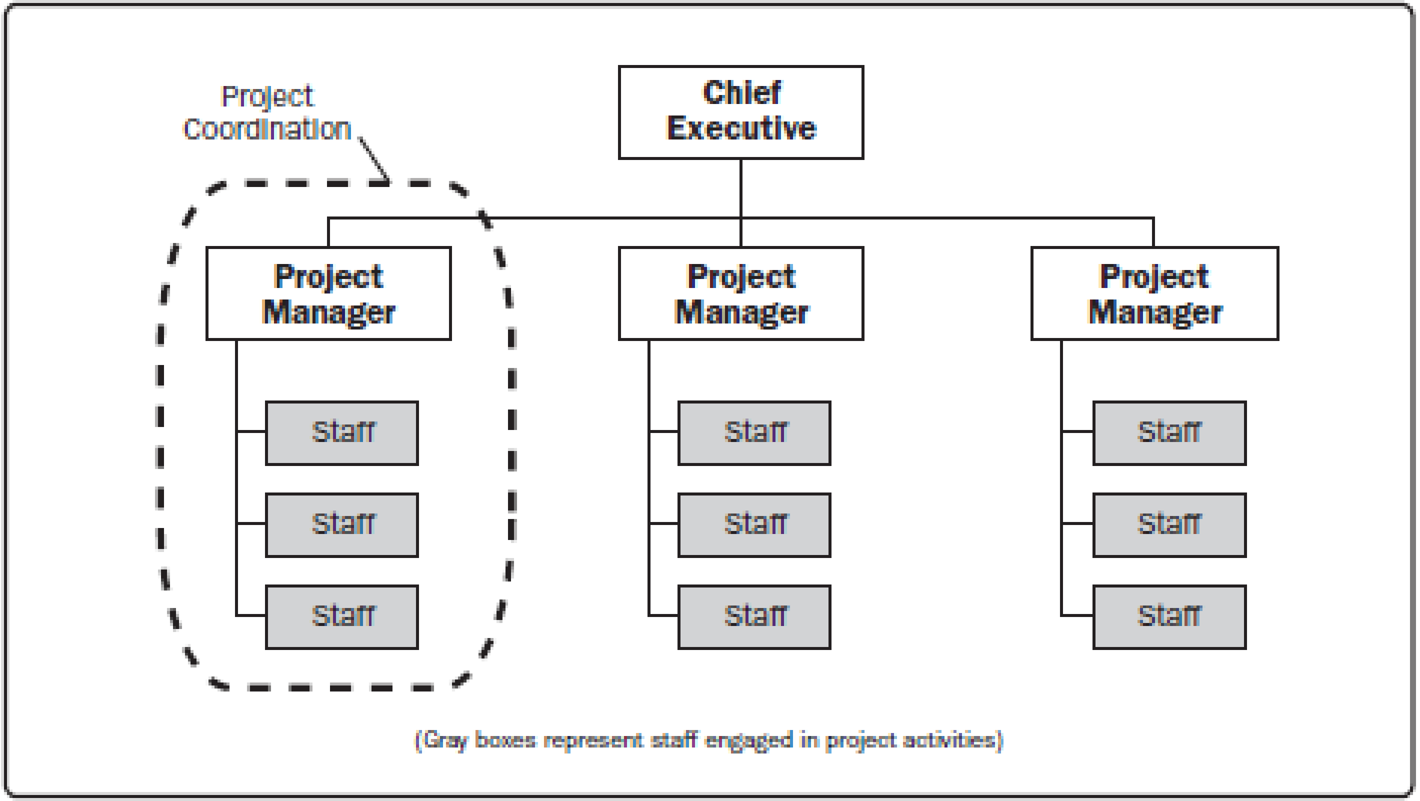
Negotiation – Conflicts by category and stakeholders

	Categories of Conflict		
Stakeholder	***Goals***	***Authority***	***Interpersonal***
Project team	Schedules	Technical	Personality
	Priorities		
Client	Schedules	Technical	
	Priorities		
Functional and senior management	Schedules	Technical	Personality
	Priorities	Administrative	
	Labor Cost		

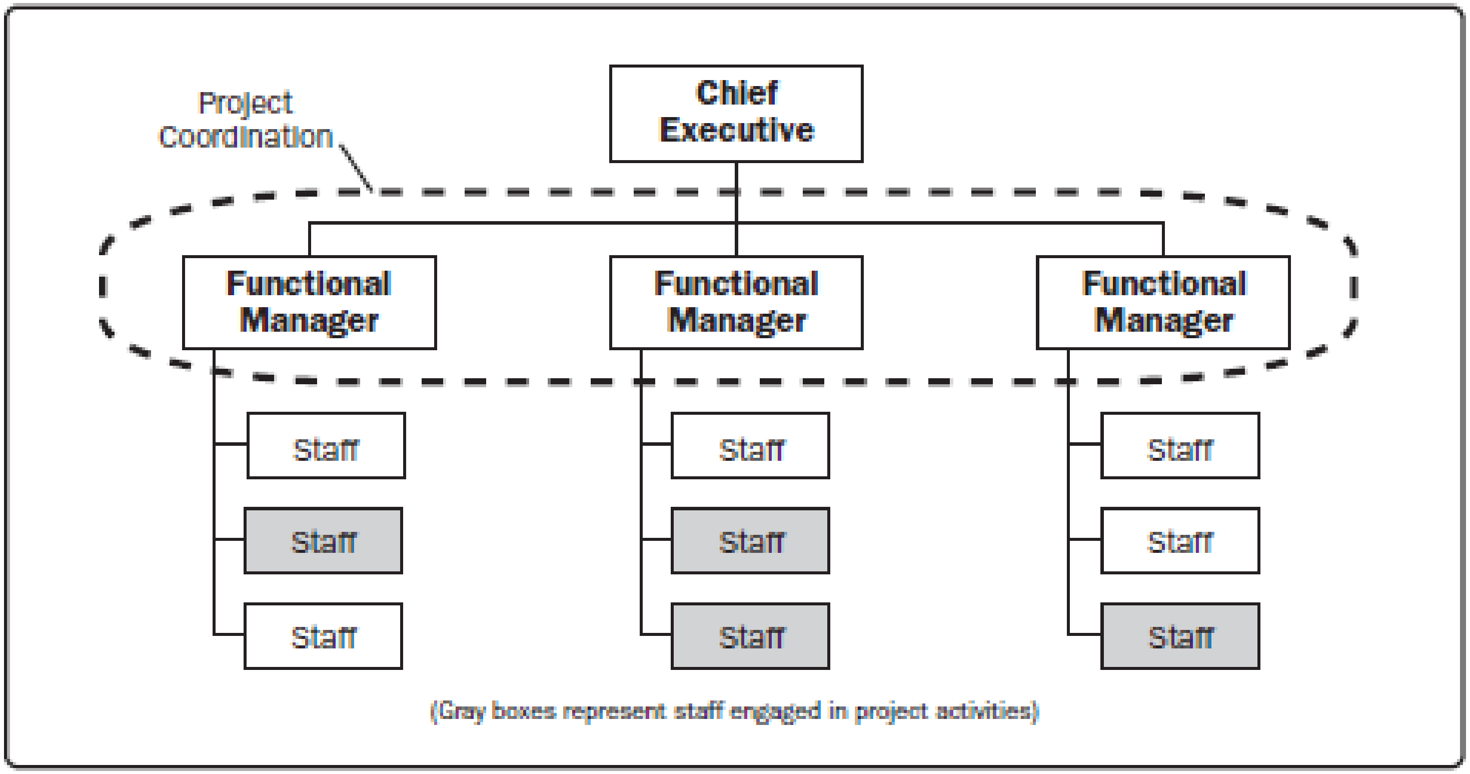
Type of Organizational Structures

1. Projectized Structures
2. Functionalized Structures
3. Matrix Structures

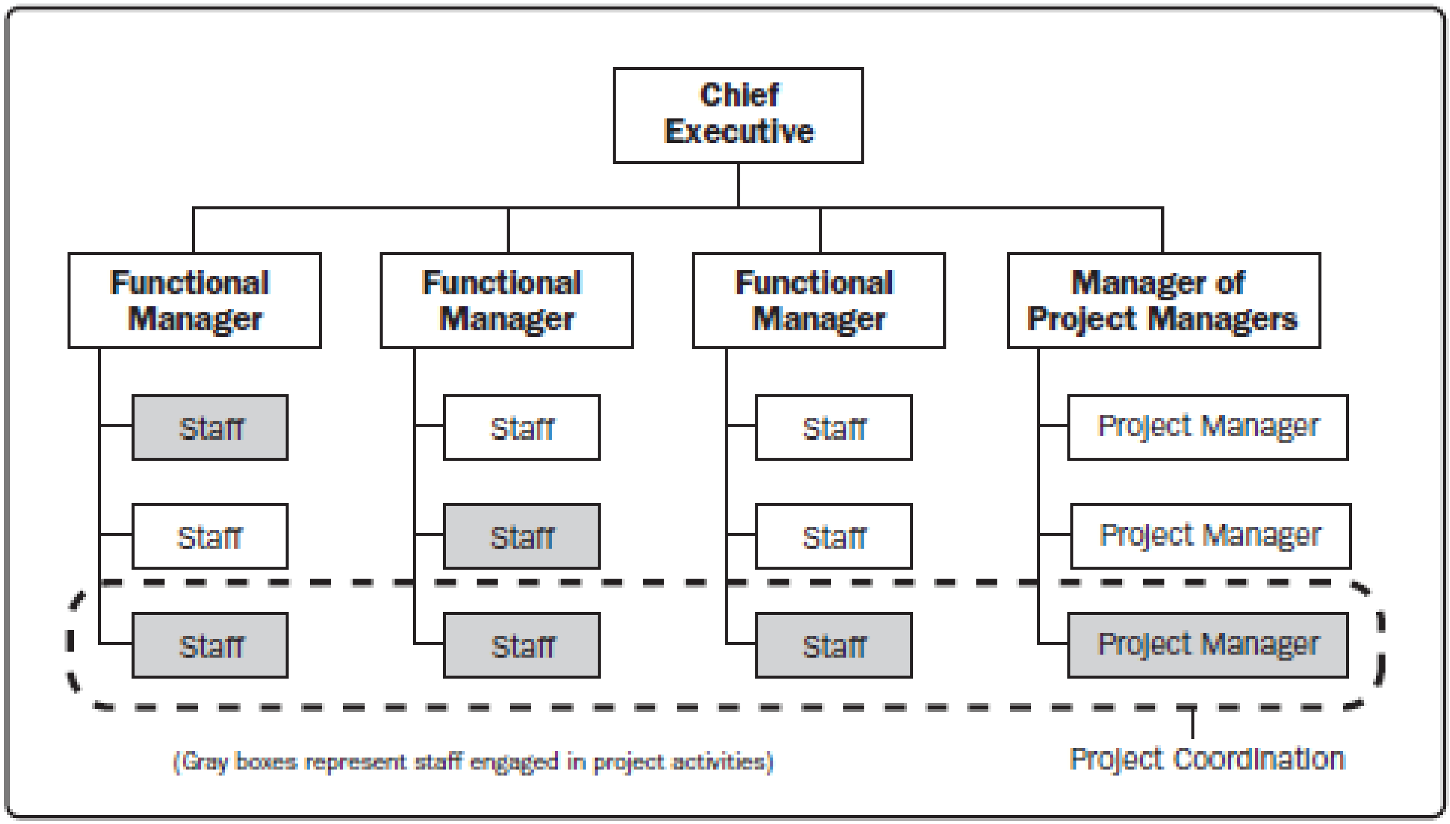
Projectized Structures



Functional Structures

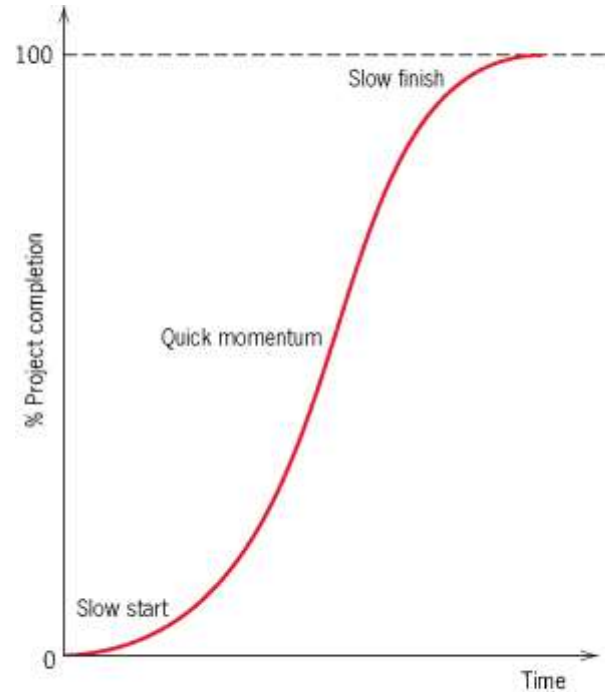


Matrix Structures



Conflicts are different at each phase of Project Integration Management

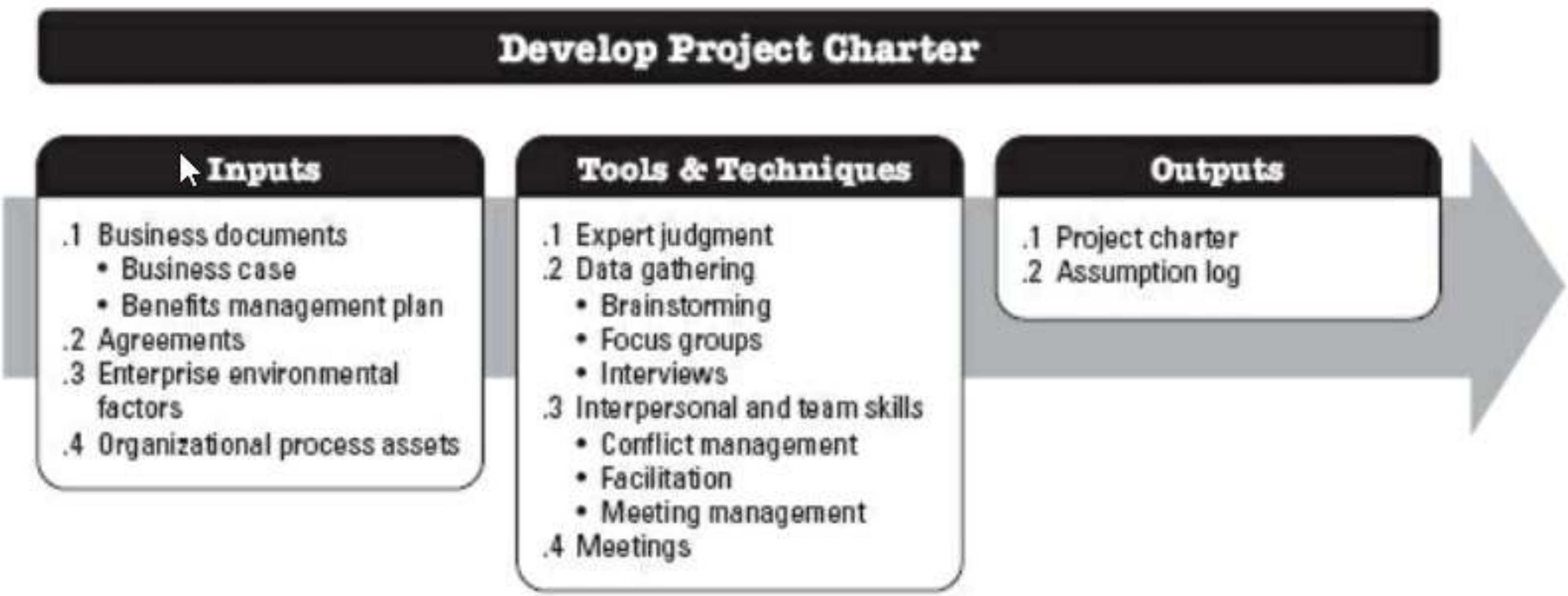
1. Develop Project Charter
2. Develop Project Management Plan
3. Direct and Manage Project Work
4. Manage Project Knowledge
5. Monitor and Control Project Work
6. Perform Integrated Change Control
7. Close Project or Phase



1. Develop Project Charter
2. Develop Project Management Plan
3. Direct and Manage Project Work
4. Manage Project Knowledge
5. Monitor and Control Project Work
6. Perform Integrated Change Control
7. Close Project or Phase

Project Charter

Develop Project Charter is the process of developing a document that formally authorizes the existence of a project and provides the project manager with the **authority** to apply organizational resources to project activities.



1. Develop Project Charter
2. Develop Project Management Plan
3. Direct and Manage Project Work
4. Manage Project Knowledge
5. Monitor and Control Project Work
6. Perform Integrated Change Control
7. Close Project or Phase

Project Management Plan

Develop Project Management Plan is the process of defining, preparing, and coordinating all plan components and consolidating them into an integrated project management plan.

1. Develop Project Charter
2. Develop Project Management Plan
3. Direct and Manage Project Work
4. Manage Project Knowledge
5. Monitor and Control Project Work
6. Perform Integrated Change Control
7. Close Project or Phase

Project Management Plan

Project Management Plan	Project Documents	
1. Scope management plan	1. Activity attributes	19. Quality control measurements
2. Requirements management plan	2. Activity list	20. Quality metrics
3. Schedule management plan	3. Assumption log	21. Quality report
4. Cost management plan	4. Basis of estimates	22. Requirements documentation
5. Quality management plan	5. Change log	23. Requirements traceability matrix
6. Resource management plan	6. Cost estimates	24. Resource breakdown structure
7. Communications management plan	7. Cost forecasts	25. Resource calendars
8. Risk management plan	8. Duration estimates	26. Resource requirements
9. Procurement management plan	9. Issue log	27. Risk register
10. Stakeholder engagement plan	10. Lessons learned register	28. Risk report
11. Change management plan	11. Milestone list	29. Schedule data
12. Configuration management plan	12. Physical resource assignments	30. Schedule forecasts
13. Scope baseline	13. Project calendars	31. Stakeholder register
14. Schedule baseline	14. Project communications	32. Team charter
15. Cost baseline	15. Project schedule	33. Test and evaluation documents
16. Performance measurement baseline	16. Project schedule network diagram	
17. Project life cycle description	17. Project scope statement	
18. Development approach	18. Project team assignments	

If too much; prefer Agile methods

PMBOK®

1. Develop Project Charter
2. Develop Project Management Plan
3. Direct and Manage Project Work
4. Manage Project Knowledge
5. Monitor and Control Project Work
6. Perform Integrated Change Control
7. Close Project or Phase

Monitor and Control Project Work

Direct and Manage Project Work is the process of leading and performing the work defined in the project management plan and implementing approved changes to achieve the project's objectives.

Direct and Manage Project Work

Inputs	Tools & Techniques	Outputs
.1 Project management plan • Any component .2 Project documents • Change log • Lessons learned register • Milestone list • Project communications • Project schedule • Requirements traceability matrix • Risk register • Risk report .3 Approved change requests .4 Enterprise environmental factors .5 Organizational process assets	.1 Expert judgment .2 Project management information system .3 Meetings	.1 Deliverables .2 Work performance data .3 Issue log .4 Change requests .5 Project management plan updates • Any component .6 Project documents updates • Activity list • Assumption log • Lessons learned register • Requirements documentation • Risk register • Stakeholder register .7 Organizational process assets updates

1. Develop Project Charter
2. Develop Project Management Plan
3. Direct and Manage Project Work
4. Manage Project Knowledge
5. Monitor and Control Project Work
6. Perform Integrated Change Control
7. Close Project or Phase

Perform Integrated Change Control

Perform Integrated Change Control is the process of reviewing all change requests; approving changes and managing changes to deliverables, project documents, and the project management plan; and communicating the decisions.

Perform Integrated Change Control

Inputs

.1 Project management plan
- Change management plan
- Configuration management plan
- Scope baseline
- Schedule baseline
- Cost baseline

.2 Project documents
- Basis of estimates
- Requirements traceability matrix
- Risk report

.3 Work performance reports

.4 Change requests

.5 Enterprise environmental factors

.6 Organizational process assets

Tools & Techniques

.1 Expert judgment

.2 Change control tools

.3 Data analysis
- Alternatives analysis
- Cost-benefit analysis

.4 Decision making
- Voting
- Autocratic decision making
- Multicriteria decision analysis

.5 Meetings

Outputs

.1 Approved change requests

.2 Project management plan updates
- Any component

.3 Project documents updates
- Change log

PMBOK®

1. Develop Project Charter
2. Develop Project Management Plan
3. Direct and Manage Project Work
4. Manage Project Knowledge
5. Monitor and Control Project Work
6. Perform Integrated Change Control
7. Close Project or Phase

Close Project or Phase

Close Project or Phase is the process of finalizing all activities for the project, phase, or contract. The key benefits of this process are the project or phase information is archived, the planned work is completed, and organizational team resources are released to pursue new endeavors.

Close Project or Phase

Inputs

.1 Project charter
.2 Project management plan
- All components

.3 Project documents
- Assumption log
- Basis of estimates
- Change log
- Issue log
- Lessons learned register
- Milestone list
- Project communications
- Quality control measurements
- Quality reports
- Requirements documentation
- Risk register
- Risk report

.4 Accepted deliverables
.5 Business documents
- Business case
- Benefits management plan

.6 Agreements
.7 Procurement documentation
.8 Organizational process assets

Tools & Techniques

.1 Expert judgment
.2 Data analysis
- Document analysis
- Regression analysis
- Trend analysis
- Variance analysis

.3 Meetings

Outputs

.1 Project documents updates
- Lessons learned register

.2 Final product, service, or result transition
.3 Final report
.4 Organizational process assets updates

PMBOK®

quiz B about Ch 4 of Meredith and PMBOK

ENGR3450-03BQz

You will get three quizzes of 5 pts. – Highest grade will be accepted.

Projects In Functional Organizations

Where is
the PM (the Superman)

He may be authorized to get any one for the team but what about The managerial Conflicts

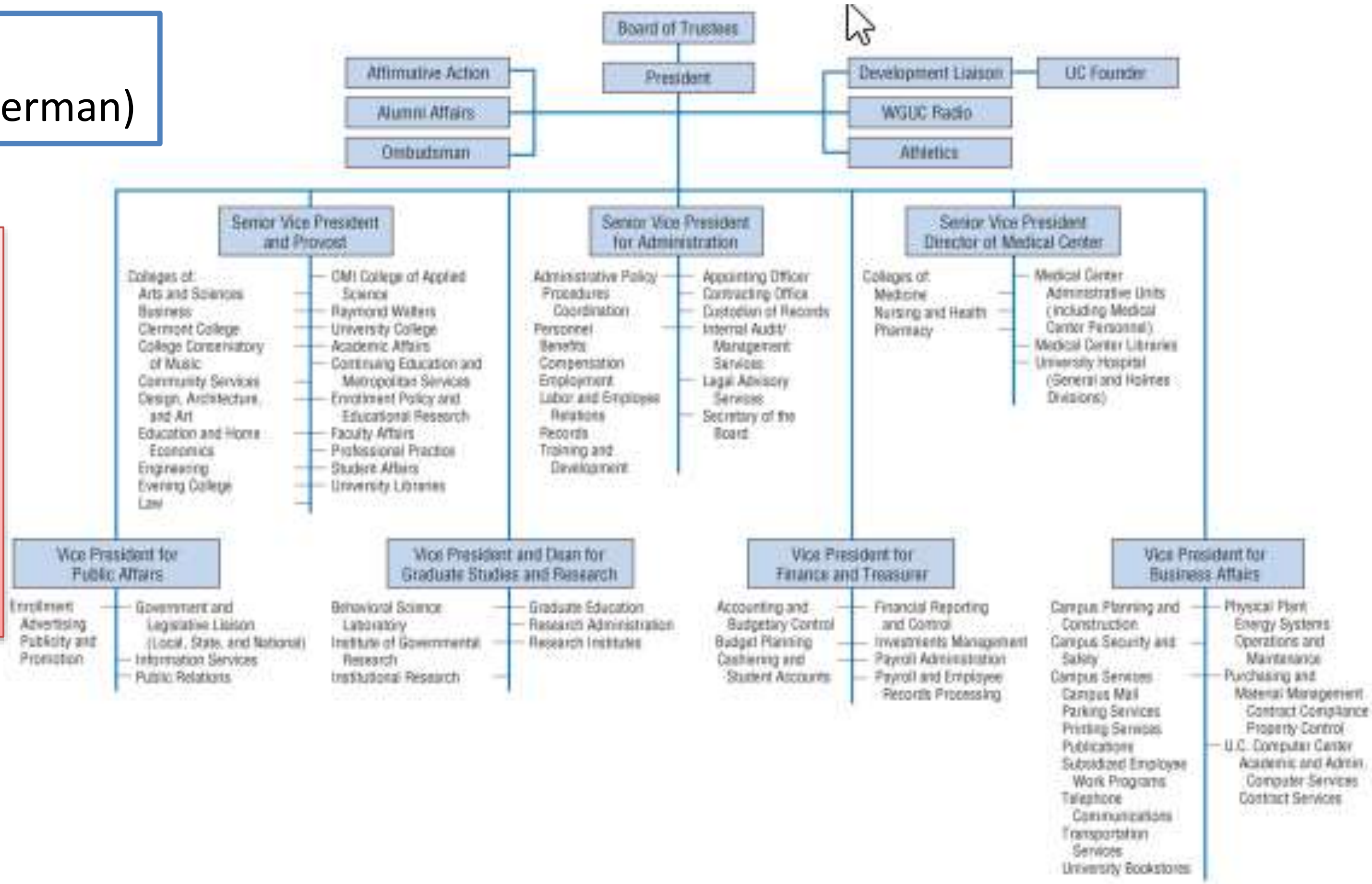


Figure 5-1 University of Cincinnati organization chart.

Projects In Matrix Organizations

Managerial Conflicts may happen again creating stress over employee (Less if executive support for PMs high And general stress In company is low)

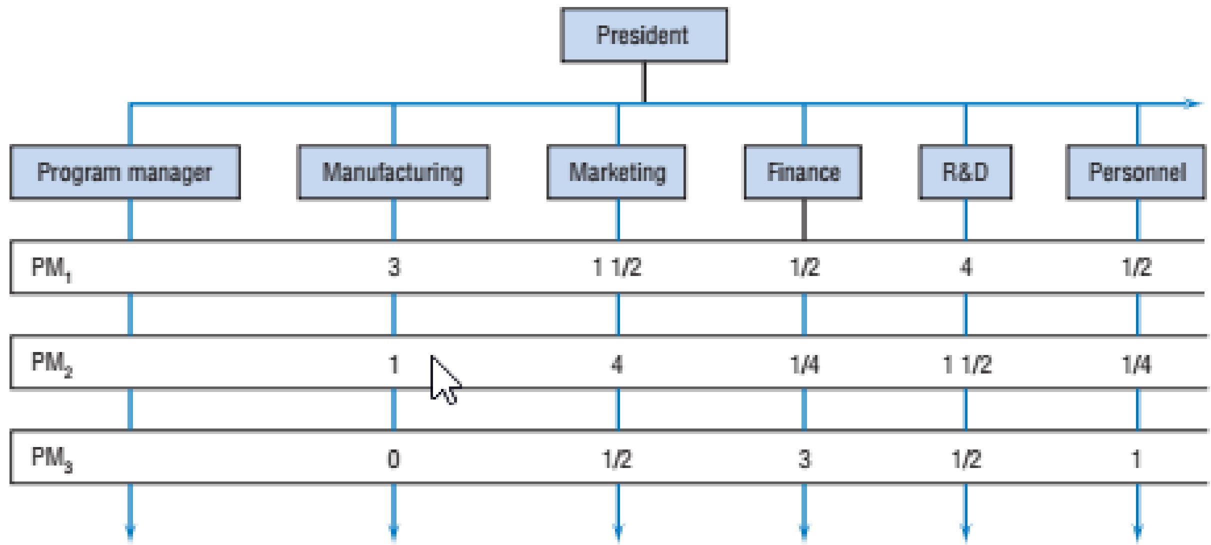


Figure 5-3 The matrix organization.

Projectized Organizations or PMO

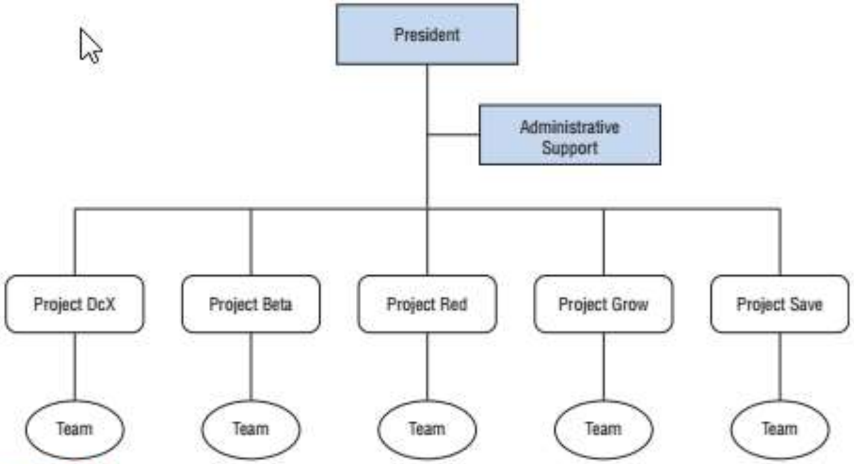


Figure 5-2 The projectized organization.

PM hires or transfers its own Employee on demand.

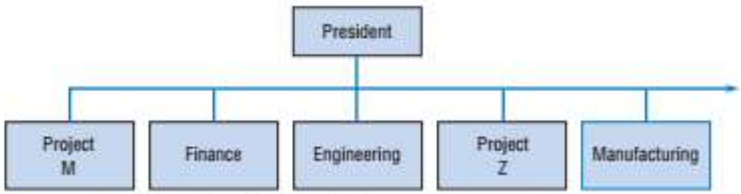
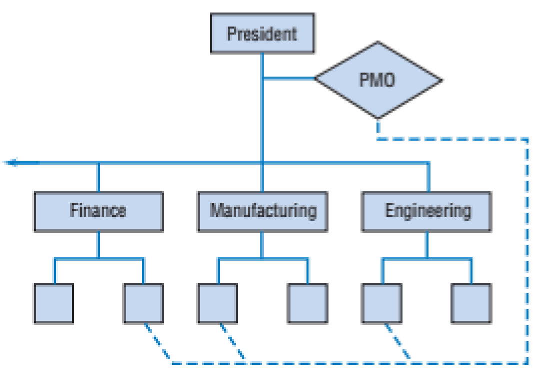


Figure 5-4 A functional/projectized composite organization.

GOOD

NOT GOOD



Projectized Organizations or PMO

GOOD

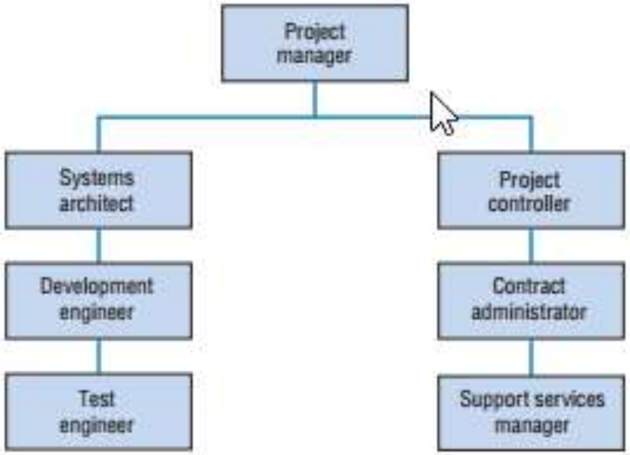


Figure 5-6 Typical organization for software projects.

Conclusion: Ability of PM to hire and fire makes Conflicts less

quiz C about Ch 5 of Meredith and PMBOK

ENGR3450-03CQz

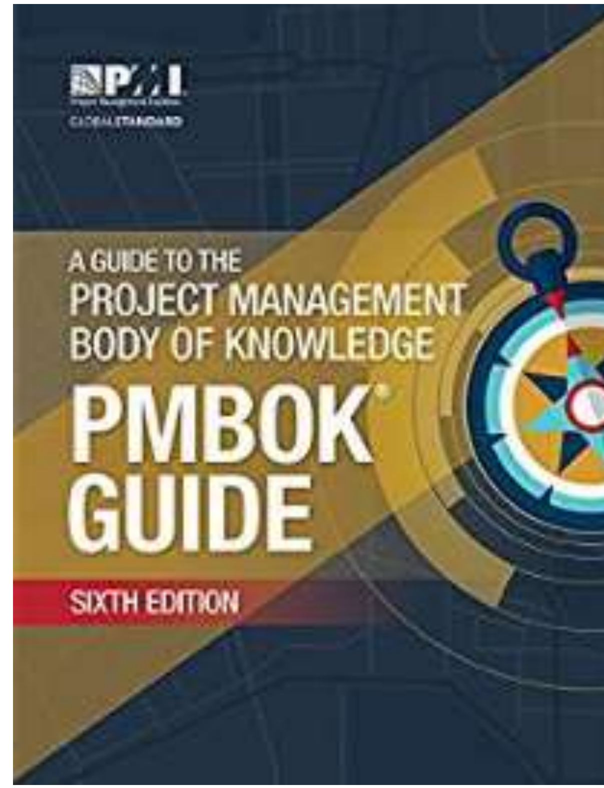
You will get three quizzes of 5 pts. – Highest grade will be accepted.

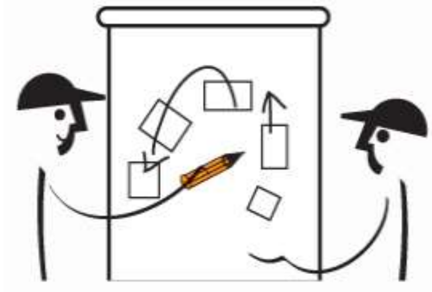
Workshop – 5 pts.

Will be published on lectures.yasar.edu

Will be done by MS-Project

Course resources

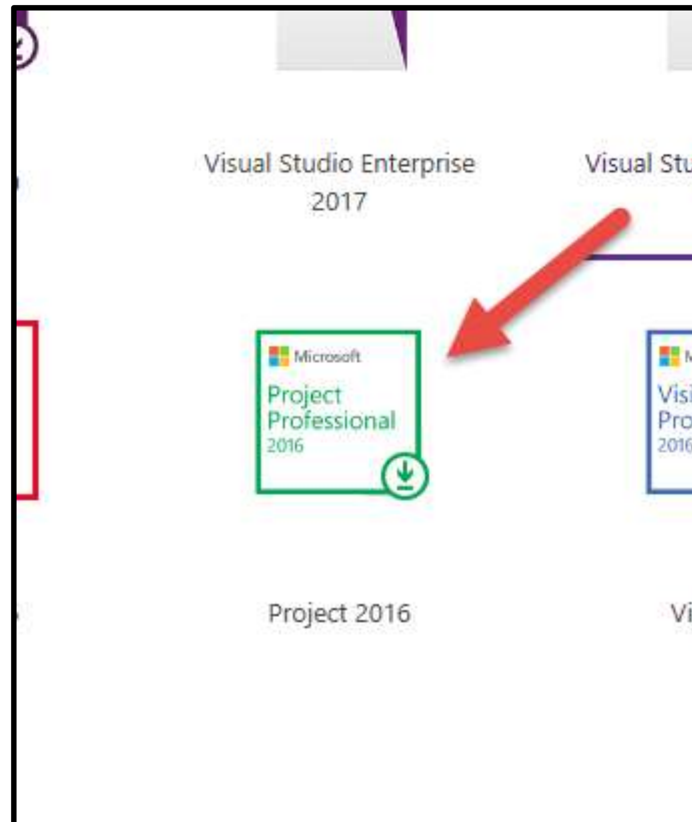




Load MS Project

https://e5.onthehub.com/WebStore/ProductsByMajorVersionList.aspx?ws=44b496ae-799b-e011-969d-0030487d8897&vsro=8

- Go to the address at top
- Select the software
- Select English version
- Add to basket
- Login by your e-mail of @yasar.edu and load.
- If you cannot, connect to Admin C H ??.



Teams for your projects

Should be Ready this week – If not I will assign the groups

- Teams of 3 to 5
  - 3 or 5 is better
  - (you will have free software for each computer)
- Team should be of the same section.
- But from Different Departments

Questions

- Questions

hp@quiztechnology.com

NEXT WEEK: The Project Planning
Integration Management – Risk Management

LAST SLIDE

Workshop – Entering and Organizing tasks on MS-Project – 5 pts weight.

1. This exercise is taken from the book of Paul E. Harris. It covers exercises from Ch1 to 8.
   You will learn how to enter tasks of a project and organize them on MS-project. If you are not a good computer person you may get some help from the book itself or from your project team members.
   You will do the same kind of work for your own project too, starting from next week.

2. Use the columns to enter the Name and Duration of the tasks as below.
   - The Estimate and Schedule will be completed by site personnel who work 6 days/ week.
   - Add new calendar as "6 Day Cal" and edit it for 6 days including Saturdays using "Resource Calendars".
   - Assign the 6-Day Working Week calendar using the Task Information Form Advanced tab to Tasks 8 and Task 9.
   - Double-click on the task to open this form and select the Advanced tab, Calendar drop-down box to assign the Task Calendar.

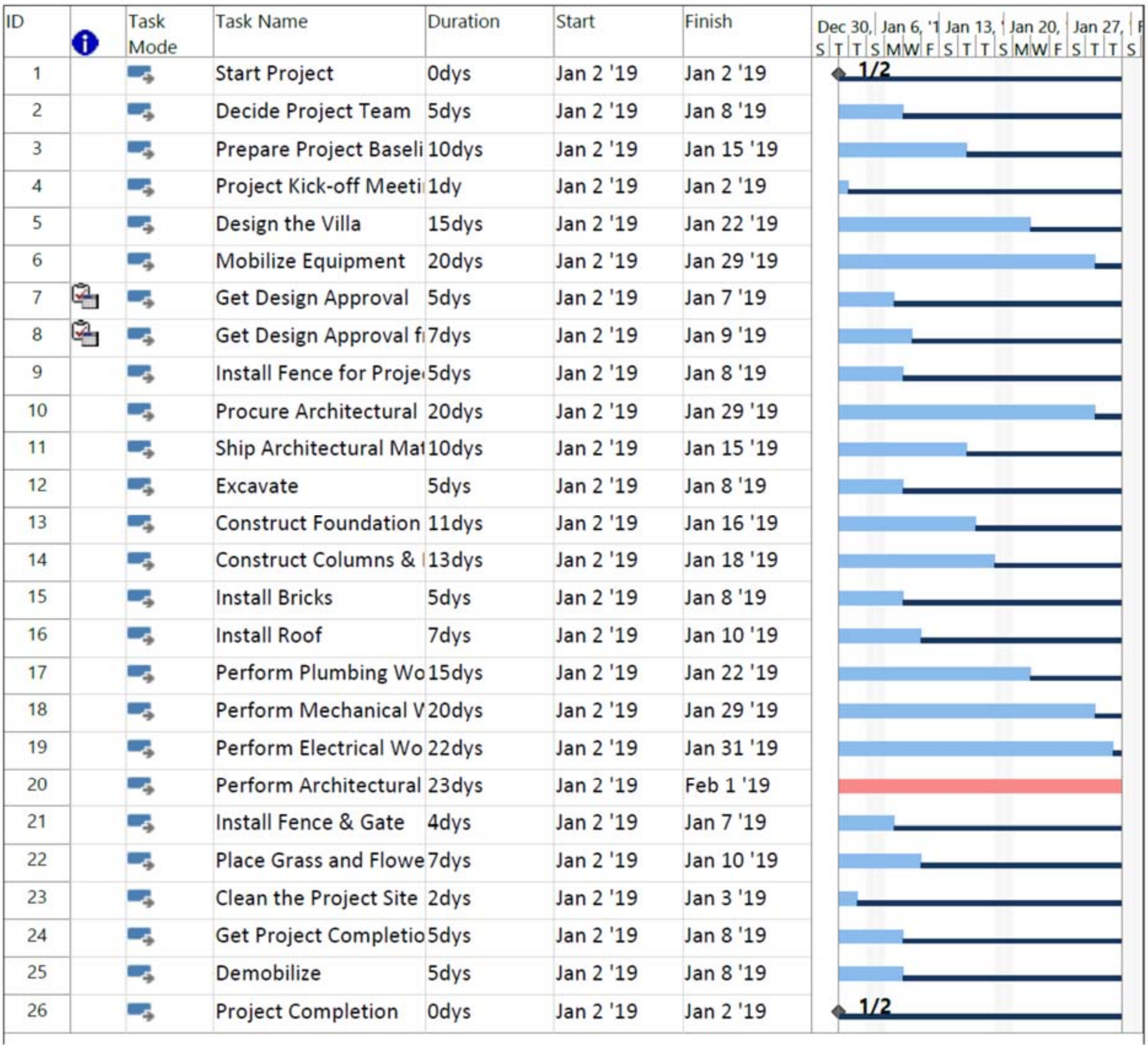
3. A task will become a milestone when assigned zero duration.

Make project start date 02 Jan 2019 from Project -> Project Information

ID	Task Name	Duration	Task Calendar
1	Start Project	0	
2	Decide Project Team	5	
3	Prepare Project Baselines	10	
4	Project Kick-off Meeting	1	
5	Design the Villa	15	
6	Mobilize Equipment	20	
7	Get Design Approval	5	6 day
8	Get Design Approval from Municipality	7	6 day
9	Install Fence for Project Site	5	
10	Procure Architectural Material	20	
11	Ship Architectural Material	10	
12	Excavate	5	
13	Construct Foundation	11	
14	Construct Columns & Beams & Slab	13	
15	Install Bricks	5	
16	Install Roof	7	
17	Perform Plumbing Works	15	
18	Perform Mechanical Works	20	
19	Perform Electrical Works	22	
20	Perform Architectural Work	23	
21	Install Fence & Gate	4	

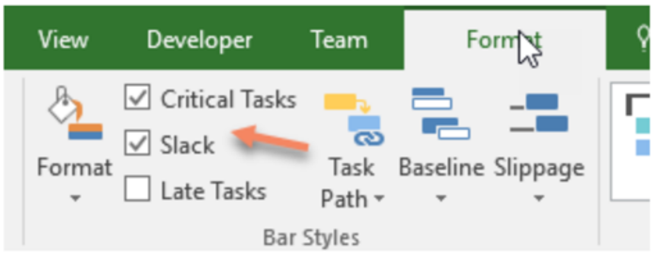
22	Place Grass and Flowers	7	
23	Clean the Project Site	2	
24	Get Project Completion Approval	5	
25	Demobilize	5	
26	Project Completion	0	

4. Your schedule should look like this with some work:



ID		Task Mode	Task Name	Duration	Start	Finish
1			Start Project	0dys	Jan 2 '19	Jan 2 '19
2			Decide Project Team	5dys	Jan 2 '19	Jan 8 '19
3			Prepare Project Baseli	10dys	Jan 2 '19	Jan 15 '19
4			Project Kick-off Meeti	1dy	Jan 2 '19	Jan 2 '19
5			Design the Villa	15dys	Jan 2 '19	Jan 22 '19
6			Mobilize Equipment	20dys	Jan 2 '19	Jan 29 '19
7			Get Design Approval	5dys	Jan 2 '19	Jan 7 '19
8			Get Design Approval fi	7dys	Jan 2 '19	Jan 9 '19
9			Install Fence for Proje	5dys	Jan 2 '19	Jan 8 '19
10			Procure Architectural	20dys	Jan 2 '19	Jan 29 '19
11			Ship Architectural Mat	10dys	Jan 2 '19	Jan 15 '19
12			Excavate	5dys	Jan 2 '19	Jan 8 '19
13			Construct Foundation	11dys	Jan 2 '19	Jan 16 '19
14			Construct Columns &	13dys	Jan 2 '19	Jan 18 '19
15			Install Bricks	5dys	Jan 2 '19	Jan 8 '19
16			Install Roof	7dys	Jan 2 '19	Jan 10 '19
17			Perform Plumbing Wo	15dys	Jan 2 '19	Jan 22 '19
18			Perform Mechanical V	20dys	Jan 2 '19	Jan 29 '19
19			Perform Electrical Wo	22dys	Jan 2 '19	Jan 31 '19
20			Perform Architectural	23dys	Jan 2 '19	Feb 1 '19
21			Install Fence & Gate	4dys	Jan 2 '19	Jan 7 '19
22			Place Grass and Flowe	7dys	Jan 2 '19	Jan 10 '19
23			Clean the Project Site	2dys	Jan 2 '19	Jan 3 '19
24			Get Project Completio	5dys	Jan 2 '19	Jan 8 '19
25			Demobilize	5dys	Jan 2 '19	Jan 8 '19
26			Project Completion	0dys	Jan 2 '19	Jan 2 '19

Hint:



NOTES:

- The icon in the Information column on the left-hand side indicates that Tasks 7 and 8 have a non-standard calendar, which is the 6-Day Working Week calendar set in this workshop.

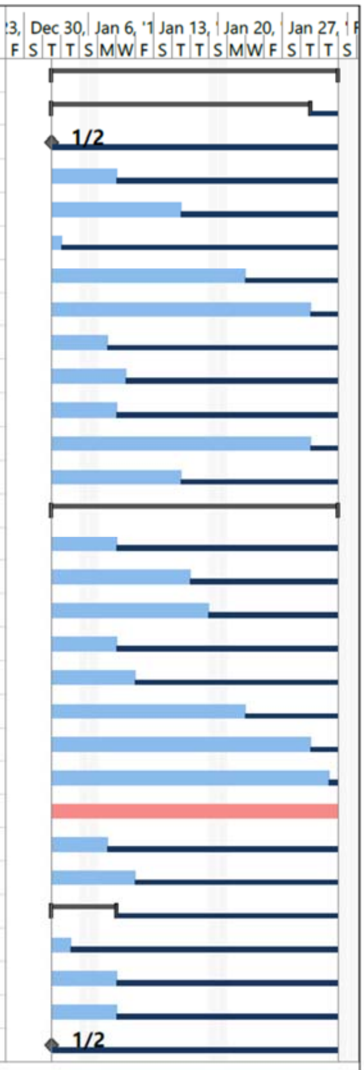
5. All tasks should be assigned the Task Mode of Auto Scheduled. If the task bars are not a solid blue color, except Task 20, which is critical and should be a solid red color, then they are Manually Scheduled and you have not set the options correctly in the Project Options. (Task → Information)

Add Summary Tasks

6. Display the Project Summary Task by checking the Format, Show/ Hide group, Project Summary Task and close the form.
7. Observe how the Project Summary Task is formatted, it will be Bold and have a Task ID of "0".
8. Hide the Project Summary Task by repeating para 6 and unchecking, as we will create an Outline Level for the Project summary task.
9. Create new Summary Tasks (Task -> Summary).
   - Villa Project
     - o Pre-Construction
     - o Construction
     - o Close-out

10. Create an Outline Level 1 for Phase entitled Villa Project and
11. Create an Outline Level 2 for each of the three Products:
12. Try using the various methods for indenting and out-denting tasks.
13. Your work should look like this.

ID		Task Mode	Task Name	Duration	Start	Finish
1			**Villa Project**	**23dys**	**Jan 2 '19**	**Feb 1 '19**
2			**Pre-construction**	**20dys**	**Jan 2 '19**	**Jan 29 '19**
3			Start Project	0dys	Jan 2 '19	Jan 2 '19
4			Decide Project Te	5dys	Jan 2 '19	Jan 8 '19
5			Prepare Project E	10dys	Jan 2 '19	Jan 15 '19
6			Project Kick-off M	1dy	Jan 2 '19	Jan 2 '19
7			Design the Villa	15dys	Jan 2 '19	Jan 22 '19
8			Mobilize Equipm	20dys	Jan 2 '19	Jan 29 '19
9			Get Design Appro	5dys	Jan 2 '19	Jan 7 '19
10			Get Design Appro	7dys	Jan 2 '19	Jan 9 '19
11			Install Fence for I	5dys	Jan 2 '19	Jan 8 '19
12			Procure Architec	20dys	Jan 2 '19	Jan 29 '19
13			Ship Architectura	10dys	Jan 2 '19	Jan 15 '19
14			**Construction**	**23dys**	**Jan 2 '19**	**Feb 1 '19**
15			Excavate	5dys	Jan 2 '19	Jan 8 '19
16			Construct Founda	11dys	Jan 2 '19	Jan 16 '19
17			Construct Colum	13dys	Jan 2 '19	Jan 18 '19
18			Install Bricks	5dys	Jan 2 '19	Jan 8 '19
19			Install Roof	7dys	Jan 2 '19	Jan 10 '19
20			Perform Plumbin	15dys	Jan 2 '19	Jan 22 '19
21			Perform Mechan	20dys	Jan 2 '19	Jan 29 '19
22			Perform Electrica	22dys	Jan 2 '19	Jan 31 '19
23			Perform Architec	23dys	Jan 2 '19	Feb 1 '19
24			Install Fence & G	4dys	Jan 2 '19	Jan 7 '19
25			Place Grass and F	7dys	Jan 2 '19	Jan 10 '19
26			**Close-out**	**5dys**	**Jan 2 '19**	**Jan 8 '19**
27			Clean the Project	2dys	Jan 2 '19	Jan 3 '19
28			Get Project Comp	5dys	Jan 2 '19	Jan 8 '19
29			Demobilize	5dys	Jan 2 '19	Jan 8 '19
30			Project Completi	0dys	Jan 2 '19	Jan 2 '19



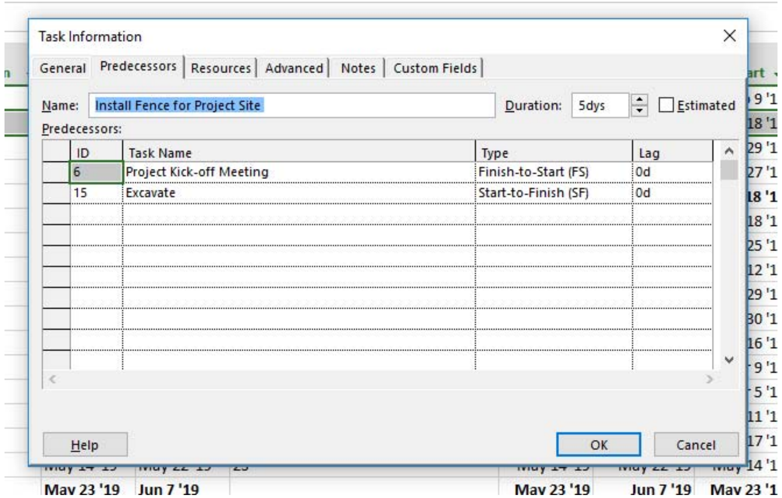
Task Dependencies (Relationships)

14. Add Predecessors to the table as below,

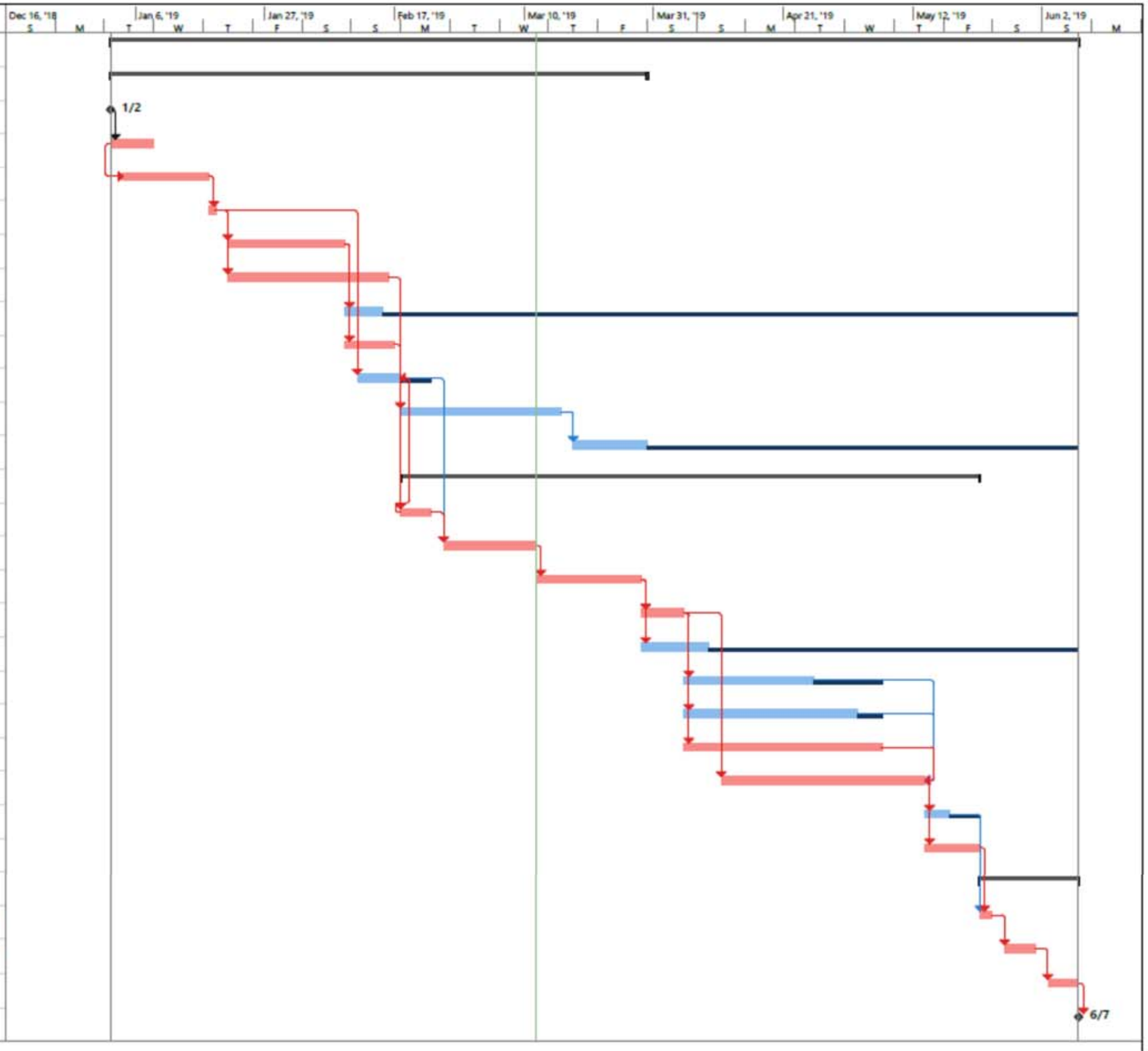
15. Try to reshape your project view as below.

Project1		Task Mode	Task Name	Duration	Start	Finish	Predecessors	Early Start	Early Finish	Late Start	Late Finish
1			**Villa Project**	**113dys**	**Jan 2 '19**	**Jun 7 '19**		**Jan 2 '19**	**Jun 7 '19**	**Jan 2 '19**	**Jun 7 '19**
2			**Pre-construction**	**63dys**	**Jan 2 '19**	**Mar 29 '19**		**Jan 2 '19**	**Mar 29 '19**	**Jan 2 '19**	**Jun 7 '19**
3			Start Project	0dys	Jan 2 '19	Jan 2 '19		Jan 2 '19	Jan 2 '19	Jan 2 '19	Jan 2 '19
4			Decide Project Team	5dys	Jan 2 '19	Jan 8 '19	3	Jan 2 '19	Jan 8 '19	Jan 2 '19	Jan 8 '19
5			Prepare Project Baselines	10dys	Jan 4 '19	Jan 17 '19	4SS+2dys	Jan 4 '19	Jan 17 '19	Jan 4 '19	Jan 17 '19
6			Project Kick-off Meeting	1dy	Jan 18 '19	Jan 18 '19	5	Jan 18 '19	Jan 18 '19	Jan 18 '19	Jan 18 '19
7			Design the Villa	15dys	Jan 21 '19	Feb 8 '19	6	Jan 21 '19	Feb 8 '19	Jan 21 '19	Feb 8 '19
8			Mobilize Equipment	20dys	Jan 21 '19	Feb 15 '19	6	Jan 21 '19	Feb 15 '19	Jan 21 '19	Feb 15 '19
9			Get Design Approval	5dys	Feb 9 '19	Feb 14 '19	7	Feb 9 '19	Feb 14 '19	Jun 3 '19	Jun 7 '19
10			Get Design Approval fron	7dys	Feb 9 '19	Feb 16 '19	7	Feb 9 '19	Feb 16 '19	Feb 9 '19	Feb 16 '19
11			Install Fence for Project S	5dys	Feb 11 '19	Feb 18 '19	6,15SF	Feb 11 '19	Feb 18 '19	Feb 18 '19	Feb 22 '19
12			Procure Architectural Ma	20dys	Feb 18 '19	Mar 15 '19	10	Feb 18 '19	Mar 15 '19	Apr 29 '19	May 24 '19
13			Ship Architectural Materi	10dys	Mar 18 '19	Mar 29 '19	12	Mar 18 '19	Mar 29 '19	May 27 '19	Jun 7 '19
14			**Construction**	**68dys**	**Feb 18 '19**	**May 22 '19**		**Feb 18 '19**	**May 22 '19**	**Feb 18 '19**	**Jun 7 '19**
15			Excavate	5dys	Feb 18 '19	Feb 22 '19	8,10	Feb 18 '19	Feb 22 '19	Feb 18 '19	Feb 22 '19
16			Construct Foundation	11dys	Feb 25 '19	Mar 11 '19	15,11	Feb 25 '19	Mar 11 '19	Feb 25 '19	Mar 11 '19
17			Construct Columns & Bea	13dys	Mar 12 '19	Mar 28 '19	16	Mar 12 '19	Mar 28 '19	Mar 12 '19	Mar 28 '19
18			Install Bricks	5dys	Mar 29 '19	Apr 4 '19	17	Mar 29 '19	Apr 4 '19	Mar 29 '19	Apr 4 '19
19			Install Roof	7dys	Mar 29 '19	Apr 8 '19	17	Mar 29 '19	Apr 8 '19	May 30 '19	Jun 7 '19
20			Perform Plumbing Works	15dys	Apr 5 '19	Apr 25 '19	18	Apr 5 '19	Apr 25 '19	Apr 16 '19	May 6 '19
21			Perform Mechanical Wor	20dys	Apr 5 '19	May 2 '19	18	Apr 5 '19	May 2 '19	Apr 9 '19	May 6 '19
22			Perform Electrical Works	22dys	Apr 5 '19	May 6 '19	18	Apr 5 '19	May 6 '19	Apr 5 '19	May 6 '19
23			Perform Architectural W	23dys	Apr 11 '19	May 13 '19	18,20FF+5dys,21FF+5dys,22FF+5dys	Apr 11 '19	May 13 '19	Apr 11 '19	May 13 '19
24			Install Fence & Gate	4dys	May 14 '19	May 17 '19	23	May 14 '19	May 17 '19	May 17 '19	May 22 '19
25			Place Grass and Flowers	7dys	May 14 '19	May 22 '19	23	May 14 '19	May 22 '19	May 14 '19	May 22 '19
26			**Close-out**	**12dys**	**May 23 '19**	**Jun 7 '19**		**May 23 '19**	**Jun 7 '19**	**May 23 '19**	**Jun 7 '19**
27			Clean the Project Site	2dys	May 23 '19	May 24 '19	24,25	May 23 '19	May 24 '19	May 23 '19	May 24 '19
28			Get Project Completion A	5dys	May 27 '19	May 31 '19	27	May 27 '19	May 31 '19	May 27 '19	May 31 '19
29			Demobilize	5dys	Jun 3 '19	Jun 7 '19	28	Jun 3 '19	Jun 7 '19	Jun 3 '19	Jun 7 '19
30			Project Completion	0dys	Jun 7 '19	Jun 7 '19	29	Jun 7 '19	Jun 7 '19	Jun 7 '19	Jun 7 '19

16. Observe and play on task predecessors.



ID		Task Mode	Task Name	Duration	Start	Finish
1			**Villa Project**	**113dys**	**Jan 2 '19**	**Jun 7 '19**
2			**Pre-construction**	**63dys**	**Jan 2 '19**	**Mar 29 '19**
3			Start Project	0dys	Jan 2 '19	Jan 2 '19
4			Decide Project T	5dys	Jan 2 '19	Jan 8 '19
5			Prepare Project E	10dys	Jan 4 '19	Jan 17 '19
6			Project Kick-off M	1dy	Jan 18 '19	Jan 18 '19
7			Design the Villa	15dys	Jan 21 '19	Feb 8 '19
8			Mobilize Equipm	20dys	Jan 21 '19	Feb 15 '19
9			Get Design Appr	5dys	Feb 9 '19	Feb 14 '19
10			Get Design Appr	7dys	Feb 9 '19	Feb 16 '19
11			Install Fence for	5dys	Feb 11 '19	Feb 18 '19
12			Procure Architec	20dys	Feb 18 '19	Mar 15 '19
13			Ship Architectura	10dys	Mar 18 '19	Mar 29 '19
14			**Construction**	**68dys**	**Feb 18 '19**	**May 22 '19**
15			Excavate	5dys	Feb 18 '19	Feb 22 '19
16			Construct Found	11dys	Feb 25 '19	Mar 11 '19
17			Construct Colum	13dys	Mar 12 '19	Mar 28 '19
18			Install Bricks	5dys	Mar 29 '19	Apr 4 '19
19			Install Roof	7dys	Mar 29 '19	Apr 8 '19
20			Perform Plumbin	15dys	Apr 5 '19	Apr 25 '19
21			Perform Mechan	20dys	Apr 5 '19	May 2 '19
22			Perform Electric	22dys	Apr 5 '19	May 6 '19
23			Perform Architectural	23dys	Apr 11 '19	May 13 '19
24			Install Fence & G	4dys	May 14 '19	May 17 '19
25			Place Grass and F	7dys	May 14 '19	May 22 '19
26			**Close-out**	**12dys**	**May 23 '19**	**Jun 7 '19**
27			Clean the Project	2dys	May 23 '19	May 24 '19
28			Get Project Com	5dys	May 27 '19	May 31 '19
29			Demobilize	5dys	Jun 3 '19	Jun 7 '19
30			Project Completi	0dys	Jun 7 '19	Jun 7 '19



ENGR3450 – Project Management

Week 4

The Project Planning

Integration Management – Risk Management

2019, İzmir

YAŞAR ÜNİVERSİTESİ
Mühendislik Fakültesi

Agenda today

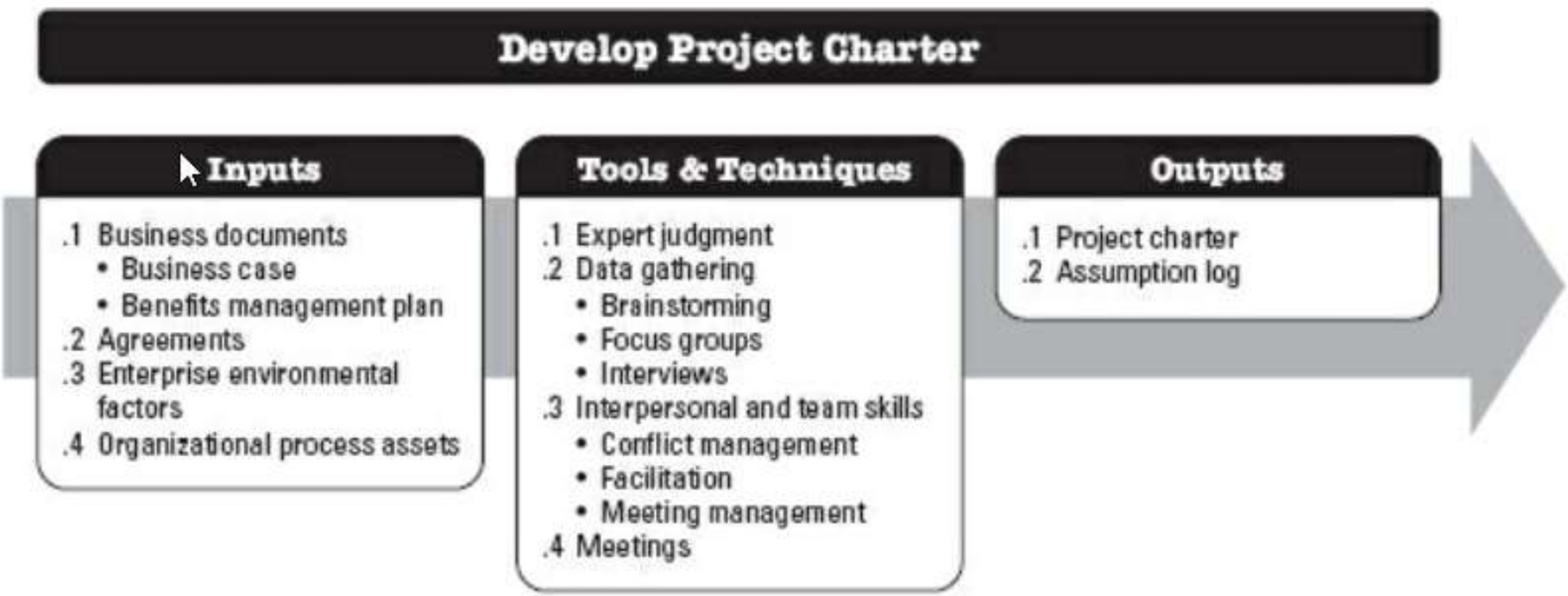
- The Project Charter and Management Plan
- WBS – Work Breakdown Structure
  - First project work – 5 Pts
  - **Gannt chart** of your project
  - Agile Methods
- Direct and Manage
- Monitor and Control
- Risk Planning

- Project work 1 (Charter and WBS)

1. Develop Project Charter
2. Develop Project Management Plan
3. Direct and Manage Project Work
4. Manage Project Knowledge
5. Monitor and Control Project Work
6. Perform Integrated Change Control
7. Close Project or Phase

Project Charter

Develop Project Charter is the process of developing a document that formally authorizes the existence of a project and provides the project manager with the **authority** to apply organizational resources to project activities.



Launch meeting

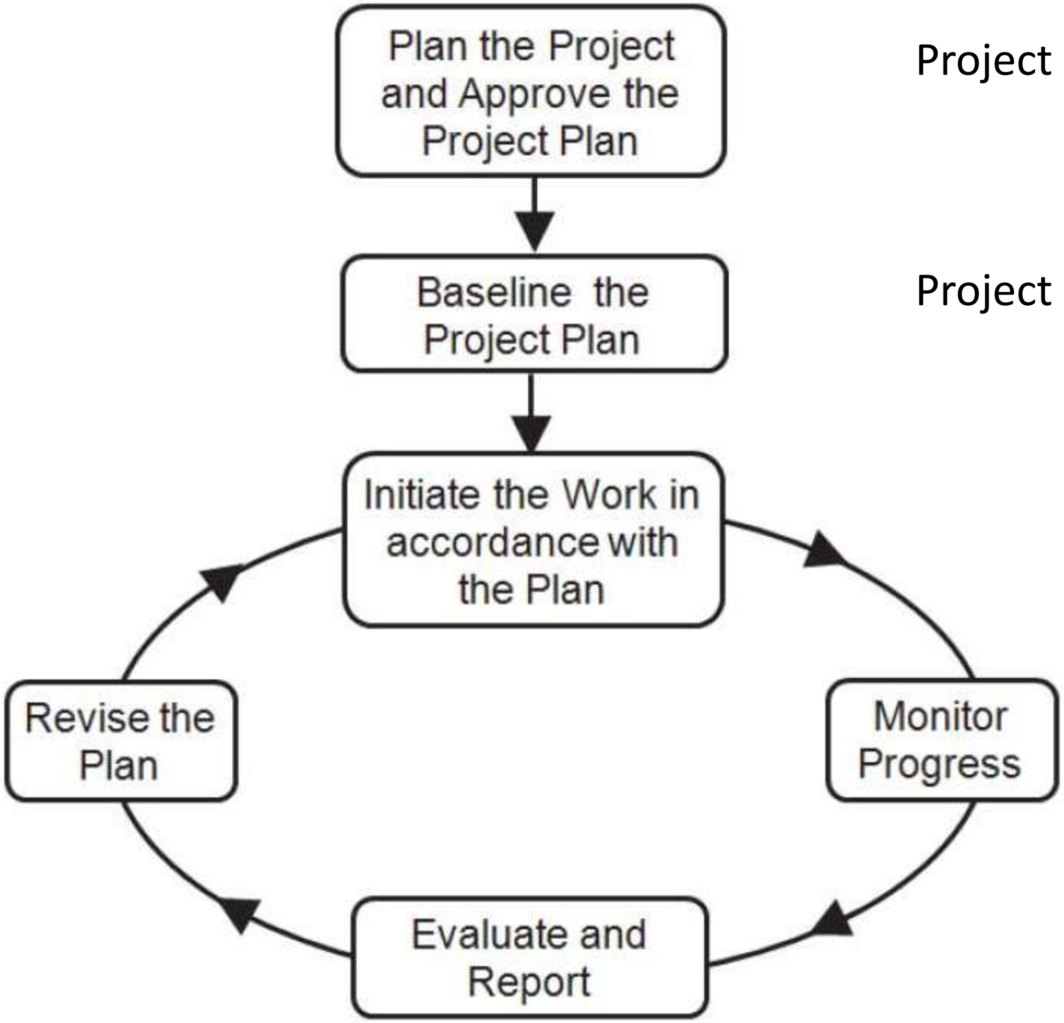
- Objectives (well defined)
  - Suitable with vision-mission
  - Analysis and design
  - Scope detailed in charter
- Touching and short (30 min)
  - Risks redefined (60 min)
- Risk Management plan
  - (PMBOK Ch 11)
- Re- observe charter
- Outside Clients permeations

Launch Meeting
Charter Elements Review

- Purpose, objectives
- Schedule
  - Milestones
- Resources
- Stakeholders
- Risk management plans
- Evaluation Methods

PM Should Make them believe

Responsibilities of PM



Project Charter

Project Management Plan

Planning Work Order

No	PLANNING (This is the only process group with a set order)	Knowledge Area
1	Determine development approach, life cycle, and how you will plan for each knowledge areas	Integration, Scope, Schedule, Cost, Quality, Resource, Communcations, Risk, Procurement, Stakeholder
2	Define and prioritize requirements	Scope
3	Create Project Scope Statement	Scope
4	Assess what to purchase and create procurement documents	Procurement
5	Determne planning team	Integration
6	Create WBS and WBS dictionary	Scope
7	Create activity list	Schedule
8	Create network diagram	Schedule
9	Estimate resource requirements	Resource
10	Estimate activity durations and costs	Schedule , Cost
11	Determine Critical Path	Schedule
12	Develop Schedule	Schedule
13	Develop Budget	Cost
14	Determine Quality Standards, processes, and, metrics	Quality
15	Determine team charter and all roles and responsibilities	Integration, Scope, Schedule, Cost, Quality, Resource, Communcations, Risk, Procurement, Stakeholder
16	Plan communications and stakeholder engagement	Communications, Stakeholder
17	Perform risk identification, qualitative and quantitative risk anlaysis, and risk response planning	Risk
18	Go back -- Iterations	Integration, Scope, Schedule, Cost, Quality, Resource, Communcations, Risk, Procurement, Stakeholder
19	Finalize procurement strategy and documents	Procurement
20	Create change and configuration management plans	Integration
21	Finalize all management plans	Integration, Scope, Schedule, Cost, Quality, Resource, Communcations, Risk, Procurement, Stakeholder
22	Develop realistic and sufficient project management plan and baselines	Integration, Scope, Schedule, Cost, Quality, Resource, Communcations, Risk, Procurement, Stakeholder
23	Gain formal approval of the plan	Integration
24	Hold kickoff meeting	Integration
25	Request Changes	Schedule, Risk, Procurement

1. Develop Project Charter
2. Develop Project Management Plan
3. Direct and Manage Project Work
4. Manage Project Knowledge
5. Monitor and Control Project Work
6. Perform Integrated Change Control
7. Close Project or Phase

Project Management Plan

Develop Project Management Plan is the process of defining, preparing, and coordinating all plan components and consolidating them into an integrated project management plan.

1. Develop Project Charter
2. Develop Project Management Plan
3. Direct and Manage Project Work
4. Manage Project Knowledge
5. Monitor and Control Project Work
6. Perform Integrated Change Control
7. Close Project or Phase

Project Management Plan

Project Management Plan	Project Documents	
1. Scope management plan	1. Activity attributes	19. Quality control measurements
2. Requirements management plan	2. Activity list	20. Quality metrics
3. Schedule management plan	3. Assumption log	21. Quality report
4. Cost management plan	4. Basis of estimates	22. Requirements documentation
5. Quality management plan	5. Change log	23. Requirements traceability matrix
6. Resource management plan	6. Cost estimates	24. Resource breakdown structure
7. Communications management plan	7. Cost forecasts	25. Resource calendars
8. Risk management plan	8. Duration estimates	26. Resource requirements
9. Procurement management plan	9. Issue log	27. Risk register
10. Stakeholder engagement plan	10. Lessons learned register	28. Risk report
11. Change management plan	11. Milestone list	29. Schedule data
12. Configuration management plan	12. Physical resource assignments	30. Schedule forecasts
13. Scope baseline	13. Project calendars	31. Stakeholder register
14. Schedule baseline	14. Project communications	32. Team charter
15. Cost baseline	15. Project schedule	33. Test and evaluation documents
16. Performance measurement baseline	16. Project schedule network diagram	
17. Project life cycle description	17. Project scope statement	
18. Development approach	18. Project team assignments	

If too much; prefer Agile methods

Project Management Plan

- The process for managing **change**
- A plan for communicating with and managing **stakeholders**
- Specifying the process for setting key characteristics of the project deliverable (technically referred to as **configuration management**)
- Establishing the **cost baseline** for the project and developing a plan to manage project costs
- Developing a plan for managing the **human resources** assigned to the project
- Developing a plan for **continuously monitoring** and improving project work processes
- Developing guidelines for **procuring** project materials and resources
- Defining the **project's scope** and establishing practices to manage the project's scope
- Developing the **<u>Work Breakdown Structure</u>**
- Developing practices to manage the **quality** of the project deliverables
- Defining how project **requirements** will be managed
- Establishing practices for managing **risk**
- Establishing the schedule baseline and developing a plan to manage the project's **schedule**

Project Management in practice

Being able to discuss objectively

1. What was the source of the problem here?

   (Root cause analysis)

2. How might a Project Charter as described above have helped avoid these shortcomings?

3. What would you suggest to recover the project?

Project Management in practice

Whole brain approach

Center of the paper coated wall

Figure 6-1a Begin mind mapping with statement of project's objective.

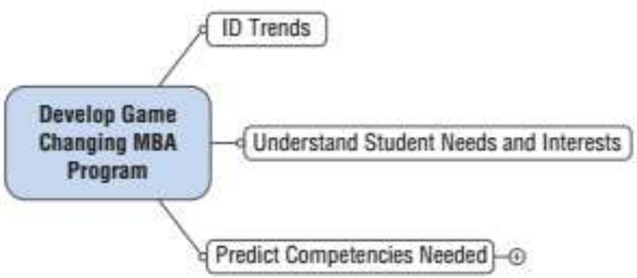


Figure 6-1b Major tasks branch off from project goal.

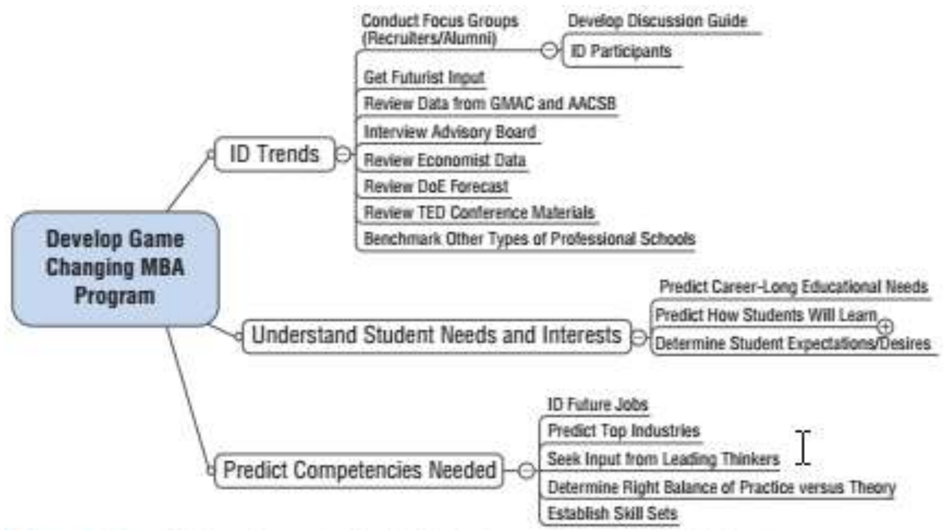


Figure 6-1c Major tasks are further broken down into more detailed tasks.

Project Management in practice

Whole brain approach

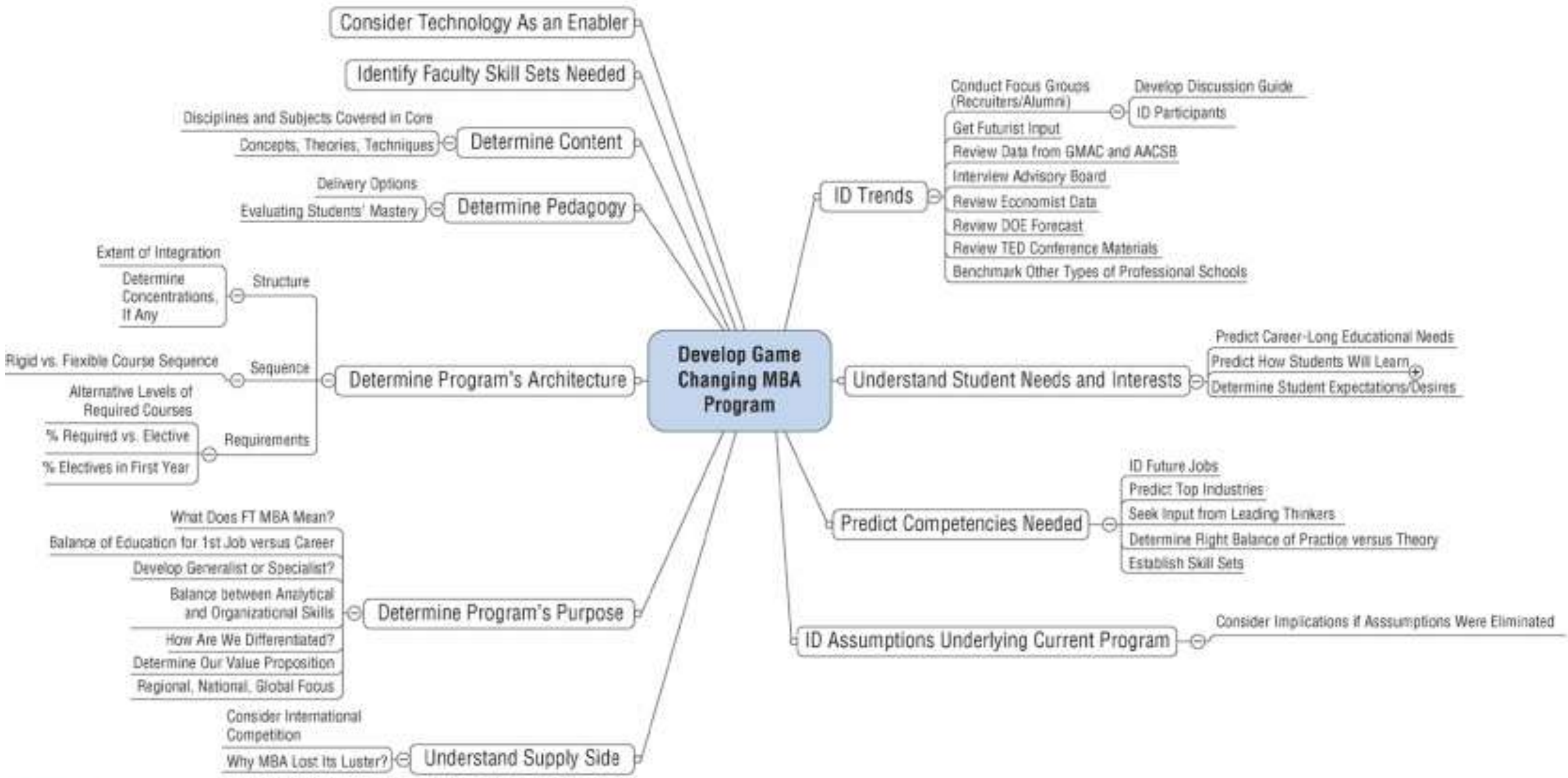


Figure 6-2 Final mind map for full-time MBA project.

Project Planning in Action

Life Cycle Sample for developing software

- Concept evaluation
- Requirements identification
- Design
- Implementation
- Test
- Integration
- Validation
- Customer test and evaluation
- Operations and maintenance

WBS – Work Breakdown Structure

Figure 6-3 Hierarchical planning.

WBS – Work Breakdown Structure

1.0. Chemical Process Facility

1.1. Construction Work

1.1.1. Preparation of the site and laying the foundation

1.1.2. Steelworks

1.1.3. Delivery of the site

1.2. Mechanical Engineering Work

1.2.1. Installing equipment

1.2.2. Ductwork

1.2.3. Pipework

1.3. Electrical & Electronics Engineering Work

1.3.1. Instrumentation

1.3.2. Electrical apparatus

WBS – Work Breakdown Structure

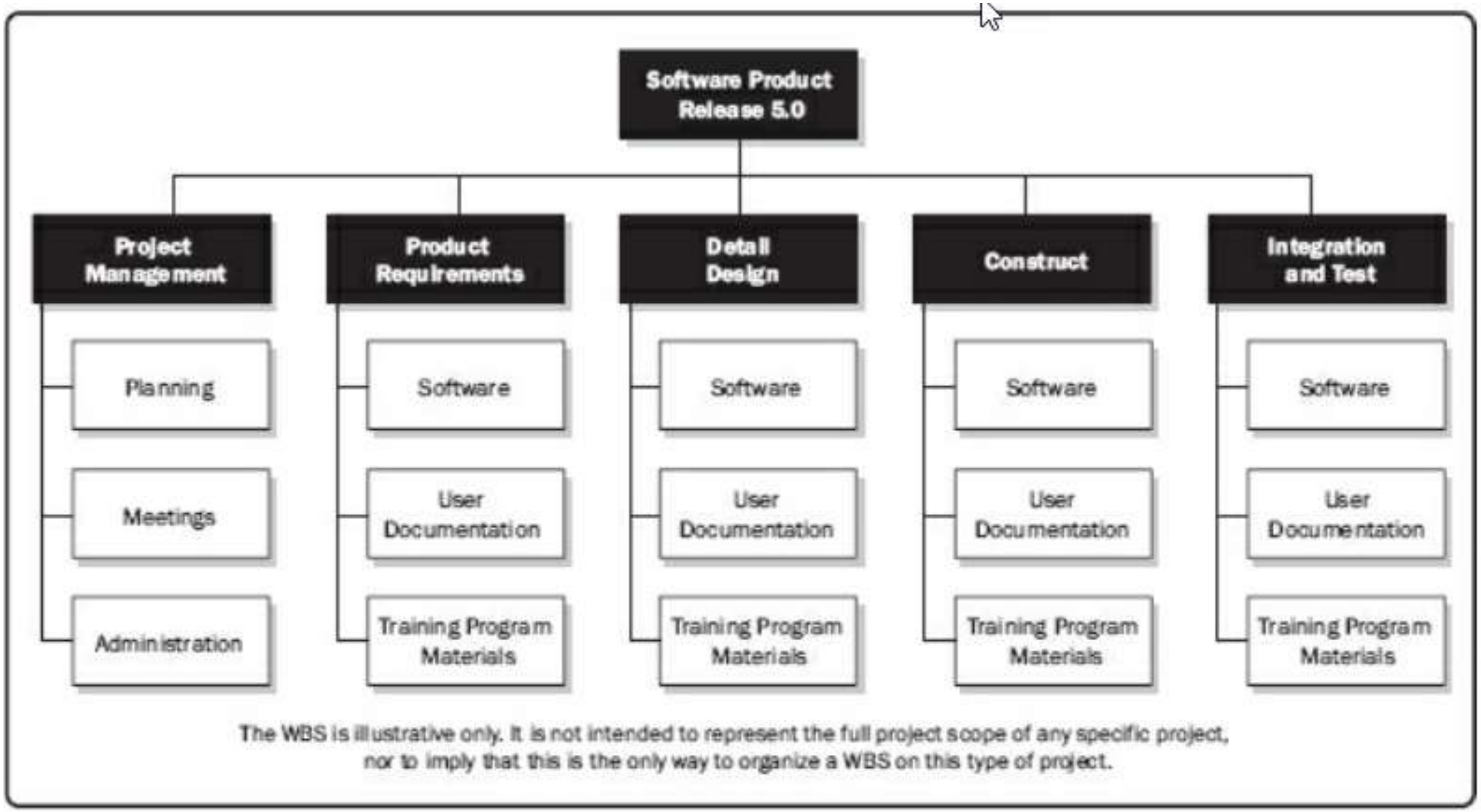
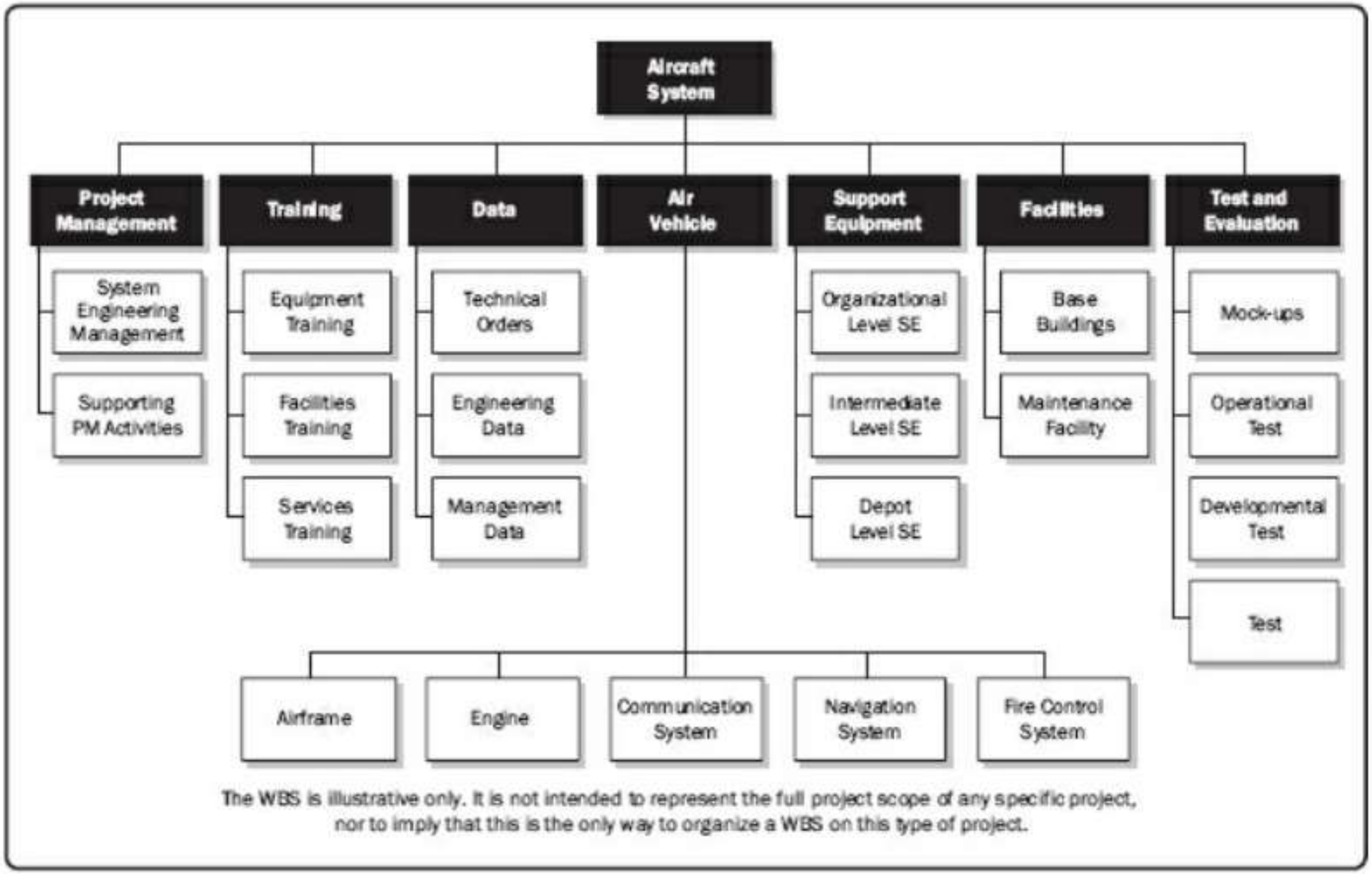


Figure 5-13. Sample WBS Organized by Phase

PMBOK®

WBS – Work Breakdown Structure

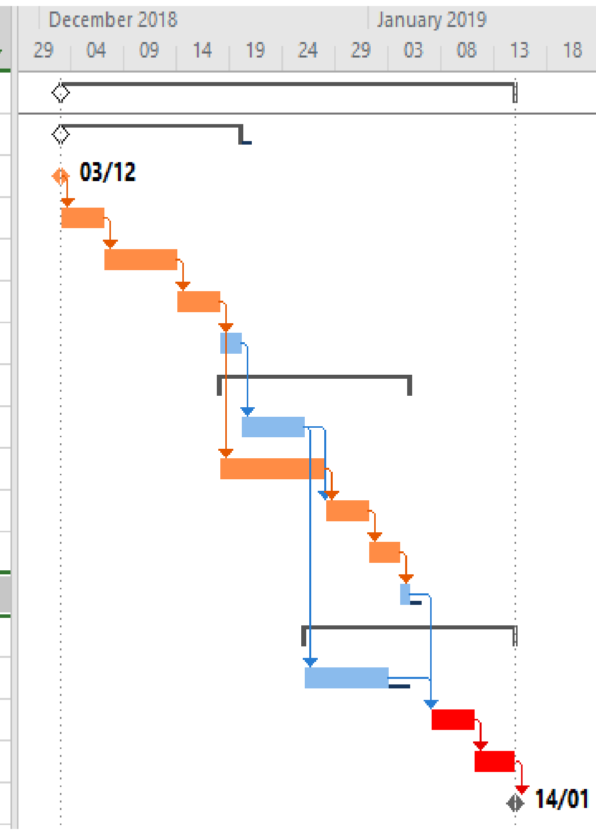


PMBOK®

Figure 5-14. Sample WBS with Major Deliverables

WBS – Work Breakdown Structure

		Task Name	Duration	Start	Finish	Total Slack	Predecessors
1		**Bid for Facility Extaension**	**31 d**	**03 Dec '18**	**14 Jan '19**	**0 d**	
2		**Technical Specifications**	**13 d**	**03 Dec '18**	**19 Dec '18**	**1 d**	
3		Approval to bid	0 d	03 Dec '18	03 Dec '18	1 d	
4		Determine Installation Requirements	4 d	03 Dec '18	06 Dec '18	1 d	3
5		Create Technical Specification	5 d	07 Dec '18	13 Dec '18	1 d	4
6		Identify Supplier Components	2 d	14 Dec '18	17 Dec '18	1 d	5
7		Validate Technical Spesification	2 d	18 Dec '18	19 Dec '18	2 d	6
8		**Delivery Plan**	**14 d**	**18 Dec '18**	**04 Jan '19**	**0 d**	
9		Document Deliver Methodology	4 d	20 Dec '18	25 Dec '18	2 d	7
10		Obtain Quotes From Suppliers	8 d	18 Dec '18	27 Dec '18	1 d	6
11		Crete the Project Schedule	3 d	28 Dec '18	31 Dec '18	1 d	9,10
12		Create the project schedule	3 d	01 Jan '19	03 Jan '19	1 d	11
13		Rewew thw Delivery Plan	1 d	04 Jan '19	04 Jan '19	1 d	12
14		**Bid Document**	**14 d**	**26 Dec '18**	**14 Jan '19**	**0 d**	
15		Create Draft of Bid Document	6 d	26 Dec '18	02 Jan '19	2 d	9
16		Review Bid Document	4 d	07 Jan '19	10 Jan '19	0 d	13,15
17		Finalize and Submit Bid Document	2 d	11 Jan '19	14 Jan '19	0 d	16
18		Bid Document Submitted	0 d	14 Jan '19	14 Jan '19	0 d	17



WBS Sample (Meredith Ch 6)

WBS

Career Day				
Steps	**Responsibility**	**Time (weeks)**	**Prec.**	**Resources**
1. Contact Organizations				
a. Print forms	Secretary	6	–	Print shop
b. Contact organizations	Program manager	15	1.a	Word processing
c. Collect display information	Office manager	4	1.b	
d. Gather college particulars	Secretary	4	1.b	
e. Print programs	Secretary	6	1.d	Print shop
f. Print participants' certificates	Graduate assistant	8	–	Print Shop
2. Banquet and Refreshments				
a. Select guest speaker	Program manager	14	–	
b. Organize food	Program manager	3	1.b	Caterer
c. Organize liquor	Director	10	1.b	Dept. of Liquor Control
d. Organize refreshments	Graduate assistant	7	1.b	Purchasing
3. Publicity and Promotion				
a. Send invitations	Graduate assistant	2	–	Word processing
b. Organize gift certificates	Graduate assistant	5.5	–	
c. Arrange banner	Graduate assistant	5	1.d	Print shop
d. Contact faculty	Program manager	1.5	1.d	Word processing
e. Advertise in college paper	Secretary	5	1.d	Newspaper
f. Class announcements	Graduate assistant	1	3.d	Registrar's office
g. Organize posters	Secretary	4.5	1.d	Print shop
4. Facilities				
a. Arrange facility for event	Program manager	2.5	1.c	
b. Transport materials	Office manager	.5	4.a	Movers

Project Work 1 – A

1. Select the Project Topic (You may select any topic or look at samples on next page)

   Use brain storming and mapping with your team.

   Keep the term project small and agile. If it is not small, take a part of the selected bigger project. (Example: Roof of a warehouse instead of the whole) Number of tasks and subtasks should not exceed 30 for being agile.

Project Samples

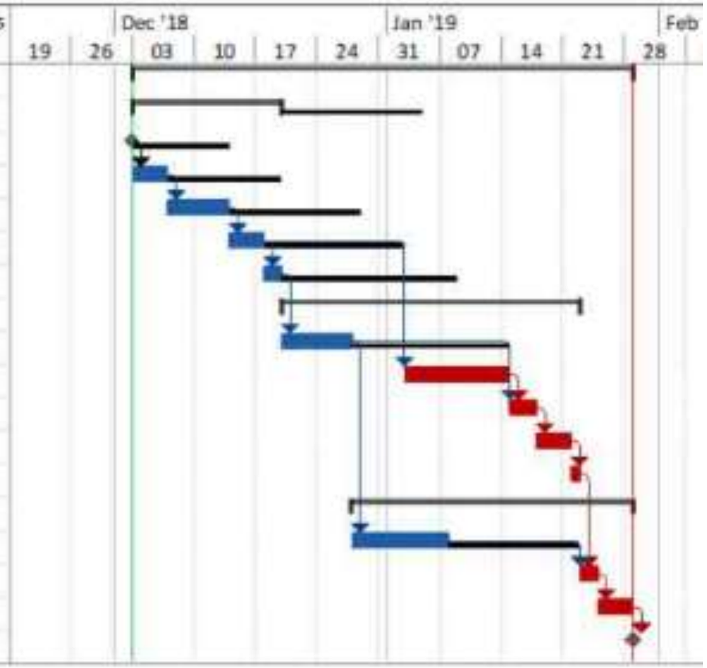
- Construction (Residential or commercial)
  - New Building
    - House, cottage, pool, barn, warehouse, solar farm, wind turbine, etc.
  - Renovate
    - House, flat, barn, pool, kitchen, bathroom, road, bike line, etc.
- Software development
  - Quiz, ledger, group management, electric bike rental system
- New marketing campaign
  - Product, political, new juice brand, etc.
- New production line or redesign for improvement
  - Automatic(sensor opening) trash box, battery, baklava line electric scooter with GSM and GPS, etc.
- Design
  - Electric bike, a new course, blue-tooth guitar, bike rental system

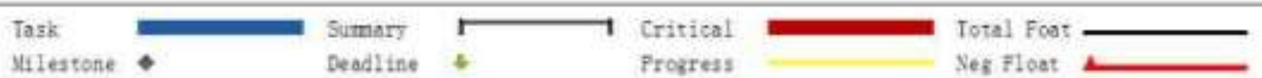
Project groups may have projects of the same name but with different attributes and properties.

Gantt Chart

Wilson International Bid
OzBuild

ID		Task Name	Dur	Start	Finish	Total Slack	Predecessors
1		**Bid For Facility Extension**	**38d**	**03 Dec '18**	**28 Jan '19**	**0d**	
2		**Technical Specification**	**13d**	**03 Dec '18**	**19 Dec '18**	**9d**	
3		Approval to Bid	0d	03 Dec '18	03 Dec '18	9d	
4		Determine Installation Requiremen	4d	03 Dec '18	06 Dec '18	9d	3
5		Create Technical Specification	5d	07 Dec '18	13 Dec '18	9d	4
6		Identify Supplier Components	2d	14 Dec '18	17 Dec '18	9d	5
7		Validate Technical Specification	2d	18 Dec '18	19 Dec '18	11d	6
8		**Delivery Plan**	**21d**	**20 Dec '18**	**22 Jan '19**	**0d**	
9		Document Delivery Methodology	4d	20 Dec '18	27 Dec '18	11d	7
10		Obtain Quotes from Suppliers	8d	03 Jan '19	14 Jan '19	0d	6
11		Calculate the Bid Estimate	3d	15 Jan '19	17 Jan '19	0d	9,10
12		Create the Project Schedule	3d	18 Jan '19	21 Jan '19	0d	11
13		Review the Delivery Plan	1d	22 Jan '19	22 Jan '19	0d	12
14		**Bid Document**	**21d**	**28 Dec '18**	**28 Jan '19**	**0d**	
15		Create Draft of Bid Document	6d	28 Dec '18	07 Jan '19	11d	9
16		Review Bid Document	2d	23 Jan '19	24 Jan '19	0d	13,15
17		Finalize and Submit Bid Document	2d	25 Jan '19	28 Jan '19	0d	16
18		Bid Document Submitted	0d	28 Jan '19	28 Jan '19	0d	17





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Page 1 of 1

Printed on: 21 Jan

Gantt Chart – on the wall

Subproject		Task	Responsible Dept.	Dependent Dept.	2011												2012											
					J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Determine need	A1	Find operations that benefit most	Industrial				△ ▲																					
	A2	Approx. size and type needed	Project Eng.	I.E.					△		▲																	
Solicit quotations	B1	Contact vendors & review quotes	P.E.	Fin., I.E., Purch.					○		●		△ ○	▲	□													
Write appropriation request	C1	Determine tooling costs	Tool Design	I.E.								○			●		△											
	C2	Determine labor savings	I.E.	I.E.										▲	△													
	C3	Actual writing	P.E.	Tool Dsgn., Fin., I.E.														△ ○										
Purchase machine tooling, and gauges	D1	Order robot	Purchasing	P.E.																	△							
	D2	Design and order or manufacture tooling	Tool Design	Purch., Tooling																				△				
	D3	Specify needed gauges and order or mfg.	Q.C.	Tool Dsgn., Purch.																				△ ○				
Installation and startup	E1	Install robot	Plant Layout	Mill-wrights																					△			
	E2	Train employees	Personnel	P.E. Mfg.																					△			
	E3	Runoff	Mfg.	Q.C.																								△ □

Legend:
* Project completion □ Contractual commitment △ Planned completion ▲ Actual completion
^ Status date ○ Milestone planned ● Milestone achieved --- Planned progress — Actual progress

Note: As of Jan. 31, 2012, the project is one month behind schedule. This is due mainly to the delay in task C1, which was caused bythe late completion of A2.

Agile Project Management

- Small project teams
- Smaller sub projects if necessary
- Well defined responsibilities of HR
  - Simple responsibility chart
  - Frequent meetings
  - Use of software as Smartsheet https://www.smartsheet.com/

Direct And Manage

Direct and Manage Project Work

Inputs

.1 Project management plan
- Any component

.2 Project documents
- Change log
- Lessons learned register
- Milestone list
- Project communications
- Project schedule
- Requirements traceability matrix
- Risk register
- Risk report

.3 Approved change requests

.4 Enterprise environmental factors

.5 Organizational process assets

Tools & Techniques

.1 Expert judgment

.2 Project management information system

.3 Meetings

Outputs

.1 Deliverables

.2 Work performance data

.3 Issue log

.4 Change requests

.5 Project management plan updates
- Any component

.6 Project documents updates
- Activity list
- Assumption log
- Lessons learned register
- Requirements documentation
- Risk register
- Stakeholder register

.7 Organizational process assets updates

Figure 4-6. Direct and Manage Project Work: Inputs, Tools & Techniques, and Outputs

Manage Knowledge

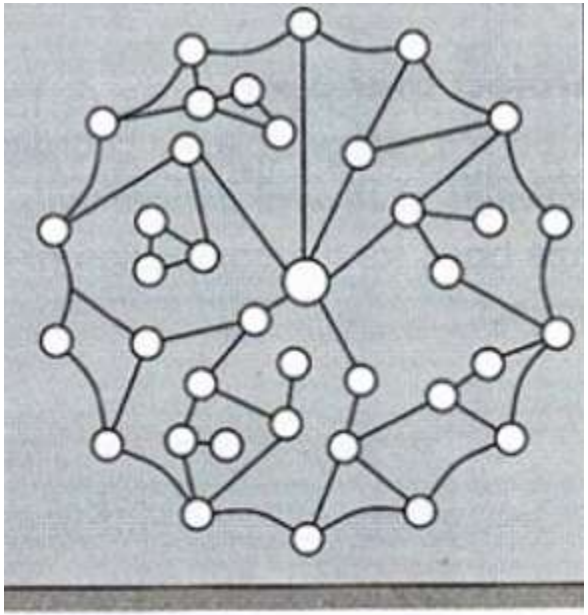
Manage Project Knowledge

Inputs	Tools & Techniques	Outputs
.1 Project management plan • All components .2 Project documents • Lessons learned register • Project team assignments • Resource breakdown structure • Source selection criteria • Stakeholder register .3 Deliverables .4 Enterprise environmental factors .5 Organizational process assets	.1 Expert judgment .2 Knowledge management .3 Information management .4 Interpersonal and team skills • Active listening • Facilitation • Leadership • Networking • Political awareness	.1 Lessons learned register .2 Project management plan updates • Any component .3 Organizational process assets updates

Figure 4-8. Manage Project Knowledge: Inputs, Tools & Techniques, and Outputs

Manage Knowledge

Knowledge is NOT only written documents



New Workplace
Learning Organization

Monitor and Control

Monitor and Control Project Work

Inputs

.1 Project management plan
- Any component

.2 Project documents
- Assumption log
- Basis of estimates
- Cost forecasts
- Issue log
- Lessons learned register
- Milestone list
- Quality reports
- Risk register
- Risk report
- Schedule forecasts

.3 Work performance information

.4 Agreements

.5 Enterprise environmental factors

.6 Organizational process assets

Tools & Techniques

.1 Expert judgment

.2 Data analysis
- Alternatives analysis
- Cost-benefit analysis
- Earned value analysis
- Root cause analysis
- Trend analysis
- Variance analysis

.3 Decision making

.4 Meetings

Outputs

.1 Work performance reports

.2 Change requests

.3 Project management plan updates
- Any component

.4 Project documents updates
- Cost forecasts
- Issue log
- Lessons learned register
- Risk register
- Schedule forecasts

Figure 4-10. Monitor and Control Project Work: Inputs, Tools & Techniques, and Outputs

Integrated Change Control

Perform Integrated Change Control

Inputs

.1 Project management plan
- Change management plan
- Configuration management plan
- Scope baseline
- Schedule baseline
- Cost baseline

.2 Project documents
- Basis of estimates
- Requirements traceability matrix
- Risk report

.3 Work performance reports
.4 Change requests
.5 Enterprise environmental factors
.6 Organizational process assets

Tools & Techniques

.1 Expert judgment
.2 Change control tools
.3 Data analysis
- Alternatives analysis
- Cost-benefit analysis

.4 Decision making
- Voting
- Autocratic decision making
- Multicriteria decision analysis

.5 Meetings

Outputs

.1 Approved change requests
.2 Project management plan updates
- Any component

.3 Project documents updates
- Change log

Figure 4-12. Perform Integrated Change Control: Inputs, Tools & Techniques, and Outputs

Close Project or Phase

Close Project or Phase

Inputs

.1 Project charter
.2 Project management plan
- All components

.3 Project documents
- Assumption log
- Basis of estimates
- Change log
- Issue log
- Lessons learned register
- Milestone list
- Project communications
- Quality control measurements
- Quality reports
- Requirements documentation
- Risk register
- Risk report

.4 Accepted deliverables
.5 Business documents
- Business case
- Benefits management plan

.6 Agreements
.7 Procurement documentation
.8 Organizational process assets

Tools & Techniques

.1 Expert judgment
.2 Data analysis
- Document analysis
- Regression analysis
- Trend analysis
- Variance analysis

.3 Meetings

Outputs

.1 Project documents updates
- Lessons learned register

.2 Final product, service, or result transition
.3 Final report
.4 Organizational process assets updates

Risk Planning
Identification of risks

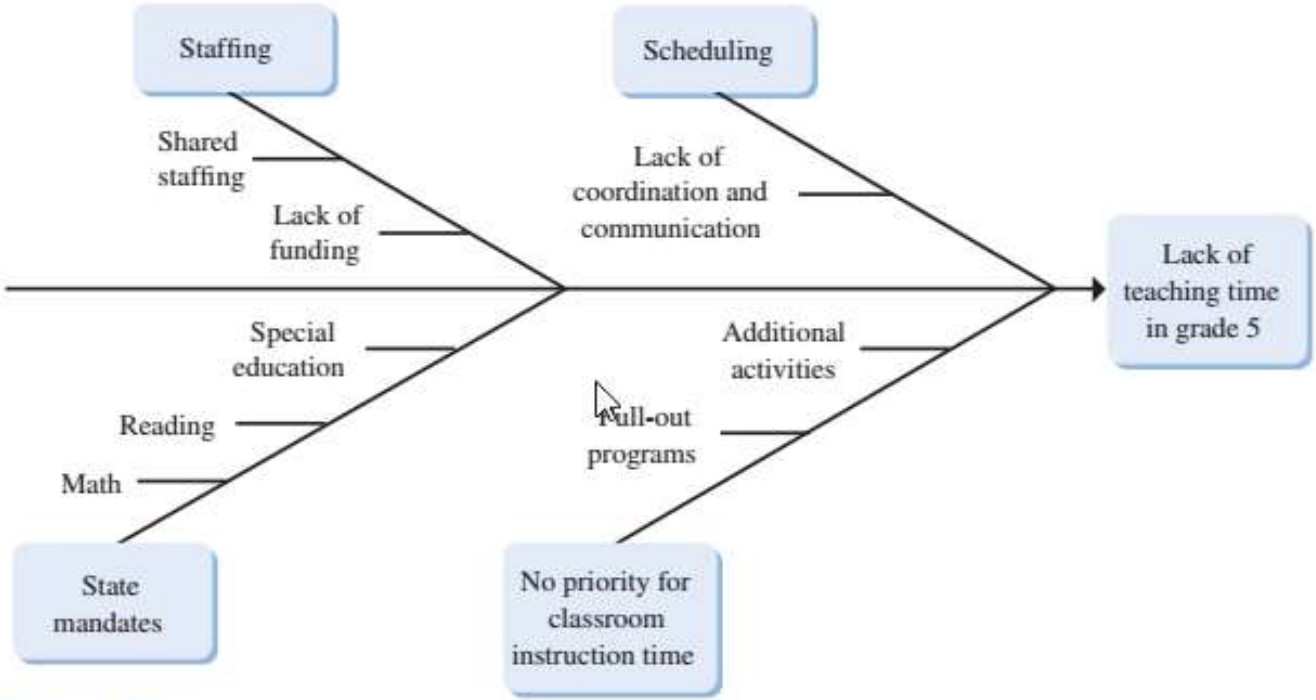


Figure 6-11 Fishbone diagram to identify potential factors.

Risk Planning
Qualitative Analysis

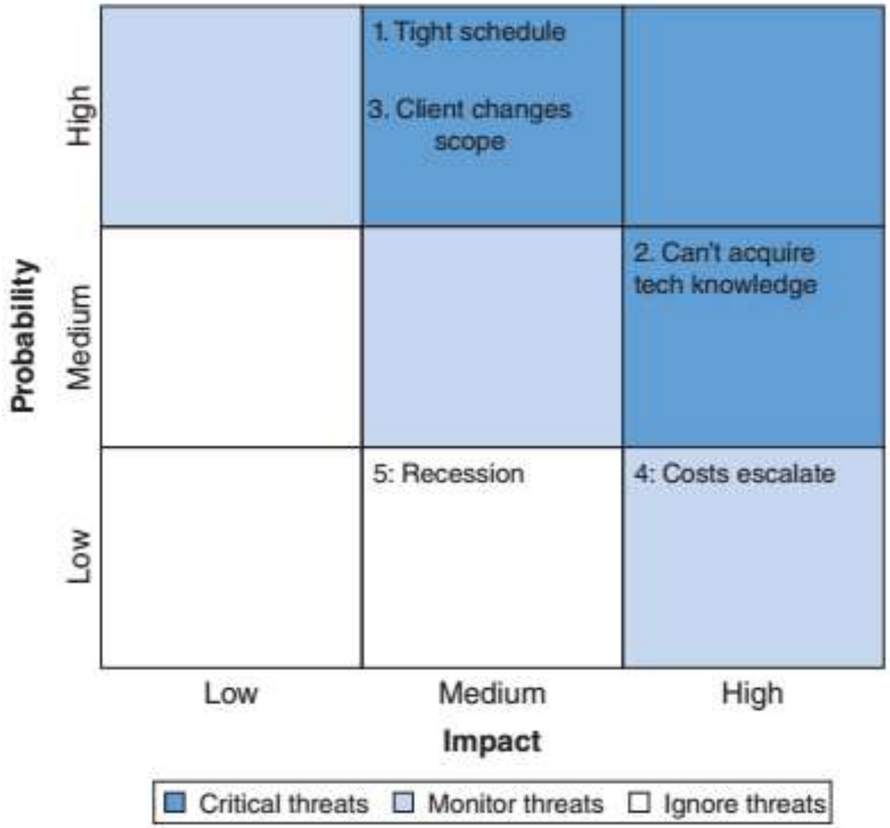


Figure 6-12 Risk Matrix.

Risk Planning

Quantitative Analysis

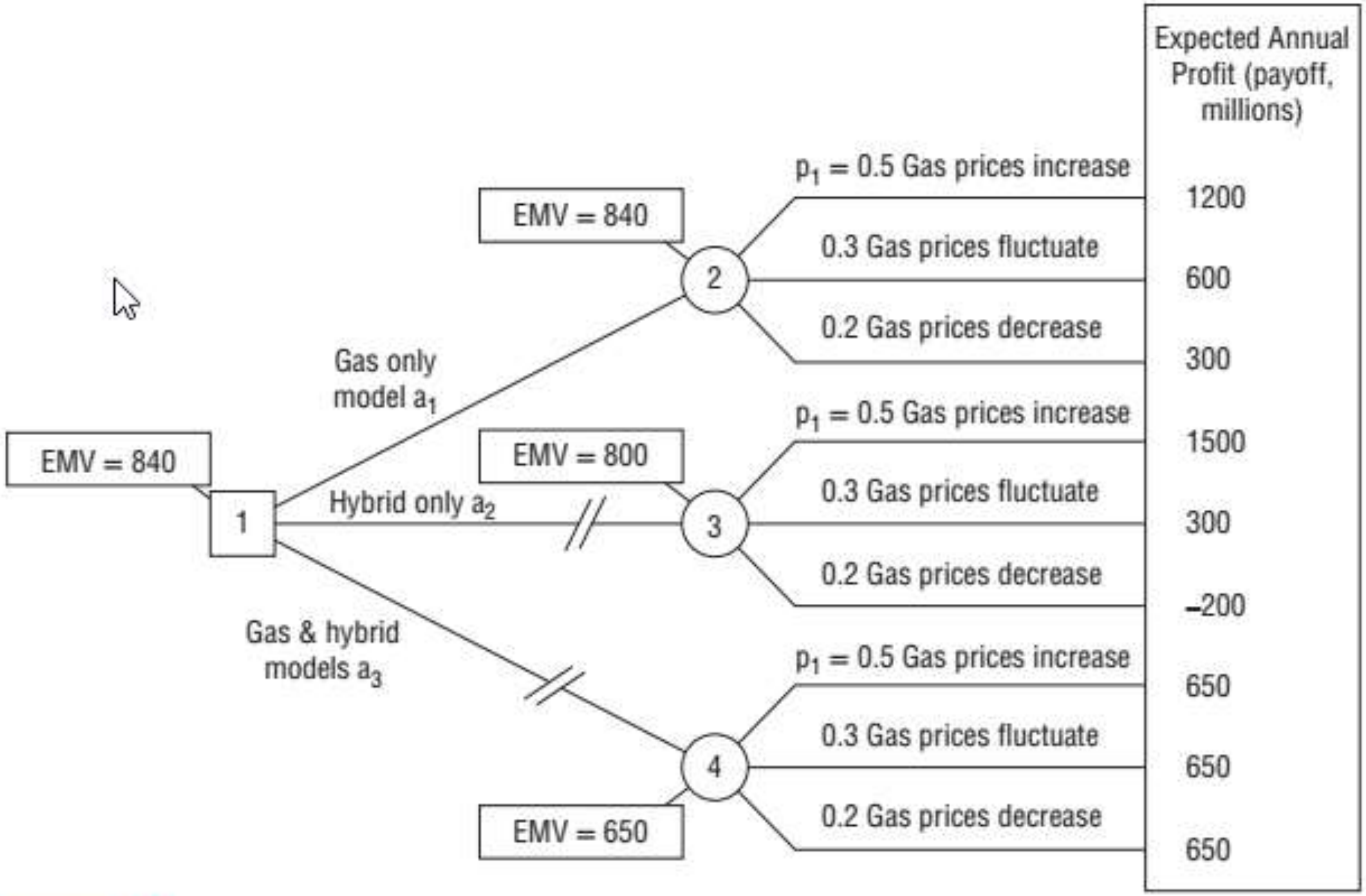
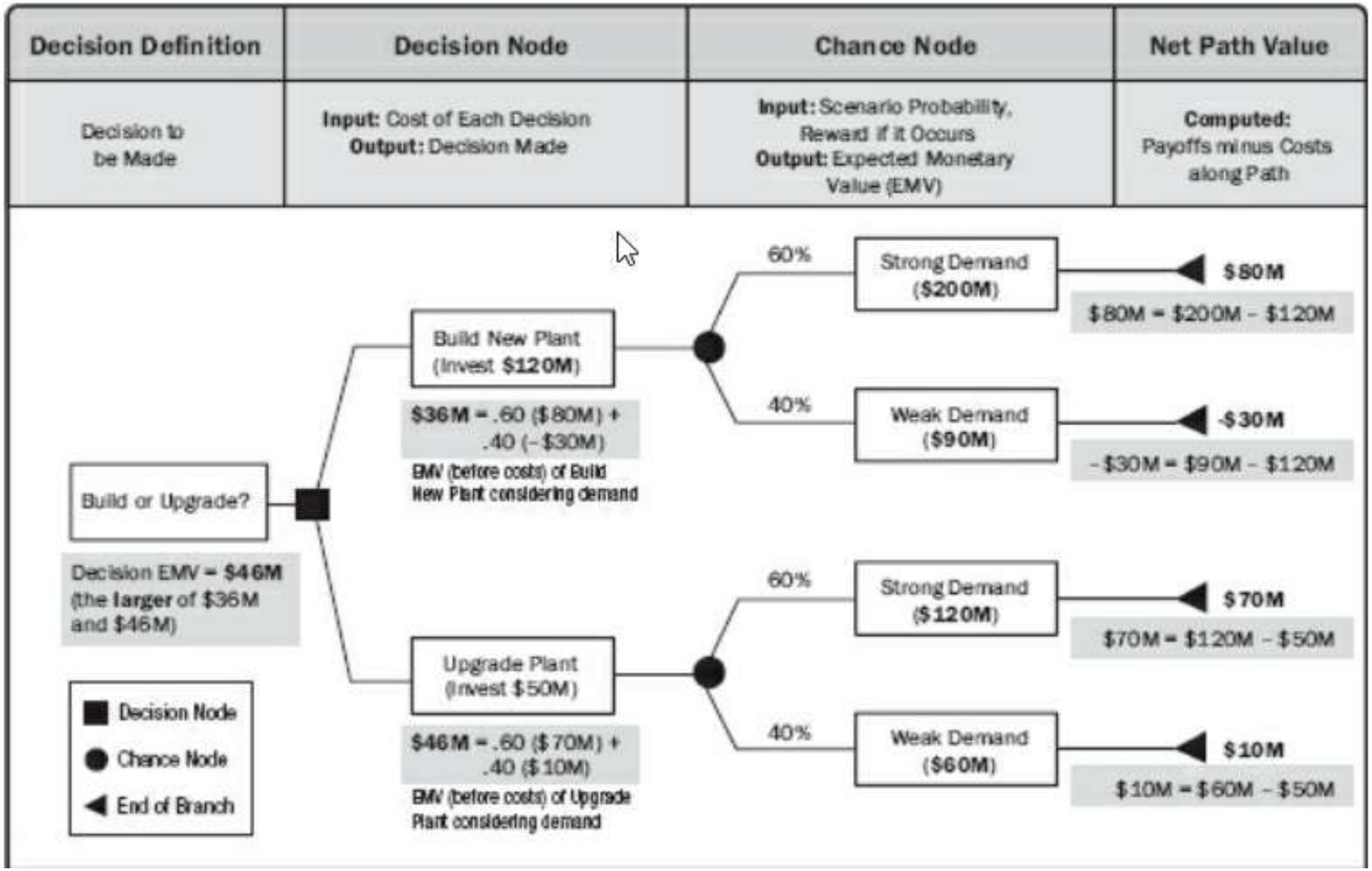


Figure 6-13 Decision tree based on expected monetary value (EMV).

Decision tree sample



Project Risk Management Overview

11.1 Plan Risk Management

.1 Inputs
- .1 Project charter
- .2 Project management plan
- .3 Project documents
- .4 Enterprise environmental factors
- .5 Organizational process assets

.2 Tools & Techniques
- .1 Expert judgment
- .1 Data analysis
- .3 Meetings

.3 Outputs
- .1 Risk management plan

11.2 Identify Risks

.1 Inputs
- .1 Project management plan
- .2 Project documents
- .3 Agreements
- .4 Procurement documentation
- .5 Enterprise environmental factors
- .6 Organizational process assets

.2 Tools & Techniques
- .1 Expert judgment
- .2 Data gathering
- .3 Data analysis
- .4 Interpersonal and team skills
- .5 Prompt lists
- .6 Meetings

.3 Outputs
- .1 Risk register
- .2 Risk report
- .3 Project documents updates

11.3 Perform Qualitative Risk Analysis

.1 Inputs
- .1 Project management plan
- .2 Project documents
- .3 Enterprise environmental factors
- .4 Organizational process assets

.2 Tools & Techniques
- .1 Expert judgment
- .2 Data gathering
- .3 Data analysis
- .4 Interpersonal and team skills
- .5 Risk categorization
- .6 Data representation
- .7 Meetings

.3 Outputs
- .1 Project documents updates

11.4 Perform Quantitative Risk Analysis

.1 Inputs
- .1 Project management plan
- .2 Project documents
- .3 Enterprise environmental factors
- .4 Organizational process assets

.2 Tools & Techniques
- .1 Expert judgment
- .2 Data gathering
- .3 Interpersonal and team skills
- .4 Representations of uncertainty
- .5 Data analysis

.3 Outputs
- .1 Project documents updates

11.5 Plan Risk Responses

.1 Inputs
- .1 Project management plan
- .2 Project documents
- .3 Enterprise environmental factors
- .4 Organizational process assets

.2 Tools & Techniques
- .1 Expert judgment
- .2 Data gathering
- .3 Interpersonal and team skills
- .4 Strategies for threats
- .5 Strategies for opportunities
- .6 Contingent response strategies
- .7 Strategies for overall project risk
- .8 Data analysis
- .9 Decision making

.3 Outputs
- .1 Change requests
- .2 Project management plan updates
- .3 Project documents updates

11.6 Implement Risk Responses

.1 Inputs
- .1 Project management plan
- .2 Project documents
- .3 Organizational process assets

.2 Tools & Techniques
- .1 Expert judgment
- .2 Interpersonal and team skills
- .3 Project management information system

.3 Outputs
- .1 Change requests
- .2 Project documents updates

11.7 Monitor Risks

.1 Inputs
- .1 Project management plan
- .2 Project documents
- .3 Work performance data
- .4 Work performance reports

.2 Tools & Techniques
- .1 Data analysis
- .2 Audits
- .3 Meetings

.3 Outputs
- .1 Work performance information
- .2 Change requests
- .3 Project management plan updates
- .4 Project documents updates
- .5 Organizational process assets updates

For Midterm Exam

From Chapter 6 of Meredith
Solve End of Chapter Problems 4 – 5
You may apply Problem 3 to your project.

Do not forget Project Work 1 – 5 Pts

1. Create the **Project Charter as Word document** to be confirmed by your Instructor.

2. Create **first WBS draft (task list) for your project in MS-Project**
   (You may need to complete workshop 2 first to learn about creating tasks and subtasks within MS-project)

3. Upload files to lectures.yasar.edu.tr

Sample Problems for Exam

4. The yearly demand for a seasonal, profitable item follows the distribution:

Demand (units)	***Probability***
1,000	.20
2,000	.30
3,000	.40
4,000	.10

A manufacturer is considering launching a project to produce this item and could produce it by one of three methods:

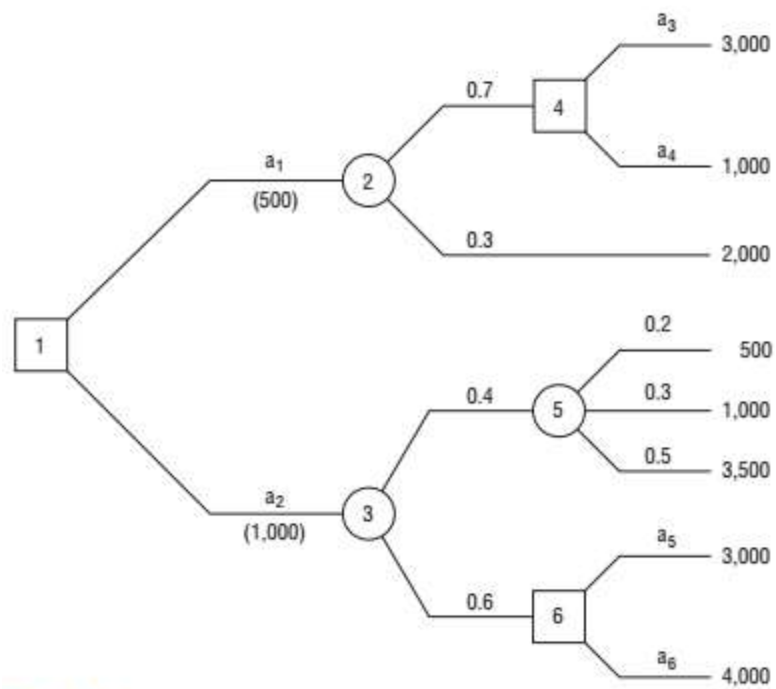
a. Use existing tools at a cost of $6 per unit.

b. Buy cheap, special equipment for $1,000. The value of the equipment at the end of the year (salvage value) is zero. The cost would be reduced to $3 per unit.

c. Buy high-quality, special equipment for $10,000 that can be depreciated over four years (one fourth of the cost each year). The cost with this equipment would be only $2 per unit.

Set up this project as a decision tree to find whether the manufacturer should approve this project, and if so, which method of production to use to maximize profit. *Hint:* Compare total annual costs. Assume production must meet all demand; each unit demanded and sold means more profit.

5. Given the decision tree below for a two-stage (decision) project to enter a joint venture, find the best alternatives (among a_1-a_6 in the figure) and their expected values. The outcomes shown are *revenues* and the investment expenses are in parentheses. Node 4 represents the situation where alternative a_1 was chosen, and then the top outcome with a 70 percent probability occurred; note that there is no choice of alternative if the 30 percent probability outcome occurred. Similarly with Node 5.



Problem 5 Decision Tree.

Fish bone Exercise

3. You might not have realized it, but getting a college degree is a project. Assume you are in a degree program in college and are concerned about getting your degree. Create a fishbone (cause–effect) diagram, with "failure to get degree" as the problem outcome. Identify at least four possible threat risks for this problem to occur. Then for each threat list at least three reasons/factors for how that threat could conceivably come to pass. Finally, review your diagram to estimate probabilities and impacts of each threat to getting your degree. Based on this analysis, what threats and factors should you direct your attention to, as the project manager of your project to get your degree.

Sample Problems for Exam

Problem 1: Your company wants to decide between Investment A, which will cost $100K upfront, and Investment B, which will cost $150K upfront. If the economy performs well, Investment A will bring in $750K for your company, but if the economy performs poorly, then it will lose $250K for your company. If the economy performs well, Investment B will bring in $850K for your company, but if the economy performs poorly, then it will lose $300K for your company. There's a 60% chance of a strong market and a 40% chance of a weak market.

Problem 2: You are asked to choose between two projects A or B based on the highest gain (or the lowest loss). A will cost U.S. $650,000 and B will cost U.S. $467,000. There is a 56% chance that project A will be successful, which will result in a gain of U.S. $1,800,000. If project A fails there will be a loss of U.S. $900,000. There is a 67% project B will be successful. If Project B fails there will be a loss of U.S. $670,000. Based on this information, what is the minimum gain of project B in order to be a better option than project A?

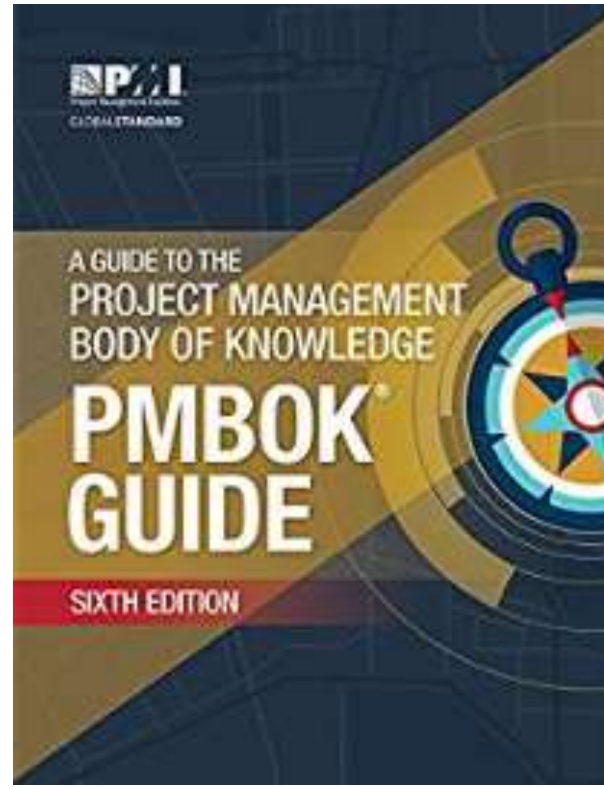
Sample Problems for Exam

Problem 3: Michael Dell, president of Dell Computers, Inc., has two design options for his new high resolution flat screen monitors for CAD workstations. The life cycle sales forecast of the monitors is 100,000 units.

Design option A has a 0.70 probability of yielding 59 good monitors per 100 and 0.3 probability of yielding 64 good monitors per 100. This design cost is $1,000,000. Design option B has a 0.60 probability of yielding 64 good units per 100 and 0.40 probability of yield 59 good units per 100. This design will cost $1,350,000. Good or bad, each monitor will cost $75. Each good monitor will sell for $150. Bad monitors are destroyed and have no salvage value.

Which design option should be selected and what is its expected monetary value (EMV)?

Course resources



Questions

- Questions

hp@quiztechnology.com

NEXT WEEK: Project planning
Scope, Schedule and Cost Management

The following is a guide line for your first project work. You have to prepare and submit your project charter and draft WBS within three weeks after lecture 4. The project charter should include but not limited to the following topics given below.

You don't have to create predecessor or successors of your Work Breakdown Structure yet. Remember your WBS is just a draft. You will work-on after confirmation of the Project Charter.

Project Title & Description

This section contains high level project description of the project. It explains the major components of the project and intended outcome of the project. It may also include some background about the history of how the project got to this point.

Purpose (Business Case)

This is a short summary directed to top management and those unfamiliar with the project. It contains a statement of the general goals of the project and a brief explanation of their relationship to the firm's objectives (i.e., the "Business Case," where we see how profits are gained). The Business Case includes not only market opportunities and profit potentials but also the needs of the organization, any customer requests for proposals, technological advancement opportunities, and regulatory, environmental, and social considerations.

Measurable Project Objectives

This contains a more detailed statement of the general goals of the project and their priorities, what constitutes success, and how the project will be terminated. The statement should include measurable objectives such as profit and competitive aims from the Business Case as well as technical goals based on the Statement of Work (generally abbreviated as SOW).

Schedules

This section outlines the various schedules and lists all milestone events and/or phase-gates. Each summary (major) task is listed, with the estimated time obtained from those who will do the work. The projected baseline schedule is constructed from these inputs. The responsible person or department head should sign off on the final, agreed-on schedule.

Resources

The project charter should include how many and which resources will be provided for the project at high level. The resources may include labor resources, equipment resources, or material resources. The organization may use Enterprise Environmental Factors (EEFs) and Organizational Process Assets (OPAs)

Stakeholders

This section lists the key stakeholders. Besides the client, community, and other external stakeholders, especially the project manager and the sponsor/approver of the project. The authorization level of the Project Manager should be defined.

Risk Management Plans

At a high-level, this covers potential problems as well as potential lucky breaks that could affect the project. One or more issues such as subcontractor default, unexpected technical breakthroughs, strikes, hurricanes, new markets for the technology, and sudden moves by a competitor are certain to occur— the only uncertainties are which, when, and their impact.

Evaluation Methods

Every project should be evaluated against standards and by methods established at the project's inception. This section contains a brief description of the procedures to be followed in monitoring, collecting, storing, auditing, and evaluating the project, as well as in the post-project ("lessons learned") evaluation following project termination.

Project Charter Authorization

Provide information about who is the authorized person for project charter.

ENGR3450 – Project Management

Week 5

The Project Planning

Scope, Schedule and Cost Management

İzmir, 2019

YAŞAR ÜNİVERSİTESİ
Mühendislik Fakültesi

Agenda today

- Project Scope Management
- Project Schedule Management
- Project Cost Management

Knowledge Areas & Project Management Process Groups Matrix

Knowledge Areas	Initiating	Planning	Executing	Monitoring & Control	Closing
	Project Management Process Groups				
1. Project Integration Management	a. Develop Project Charter	b. Develop Project Management Plan	c. Direct and Manage Project Work d. Manage Project Knowledge	e. Monitor and Control Project Work f. Perform Integrated Change Control	g. Close Project or Phase
2. Project Scope Management		a. Plan Scope Management b. Collect Requirements c.Define Scope d. Create WBS		e. Validate Scope f. Control Scope	
3. Project Schedule Management		a. Plan Schedule Management b. Define Activities c. Sequence Activities d. Estimate Activity Durations e. Develop Schedule		f. Control Schedule	
4. Project Cost Management		a. Plan Cost Management b. Estimate Costs c. Determine Budget		d. Control Costs	
5. Project Quality Management		a. Plan Quality Management	b. Manage Quality	c. Control Quality	
6. Project Resource Management		a. Plan Resource Management b. Estimate Activity Resources	c. Acquire Resources d. Develop Team e. Manage Team	f. Control Resources	
7. Project Communcations Management		a. Plan Communcations Management	b. Manage Communications	c. Monitor Communications	
8. Project Risk Management		a. Plan Resource Management b. Identify Risks c. Perform Qualitative Risk Analysis d. Perform Quantitative Risk Analysis e. Plan Risk Responses	f. Implement Risk Responses	g. Monitor Risks	
9. Project Procurement Management		a. Plan Procurement Management Plan	b. Conduct Procurements	c. Control Procurements	
10. Stakeholder Management	a. Identify Stakeholders	b. Plan Stakeholder Engagement	c. Manage Stakeholder Engagement	d. Monitor Stakeholder Engagement	

Project Scope Management

	Project Management Process Groups				
	Initiating	Planning	Executing	Monitoring & Control	Closing
1. Project Integration Management	a. Develop Project Charter	b. Develop Project Management Plan	c. Direct and Manage Project Work d. Manage Project Knowledge	e. Monitor and Control Project Work f. Perform Integrated Change Control	g. Close Project or Phase
2. Project Scope Management		a. Plan Scope Management b. Collect Requirements c.Define Scope d. Create WBS		e. Validate Scope f. Control Scope	
3. Project Schedule Management		a. Plan Schedule Management b. Define Activities c. Sequence Activities d. Estimate Activity Durations e. Develop Schedule		f. Control Schedule	
4. Project Cost Management		a. Plan Cost Management b. Estimate Costs c. Determine Budget		d. Control Costs	

e Areas

Scope Management processes

- Planning Process Group:
  - Collect Requirements

    (stakeholder needs and requirements to meet project objectives)

  - Define Scope

    (Detailed description of the project and product.)

  - Create WBS (Look at Previous week)

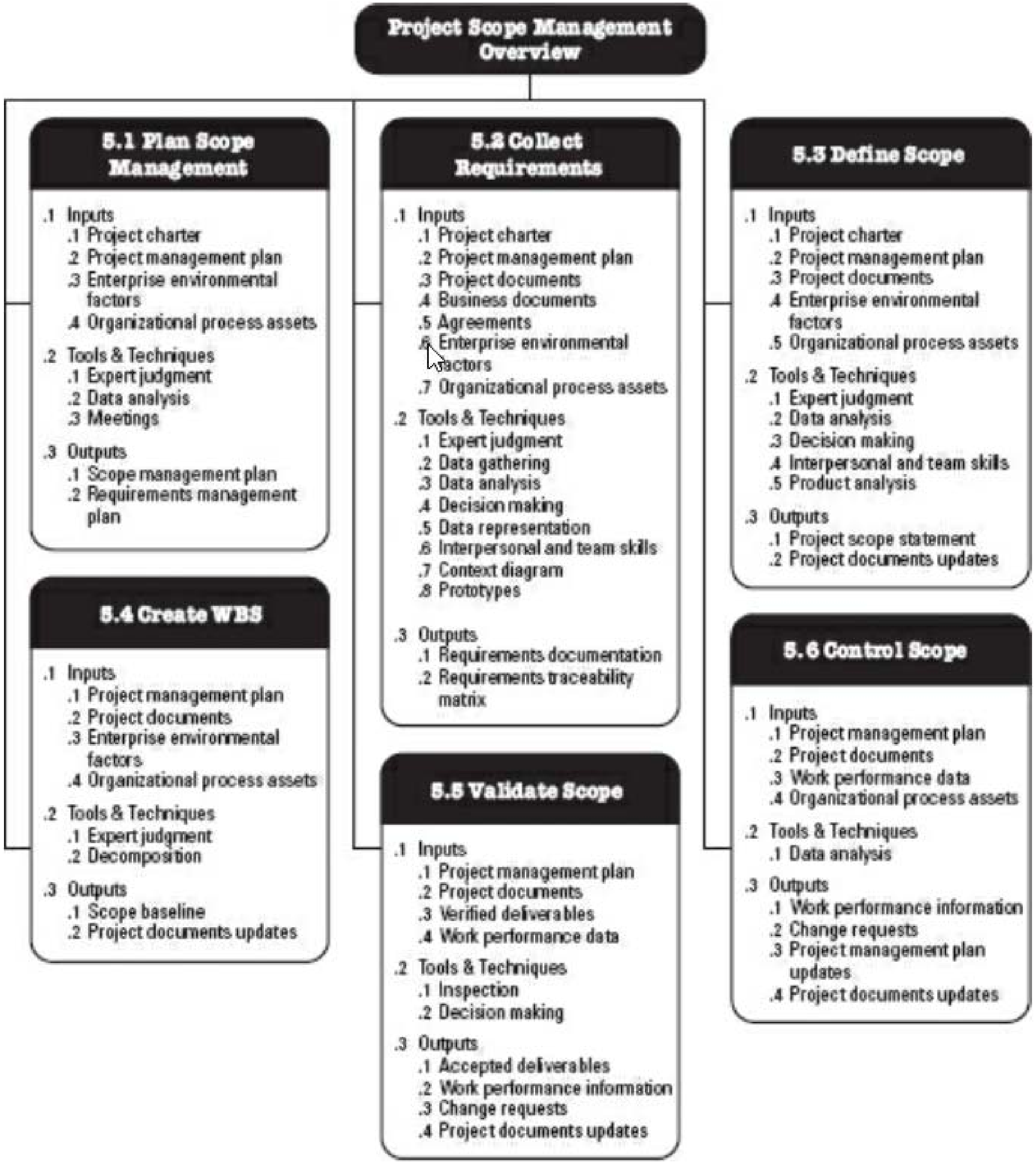
    (The process of subdividing project deliverables and project work into smaller, more manageable components.)

Scope Management processes

- Monitoring & Control Process Group:
  - Validate Scope

    (Formalizing acceptance of the completed project deliverables)
  - Control Scope

    (The process of monitoring the status of the project and product scope and managing changes to the scope baseline).


Project Scope Management Overview
5.1 Plan Scope Management
.1 Inputs
.1 Project charter
.2 Project management plan
.3 Enterprise environmental factors
.4 Organizational process assets
.2 Tools & Techniques
.1 Expert judgment
.2 Data analysis
.3 Meetings
.3 Outputs
.1 Scope management plan
.2 Requirements management plan
5.2 Collect Requirements
.1 Inputs
.1 Project charter
.2 Project management plan
.3 Project documents
.4 Business documents
.5 Agreements
.6 Enterprise environmental factors
.7 Organizational process assets
.2 Tools & Techniques
.1 Expert judgment
.2 Data gathering
.3 Data analysis
.4 Decision making
.5 Data representation
.6 Interpersonal and team skills
.7 Context diagram
.8 Prototypes
.3 Outputs
.1 Requirements documentation
.2 Requirements traceability matrix
5.3 Define Scope
.1 Inputs
.1 Project charter
.2 Project management plan
.3 Project documents
.4 Enterprise environmental factors
.5 Organizational process assets
.2 Tools & Techniques
.1 Expert judgment
.2 Data analysis
.3 Decision making
.4 Interpersonal and team skills
.5 Product analysis
.3 Outputs
.1 Project scope statement
.2 Project documents updates
5.4 Create WBS
.1 Inputs
.1 Project management plan
.2 Project documents
.3 Enterprise environmental factors
.4 Organizational process assets
.2 Tools & Techniques
.1 Expert judgment
.2 Decomposition
.3 Outputs
.1 Scope baseline
.2 Project documents updates
5.5 Validate Scope
.1 Inputs
.1 Project management plan
.2 Project documents
.3 Verified deliverables
.4 Work performance data
.2 Tools & Techniques
.1 Inspection
.2 Decision making
.3 Outputs
.1 Accepted deliverables
.2 Work performance information
.3 Change requests
.4 Project documents updates
5.6 Control Scope
.1 Inputs
.1 Project management plan
.2 Project documents
.3 Work performance data
.4 Organizational process assets
.2 Tools & Techniques
.1 Data analysis
.3 Outputs
.1 Work performance information
.2 Change requests
.3 Project management plan updates
.4 Project documents updates

Scope

- Product scope:

  The features and functions that characterize a product, service, or result.

- Project scope.

  The work performed to deliver a product, service, or result with the specified features and functions. The term "project scope" is sometimes viewed as including product scope.

Define Scope

Inputs

.1 Project charter
.2 Project management plan
- Scope management plan

.3 Project documents
- Assumption log
- Requirements documentation
- Risk register

.4 Enterprise environmental factors
.5 Organizational process assets

Tools & Techniques

.1 Expert judgment
.2 Data analysis
- Alternatives analysis

.3 Decision making
- Multicriteria decision analysis

.4 Interpersonal and team skills
- Facilitation

.5 Product analysis

Outputs

.1 Project scope statement
.2 Project documents updates
- Assumption log
- Requirements documentation
- Requirements traceability matrix
- Stakeholder register

Project Charter and Scope

Project Charter

- Project purpose
- Measurable project objectives and related success criteria
- High-level requirements
- High-level project description, boundaries, and key deliverables
- Overall project risk
- Summary milestone schedule
- Preapproved financial resources
- Key stakeholder list
- Project approval requirements (i.e., what constitutes success, who decides the project is successful, who signs off on the project)
- Project exit criteria (i.e., what are the conditions to be met in order to close or to cancel the project or phase
- Assigned project manager, responsibility, and authority level
- Name and authority of the sponsor or other person(s) authorizing the project charter

Project Scope Statement

- Project scope description (progressively elaborated)
- Project deliverables
- Acceptance criteria
- Project exclusions

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Create WBS

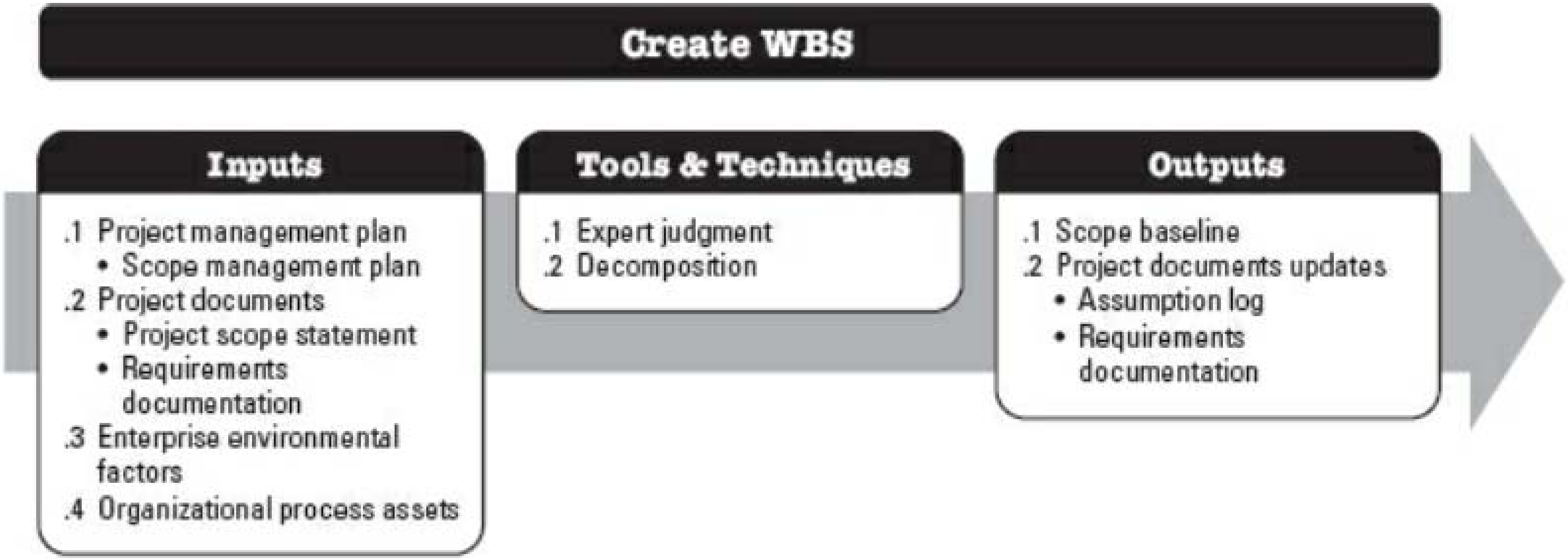


Figure 5-10. Create WBS: Inputs, Tools & Techniques, and Outputs

Project Schedule Management

...e Areas		Project Management Process Groups				
		Initiating	**Planning**	**Executing**	**Monitoring & Control**	**Closing**
	1. Project Integration Management	a. Develop Project Charter	b. Develop Project Management Plan	c. Direct and Manage Project Work d. Manage Project Knowledge	e. Monitor and Control Project Work f. Perform Integrated Change Control	g. Close Project or Phase
	2. Project Scope Management		a. Plan Scope Management b. Collect Requirements c.Define Scope d. Create WBS		e. Validate Scope f. Control Scope	
	3. Project Schedule Management		a. Plan Schedule Management b. Define Activities c. Sequence Activities d. Estimate Activity Durations e. Develop Schedule		f. Control Schedule	
	4. Project Cost Management		a. Plan Cost Management b. Estimate Costs c. Determine Budget		d. Control Costs	

Schedule Management Process

- Planning Process Group:
  - Define Activities

    The process of identifying and documenting the specific actions to be performed to produce the project deliverables.
  - Sequence Activities

    The process of identifying and documenting relationships among the project activities.
  - Estimate Activity Durations

    The process of estimating the number of work periods needed to complete individual activities with the estimated resources.
  - Develop Schedule

    The process of analyzing activity sequences, durations, resource requirements, and schedule constraints to create the project schedule model for project execution and monitoring and controlling.

Schedule Management Process

- Monitoring & Control Process Group:
  - Control Schedule

Project Schedule Management Overview

6.1 Plan Schedule Management

.1 Inputs
- .1 Project charter
- .2 Project management plan
- .3 Enterprise environmental factors
- .4 Organizational process assets

.2 Tools & Techniques
- .1 Expert judgment
- .2 Data analysis
- .3 Meetings

.3 Outputs
- .1 Schedule management plan

6.2 Define Activities

.1 Inputs
- .1 Project management plan
- .2 Enterprise environmental factors
- .3 Organizational process assets

.2 Tools & Techniques
- .1 Expert judgment
- .2 Decomposition
- .3 Rolling wave planning
- .4 Meetings

.3 Outputs
- .1 Activity list
- .2 Activity attributes
- .3 Milestone list
- .4 Change requests
- .5 Project management plan updates

6.3 Sequence Activities

.1 Inputs
- .1 Project management plan
- .2 Project documents
- .3 Enterprise environmental factors
- .4 Organizational process assets

.2 Tools & Techniques
- .1 Precedence diagramming method
- .2 Dependency determination and integration
- .3 Leads and lags
- .4 Project management information system

.3 Outputs
- .1 Project schedule network diagrams
- .2 Project documents updates

6.4 Estimate Activity Durations

.1 Inputs
- .1 Project management plan
- .2 Project documents
- .3 Enterprise environmental factors
- .4 Organizational process assets

.2 Tools & Techniques
- .1 Expert judgment
- .2 Analogous estimating
- .3 Parametric estimating
- .4 Three-point estimating
- .5 Bottom-up estimating
- .6 Data analysis
- .7 Decision making
- .8 Meetings

.3 Outputs
- .1 Duration estimates
- .2 Basis of estimates
- .3 Project documents updates

6.5 Develop Schedule

.1 Inputs
- .1 Project management plan
- .2 Project documents
- .3 Agreements
- .4 Enterprise environmental factors
- .5 Organizational process assets

.2 Tools & Techniques
- .1 Schedule network analysis
- .2 Critical path method
- .3 Resource optimization
- .4 Data analysis
- .5 Leads and lags
- .6 Schedule compression
- .7 Project management information system
- .8 Agile release planning

.3 Outputs
- .1 Schedule baseline
- .2 Project schedule
- .3 Schedule data
- .4 Project calendars
- .5 Change requests
- .6 Project management plan updates
- .7 Project documents updates

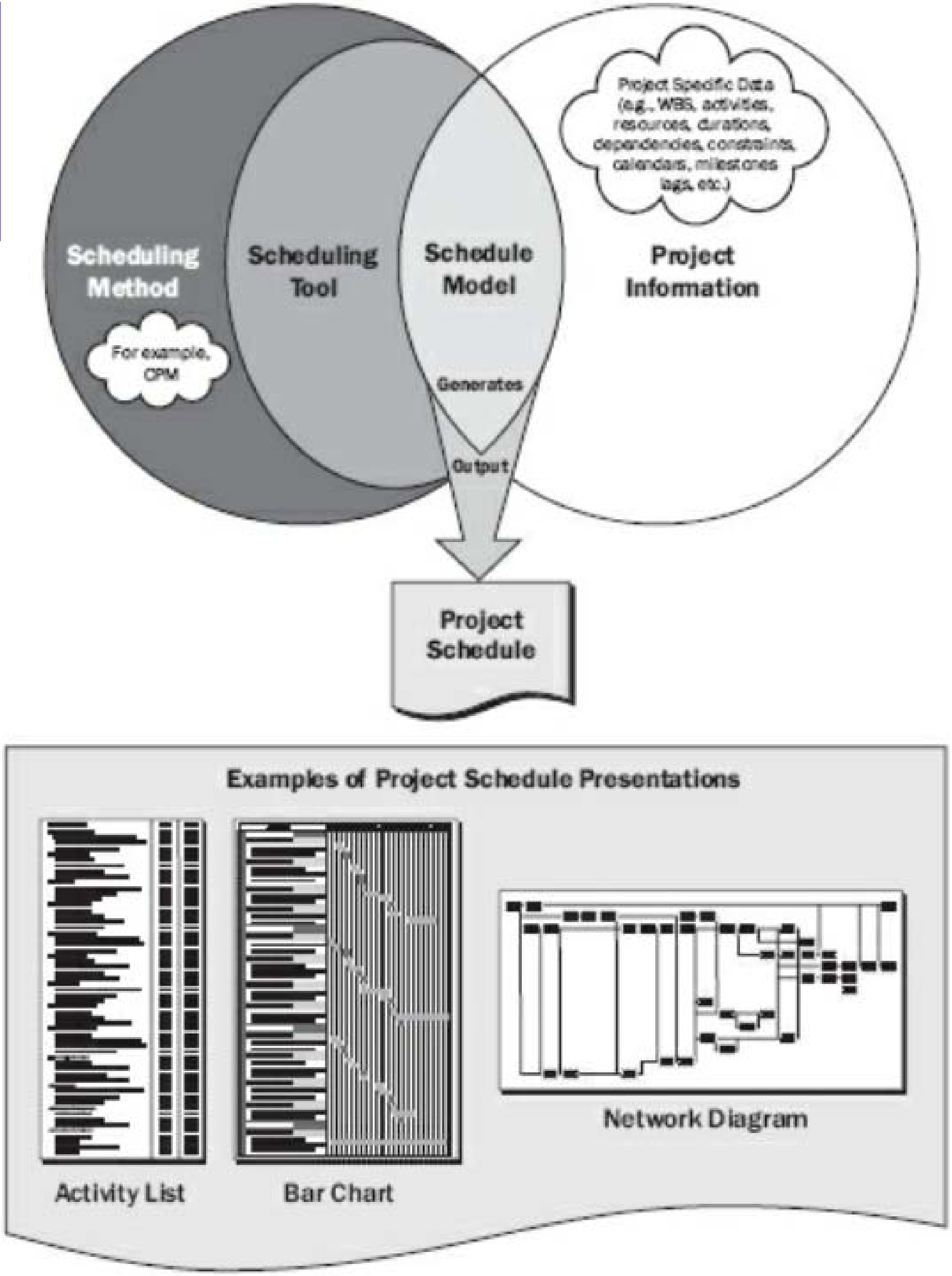
6.6 Control Schedule

.1 Inputs
- .1 Project management plan
- .2 Project documents
- .3 Work performance data
- .4 Organizational process assets

.2 Tools & Techniques
- .1 Data analysis
- .2 Critical path method
- .3 Project management information system
- .4 Resource optimization
- .5 Leads and lags
- .6 Schedule compression

.3 Outputs
- .1 Work performance information
- .2 Schedule forecasts
- .3 Change requests
- .4 Project management plan updates
- .5 Project documents updates

Scheduling Overview



PMBOK®

Define activities

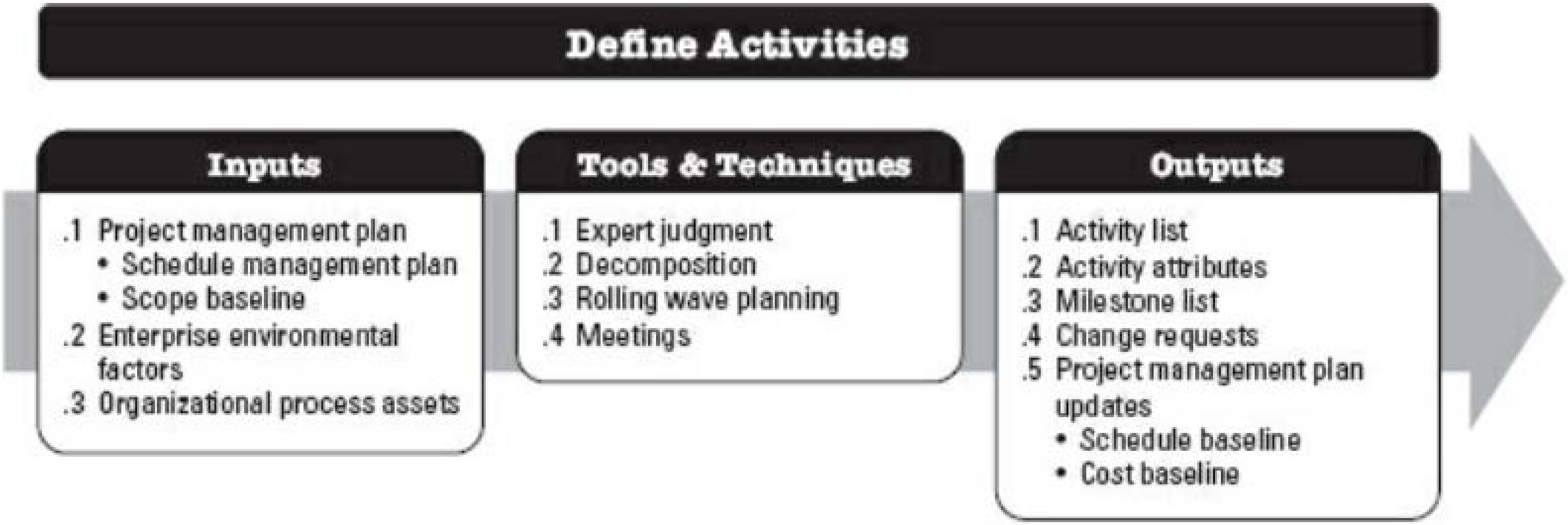


Figure 6-5. Define Activities: Inputs, Tools & Techniques, and Outputs

Sequence activities

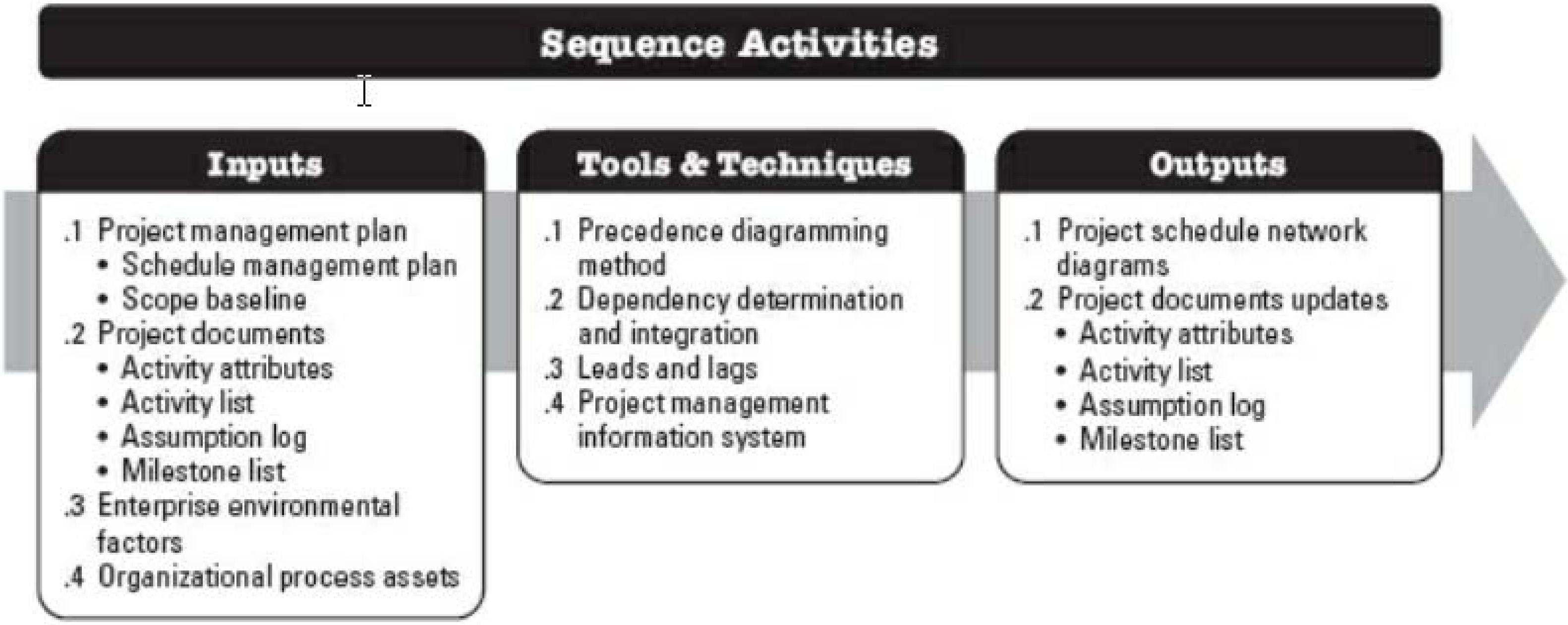


Figure 6-7. Sequence Activities: Inputs, Tools & Techniques, and Outputs

Sequence activities

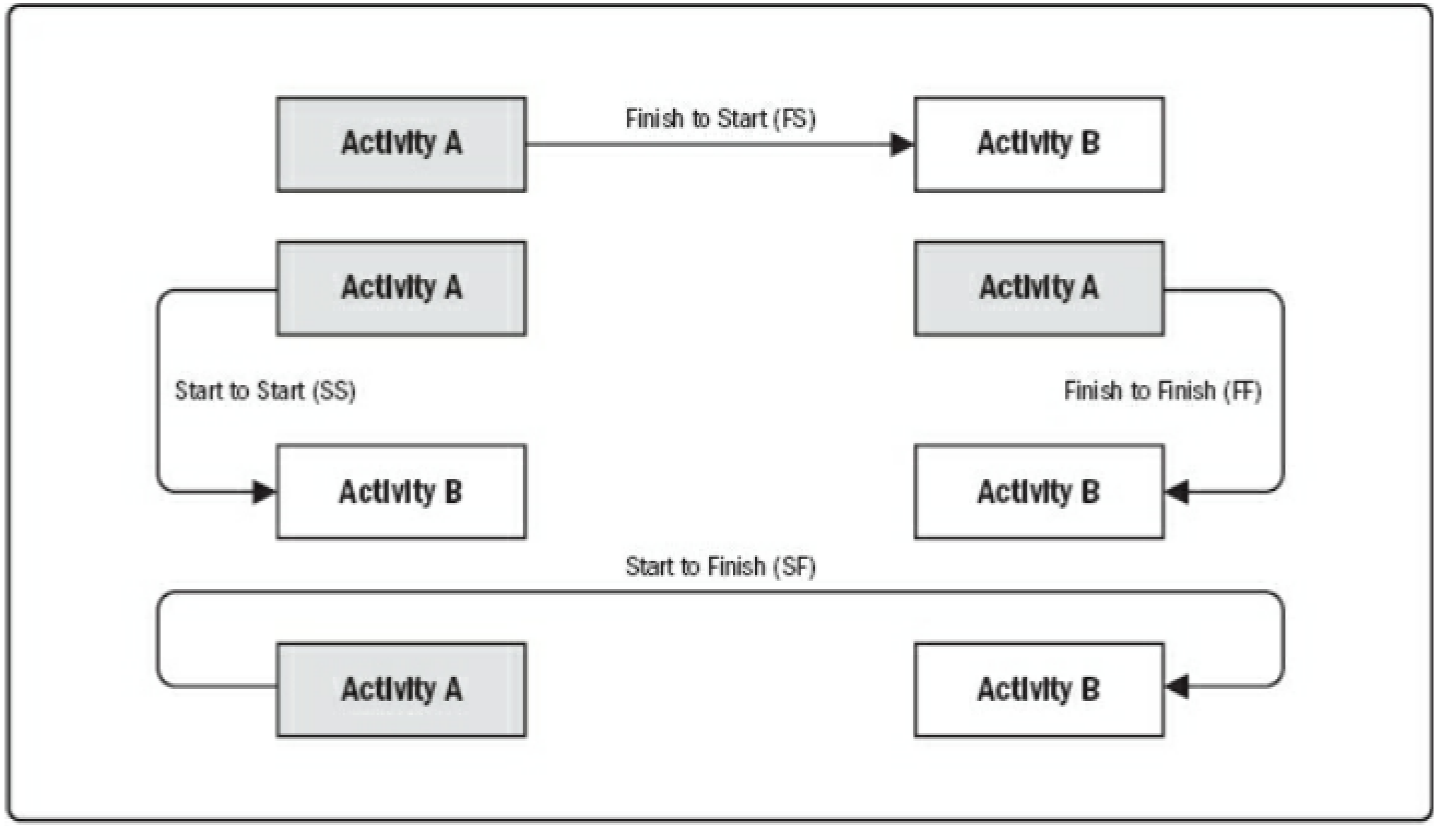


Figure 6-9. Precedence Diagramming Method (PDM) Relationship Types

Sequence activities

- Finish-to-start (FS).

  A logical relationship in which a successor activity cannot start until a predecessor activity has finished. For example, installing the operating system on a PC (successor) cannot start until the PC hardware is assembled (predecessor).

- Finish-to-finish (FF).

  A logical relationship in which a successor activity cannot finish until a predecessor activity has finished. For example, writing a document (predecessor) is required to finish before editing the document (successor) can finish.

Sequence activities

- Start-to-start (SS).

  A logical relationship in which a <u>successor activity cannot start until a predecessor activity has started</u>. For example, level concrete (successor) cannot begin until pour foundation (predecessor) begins.

- Start-to-finish (SF).

  A logical relationship in which <u>a successor activity cannot finish until a predecessor activity has started.</u> For example, a new accounts payable system (successor) has to start before the old accounts payable system can be shut down (predecessor).

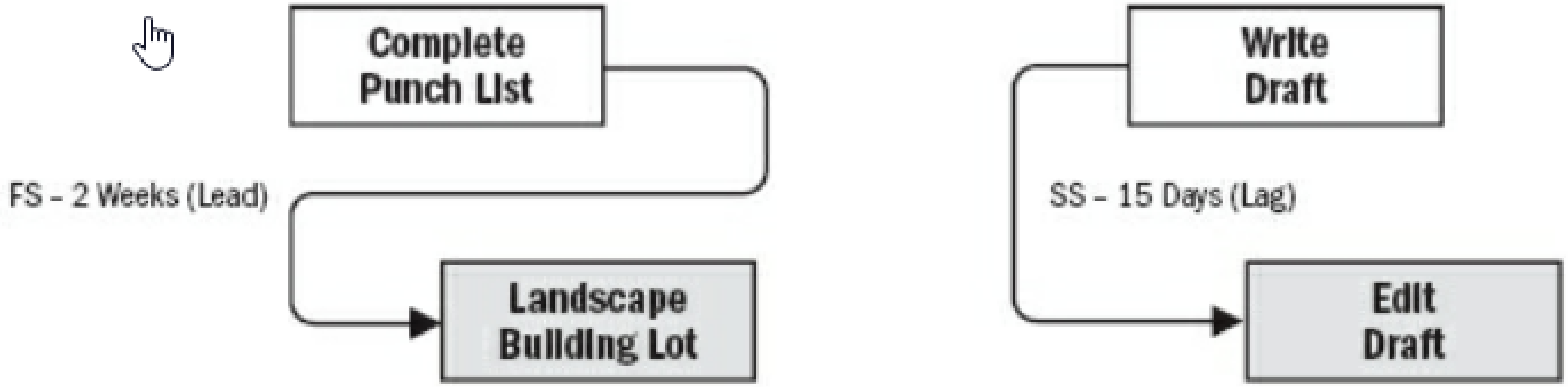
Leads and Lags

- A lead is the amount of time a successor activity can be advanced with respect to a predecessor activity.

  For example, on a project to construct a new office building, the landscaping could be scheduled to start 2 weeks prior to the scheduled punch list completion.

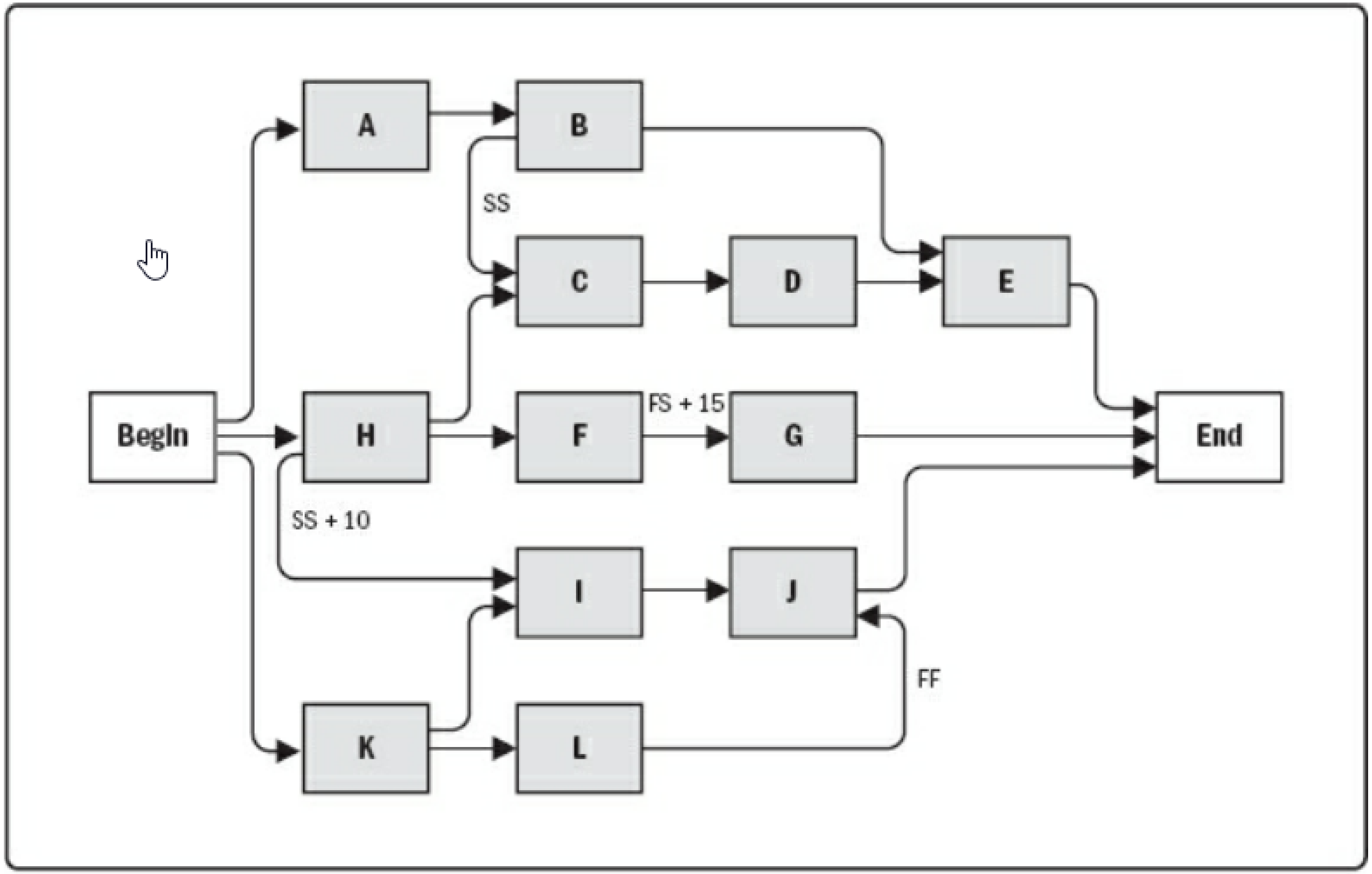
- A lag is the amount of time a successor activity will be delayed with respect to a predecessor activity.

  For example, a technical writing team may begin editing the draft of a large document 15 days after they begin writing it.

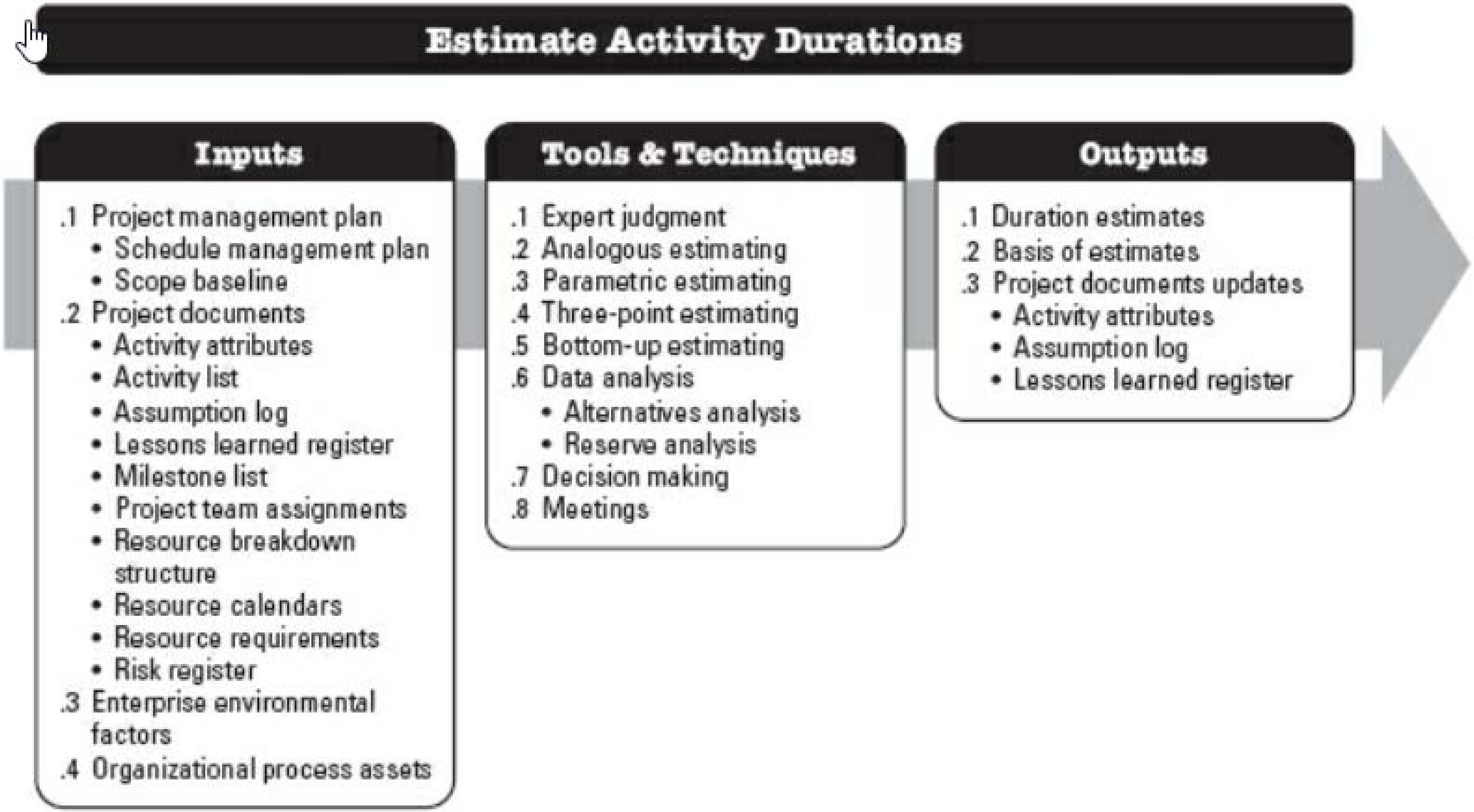


Project Schedule

Network Diagram



Estimate Task Durations



Develop Schedule

Develop Schedule

Inputs

.1 Project management plan
- Schedule management plan
- Scope baseline

.2 Project documents
- Activity attributes
- Activity list
- Assumption log
- Basis of estimates
- Duration estimates
- Lessons learned register
- Milestone list
- Project schedule network diagrams
- Project team assignments
- Resource calendars
- Resource requirements
- Risk register

.3 Agreements

.4 Enterprise environmental factors

.5 Organizational process assets

Tools & Techniques

.1 Schedule network analysis

.2 Critical path method

.3 Resource optimization

.4 Data analysis
- What-if scenario analysis
- Simulation

.5 Leads and lags

.6 Schedule compression

.7 Project management information system

.8 Agile release planning

Outputs

.1 Schedule baseline

.2 Project schedule

.3 Schedule data

.4 Project calendars

.5 Change requests

.6 Project management plan updates
- Schedule management plan
- Cost baseline

.7 Project documents updates
- Activity attributes
- Assumption log
- Duration estimates
- Lessons learned register
- Resource requirements
- Risk register

Develop Schedule

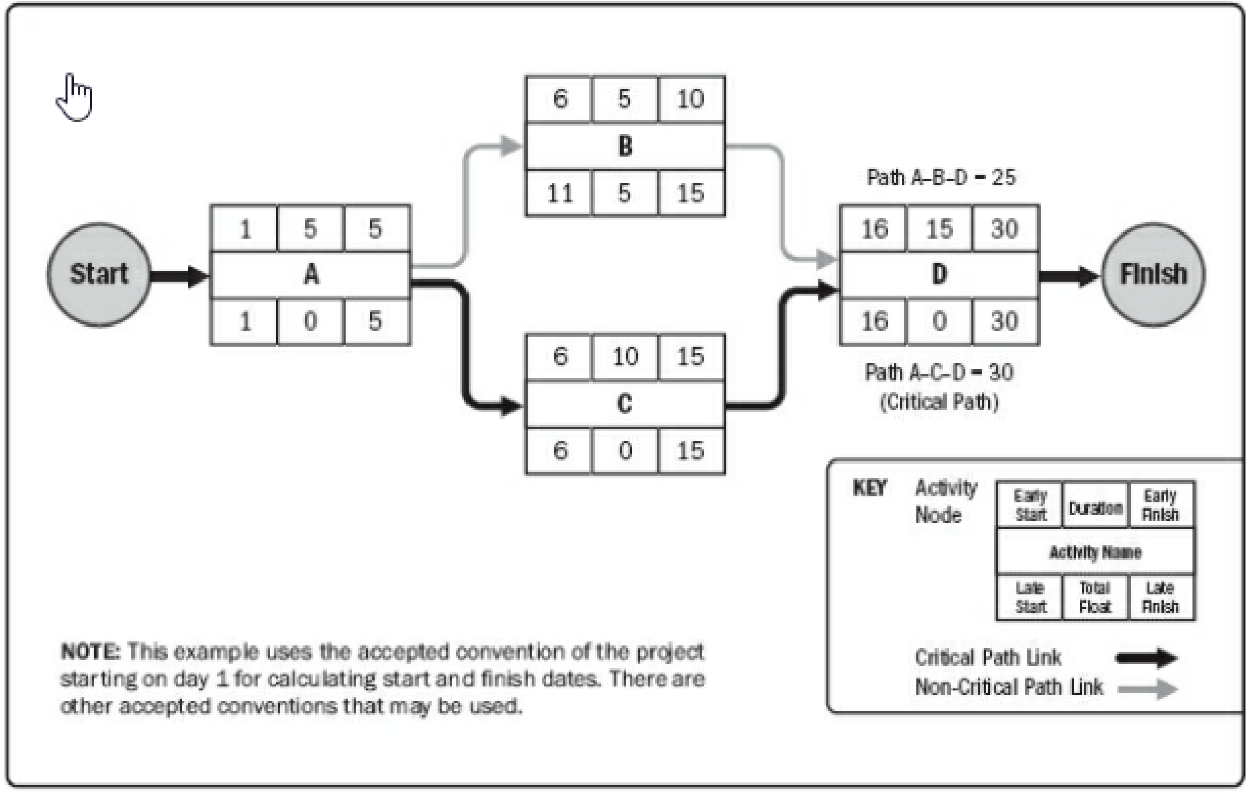


Figure 6-16. Example of Critical Path Method

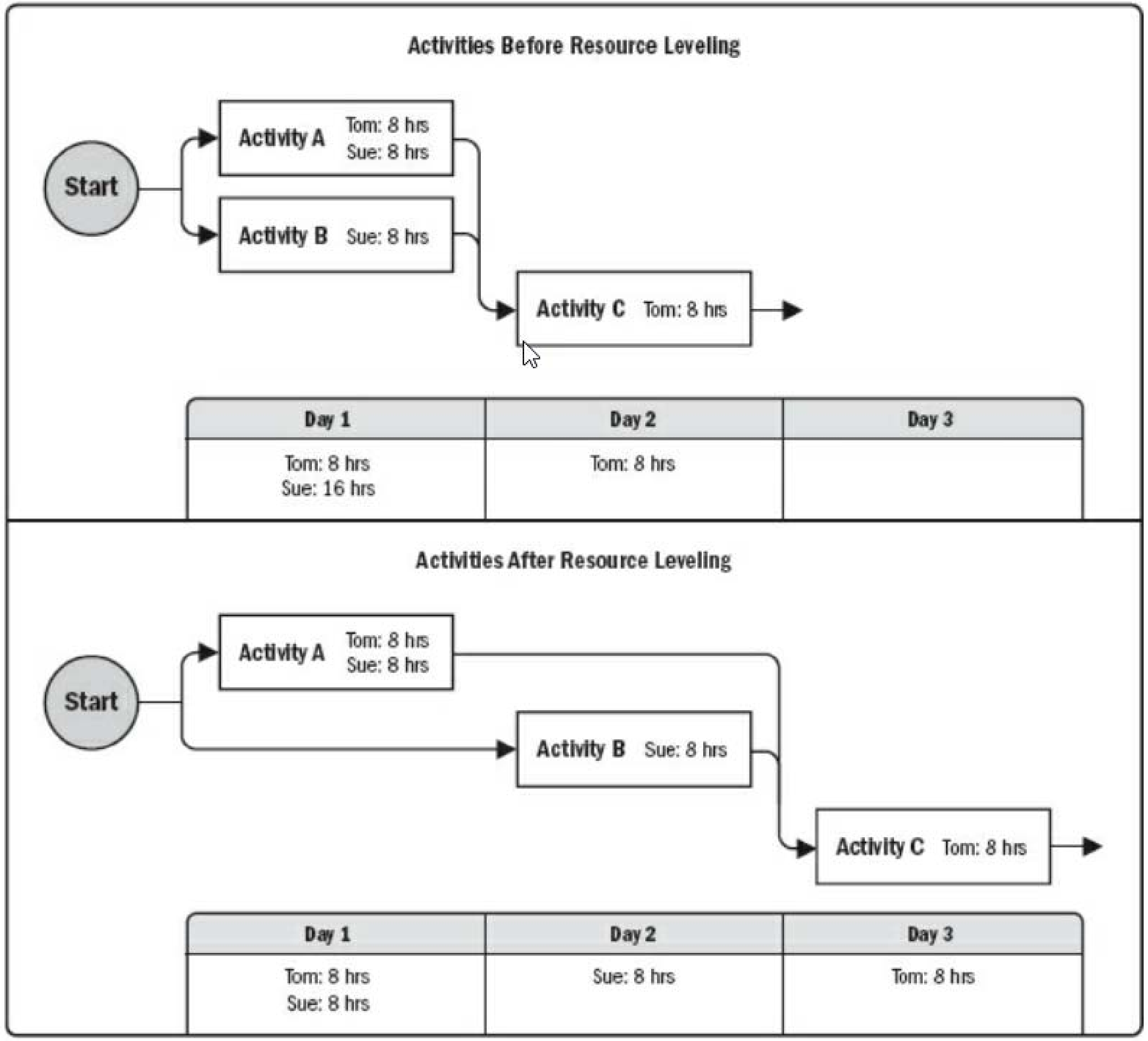
Resource Optimization

- Resource leveling.
  - A technique in which start and finish dates are adjusted based on resource constraints with the goal of balancing the demand for resources with the available supply.
  - Consequently, the critical path through the project schedule may change.

Resource Optimization

- Resource smoothing.
  - A technique that adjusts the activities of a schedule model such that the requirements for resources on the project do not exceed certain predefined resource limits.
  - Critical path is not changed.
  - Resource smoothing may not be able to optimize all resources.

Resource Levelling



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Schedule Compression

- Crashing.
  - A technique used to shorten the schedule duration for the least incremental cost by adding resources.
    - Ex: Approving overtime, bringing in additional resources, or paying to expedite delivery to activities on the critical path.
    - Crashing works only for activities on the critical path where additional resources will shorten the activity's duration.
    - May result in increased risk and/or cost.

Schedule Compression

- Fast tracking.
  - A schedule compression technique in which activities or phases normally done in sequence are performed in parallel for at least a portion of their duration.
    - Ex: Constructing the foundation for a building before completing all of the architectural drawings.
    - Fast tracking may result in rework and increased risk.
    - Fast tracking only works when activities can be overlapped to shorten the project duration on the critical path.
    - Using leads in case of schedule acceleration usually increases coordination efforts between the activities concerned and increases quality risk.
    - Fast tracking may also increase project costs.

Schedule Compression

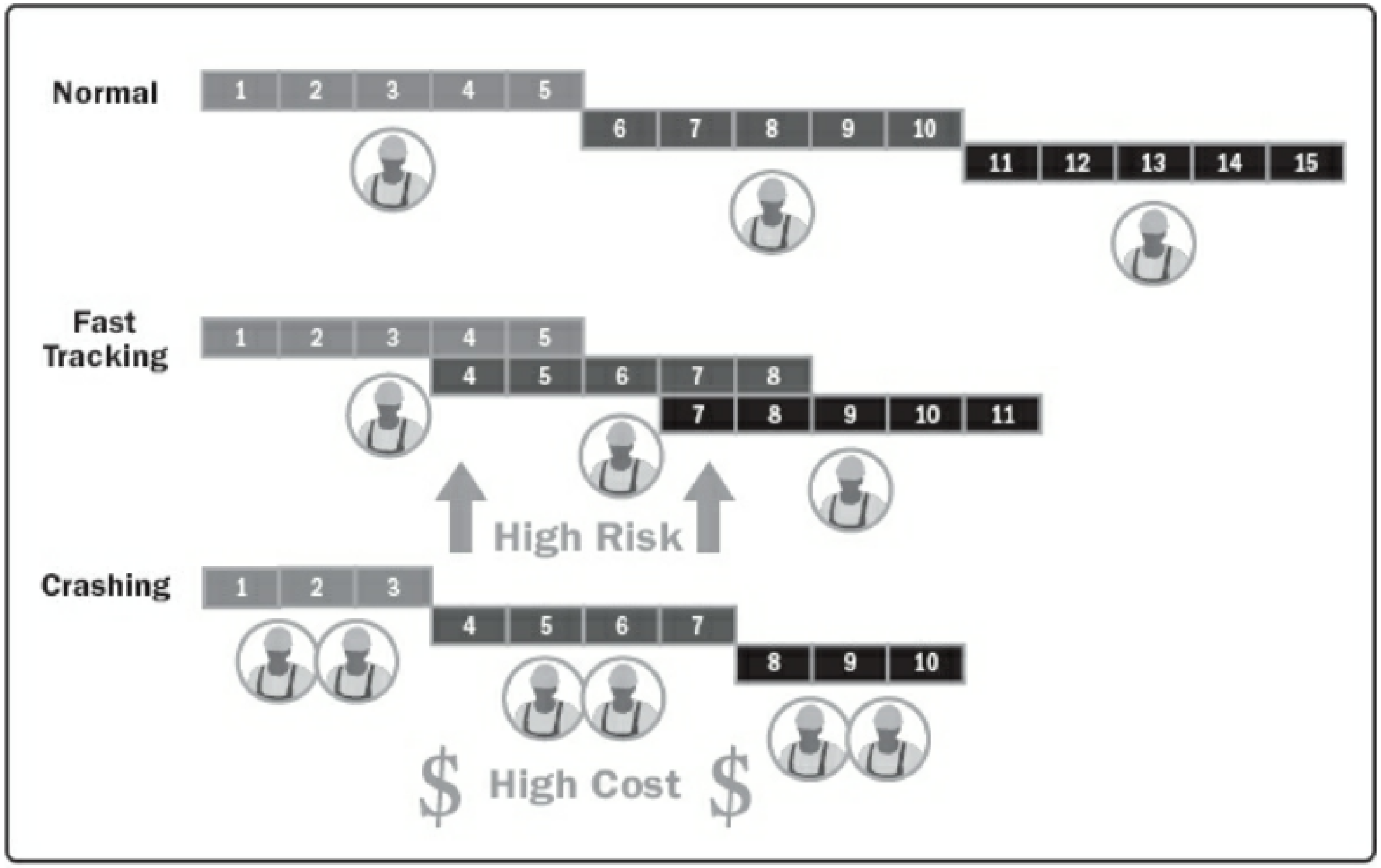


Figure 6-19. Schedule Compression Comparison

Schedule Control

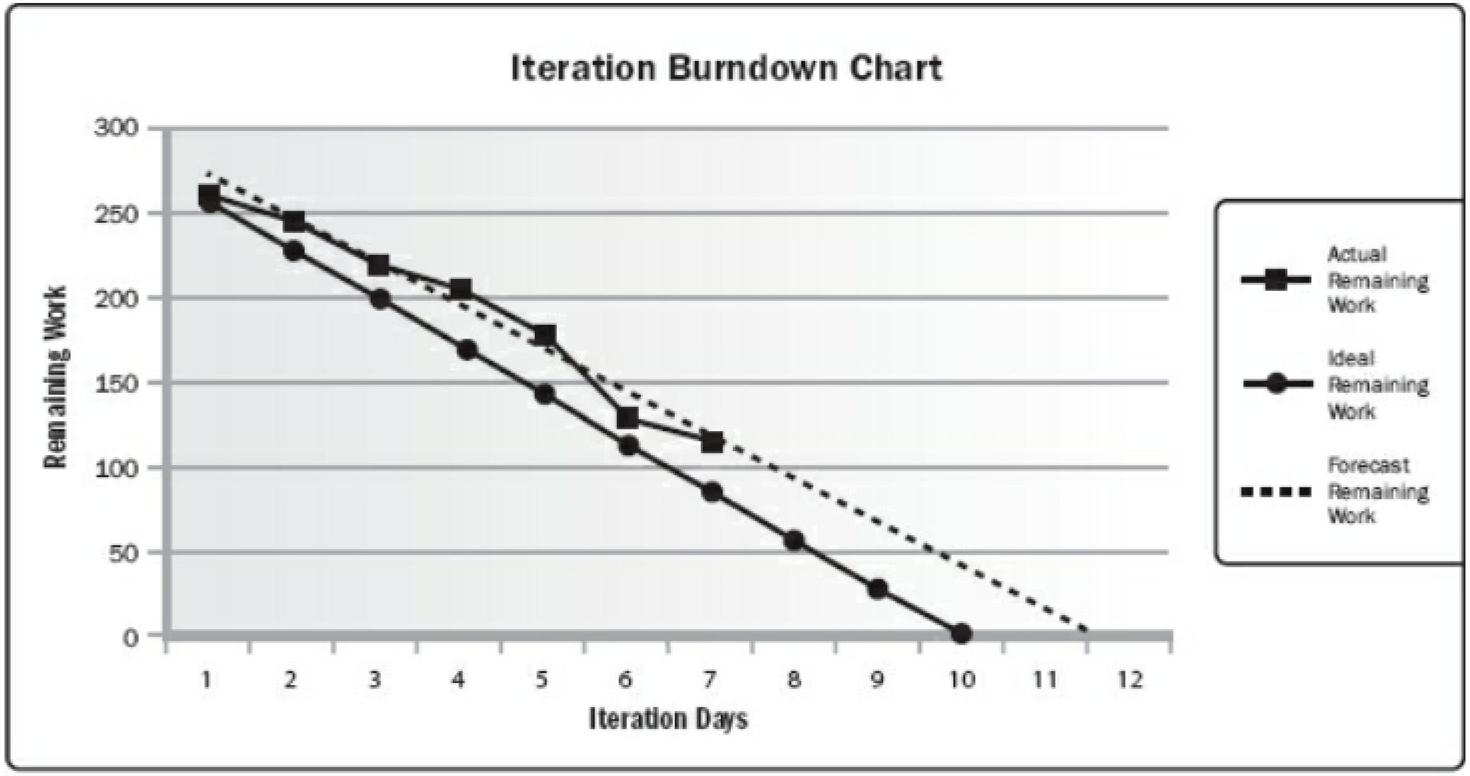


Figure 6-24. Iteration Burndown Chart

Project Cost Management

e Areas

	Project Management Process Groups				
	Initiating	Planning	Executing	Monitoring & Control	Closing
1. Project Integration Management	a. Develop Project Charter	b. Develop Project Management Plan	c. Direct and Manage Project Work d. Manage Project Knowledge	e. Monitor and Control Project Work f. Perform Integrated Change Control	g. Close Project or Phase
2. Project Scope Management		a. Plan Scope Management b. Collect Requirements c.Define Scope d. Create WBS		e. Validate Scope f. Control Scope	
3. Project Schedule Management		a. Plan Schedule Management b. Define Activities c. Sequence Activities d. Estimate Activity Durations e. Develop Schedule		f. Control Schedule	
4. Project Cost Management		a. Plan Cost Management b. Estimate Costs c. Determine Budget		d. Control Costs	

Project Cost Management

- Planning Process Group:
  - Plan Cost Management
  - Estimate Costs
  - Determine Budget

- Monitoring & Control Process Group:
  - Control

Estimate Costs

Estimate Costs

Inputs

.1 Project management plan
- Cost management plan
- Quality management plan
- Scope baseline

.2 Project documents
- Lessons learned register
- Project schedule
- Resources requirements
- Risk register

.3 Enterprise environmental factors

.4 Organizational process assets

Tools & Techniques

.1 Expert judgment

.2 Analogous estimating

.3 Parametric estimating

.4 Bottom-up estimating

.5 Three-point estimating

.6 Data analysis
- Alternatives analysis
- Reserve analysis
- Cost of quality

.7 Project management information system

.8 Decision making
- Voting

Outputs

.1 Cost estimates

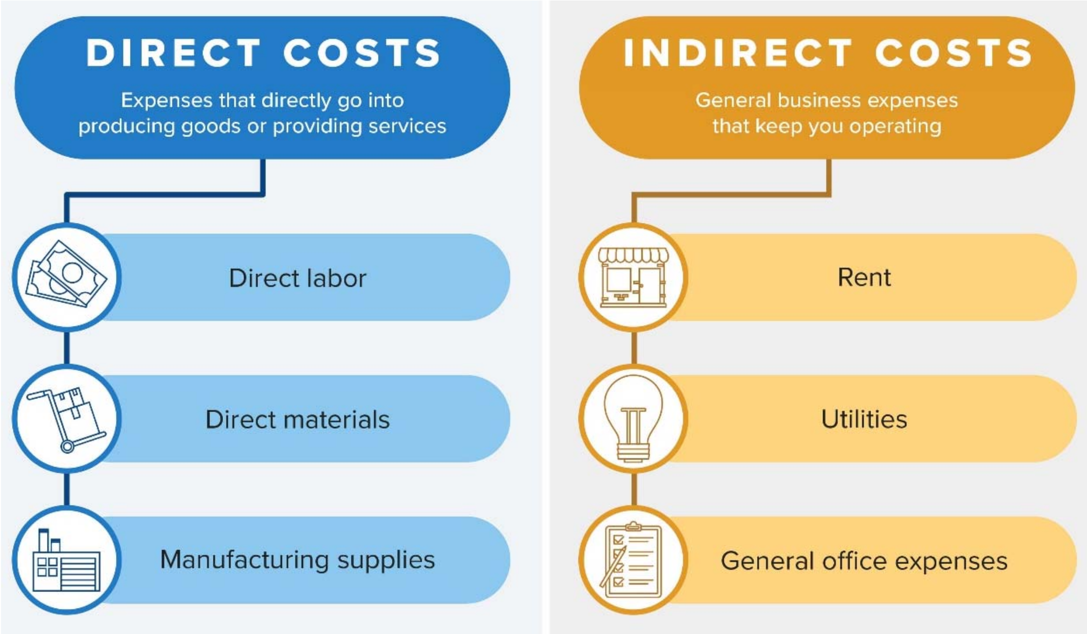
.2 Basis of estimates

.3 Project documents updates
- Assumption log
- Lessons learned register
- Risk register

Figure 7-4. Estimate Costs: Inputs, Tools & Techniques, and Outputs

Work element costing

- Direct (Variable)
  - Labor
  - Material
  - Equipment
- Indirect (Fixed)
- Overhead
- General & Administrative (G&A)



Project costing by task and month

Table 7-2 Project Budget by Task and Month

		Monthly Budget (£)							
Task	***Estimate***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
A	7000	5600	1400						
B	9000		3857	5143					
C	10000		3750	5000	1250				
D	6000		3600	2400					
E	12000				4800	4800	2400		
F	3000				3000				
G	9000			2571	5143	1286			
H	5000					3750	1250		
I	8000						2667	5333	
J	6000								6000
	75000	5600	12607	15114	14193	9836	6317	5333	6000

Source: F.L. Harrison *Advanced Project Management*. Hants, England: Gower, 1983.

Determine the Budget

Determine Budget

Inputs

.1 Project management plan
- Cost management plan
- Resource management plan
- Scope baseline

.2 Project documents
- Basis of estimates
- Cost estimates
- Project schedule
- Risk register

.3 Business documents
- Business case
- Benefits management plan

.4 Agreements

.5 Enterprise environmental factors

.6 Organizational process assets

Tools & Techniques

.1 Expert judgment

.2 Cost aggregation

.3 Data analysis
- Reserve analysis

.4 Historical information review

.5 Funding limit reconciliation

.6 Financing

Outputs

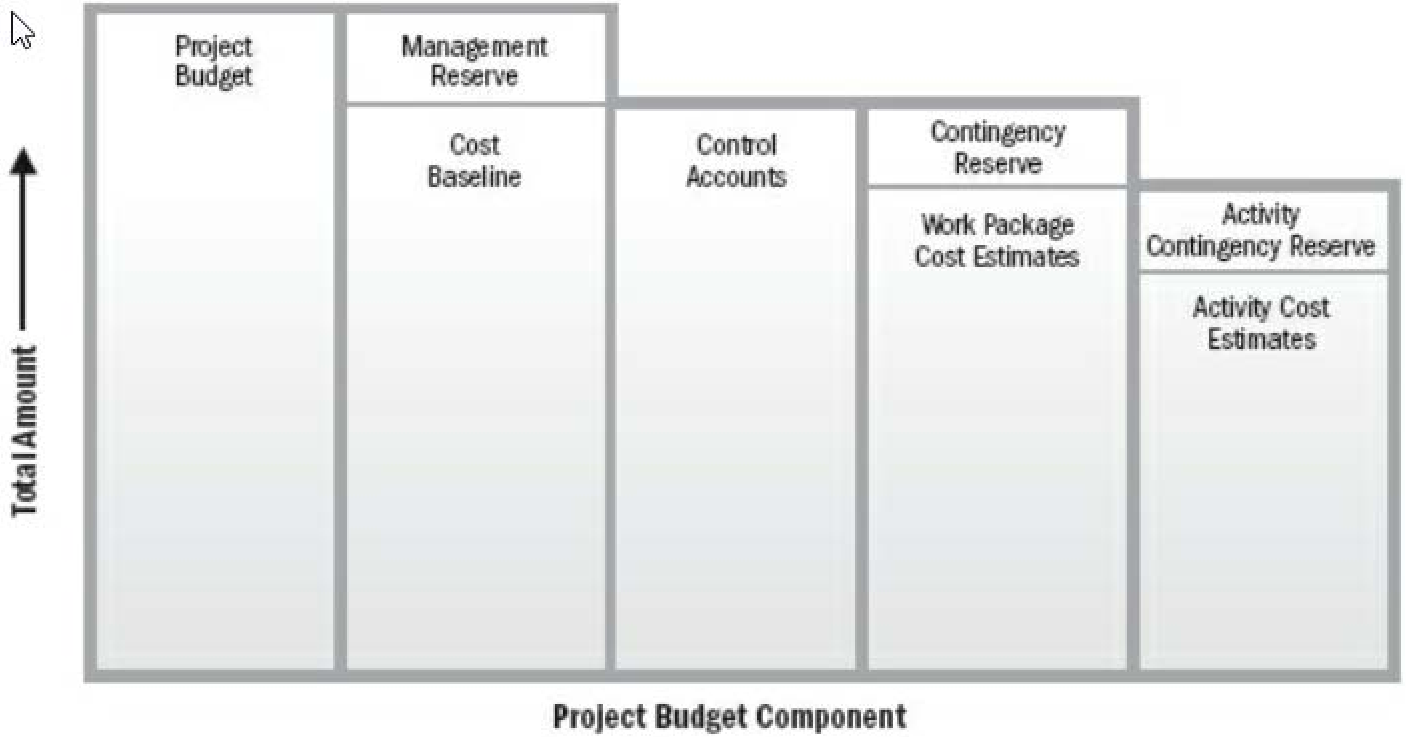
.1 Cost baseline

.2 Project funding requirements

.3 Project documents updates
- Cost estimates
- Project schedule
- Risk register

Figure 7-6. Determine Budget: Inputs, Tools & Techniques, and Outputs

Determine the Budget



Determine the Budget

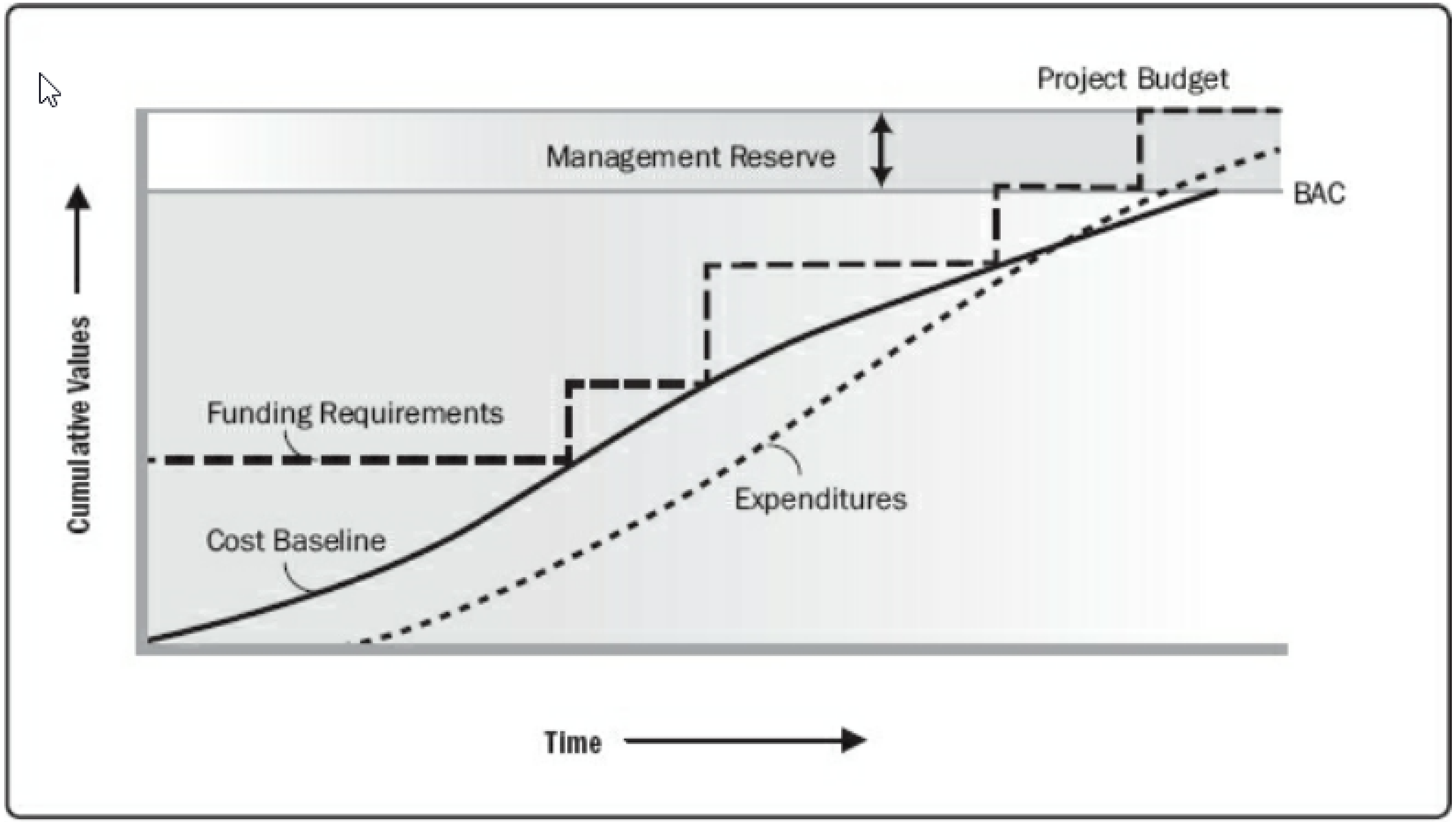
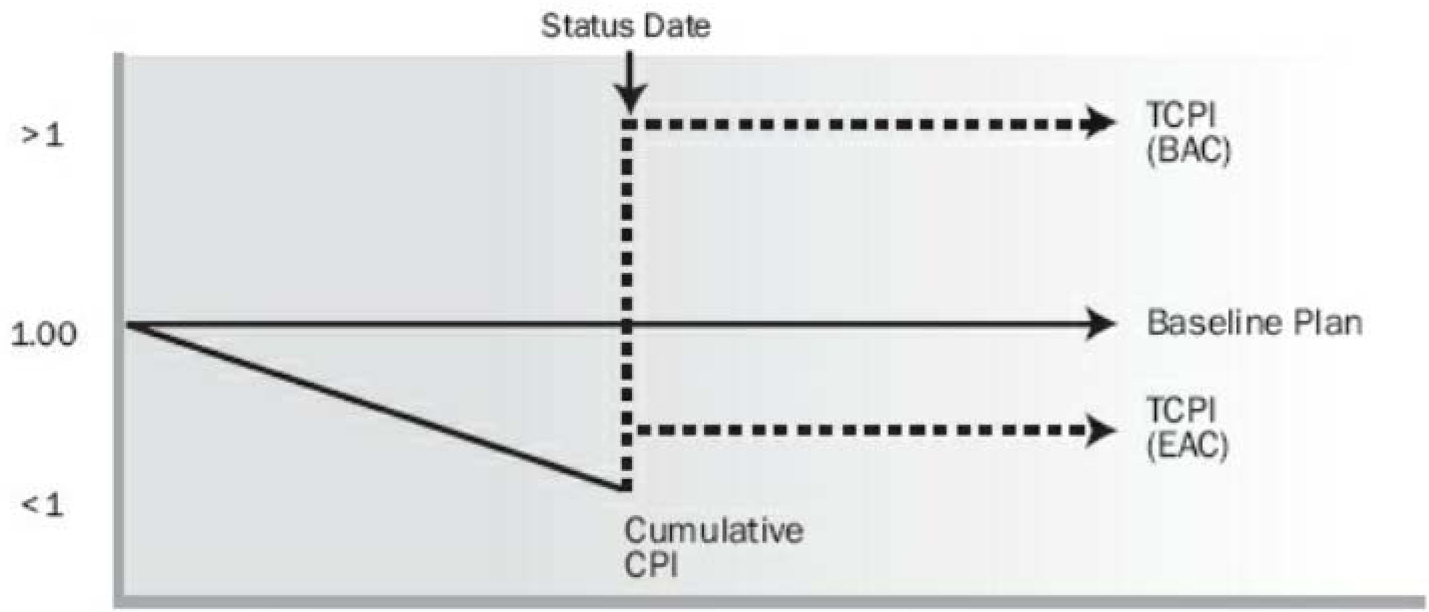


Figure 7-9. Cost Baseline, Expenditures, and Funding Requirements

Control Costs

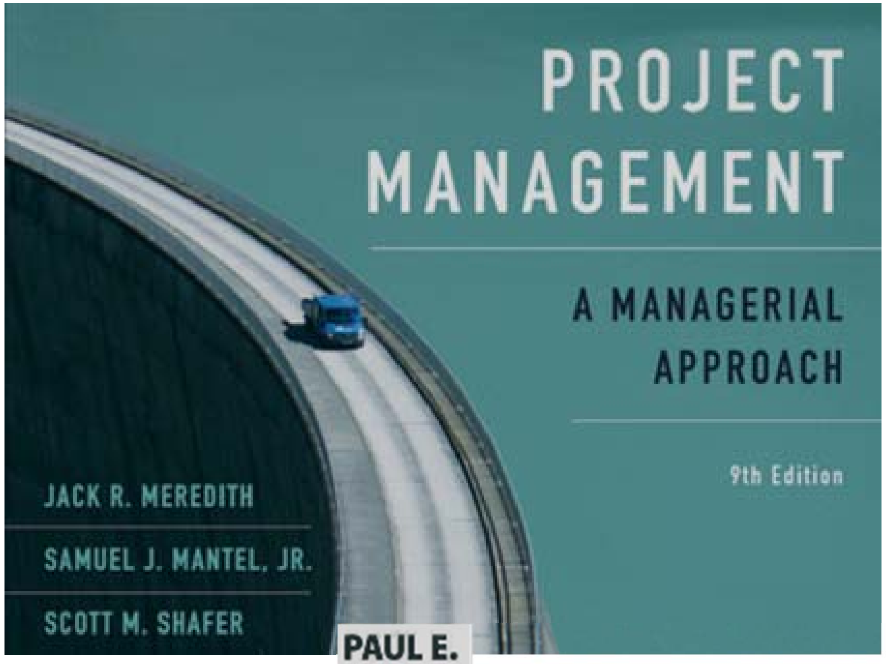


Formula:

$$\frac{\text{Work Remaining (BAC-EV)}}{\text{Funds Remaining (BAC-AC) or (EAC-AC)}} = \text{TCPI}$$

Figure 7-13. To-Complete Performance Index (TCPI)

Resources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MANAGEMENT
A MANAGERIAL
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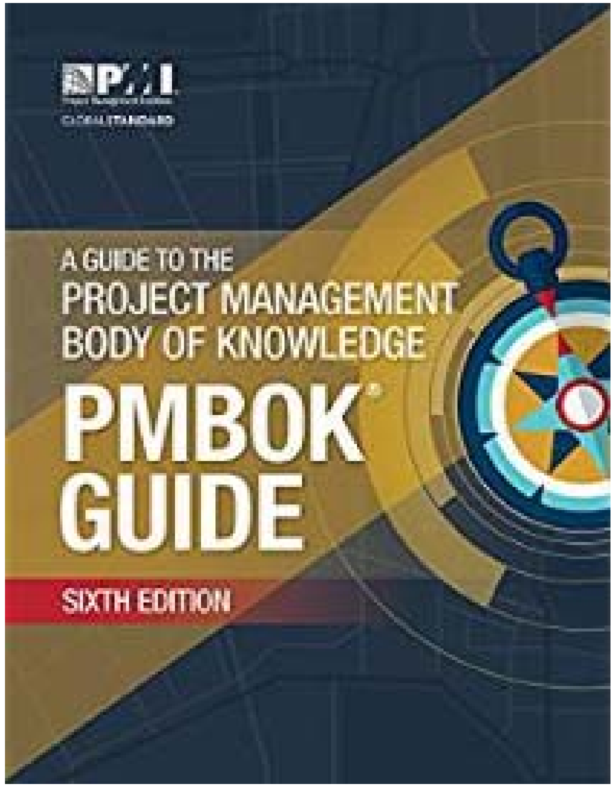
PMI
A GUIDE TO THE
PROJECT MANAGEMENT
BODY OF KNOWLEDGE
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Make up Quiz

ENGR3450-05AQz
ENGR3450-05BQz

You may do both of the quizzes on lectures.yasar.edu
Highest grade will be counted.
If previous quiz grades are lower they will be upgraded to highest too.

This is your last chance. There will be no other quiz.

Questions

- Questions

hp@quiztechnology.com

NEXT WEEK: Project Scheduling
Network Techniques PERT – CPM
MS-Project way
Precedence relations
Uncertainties in Completion
Problem solutions for Midterm

LAST SLIDE

ENGR3450 – Project Management

Week 6

The Project Planning

Scheduling

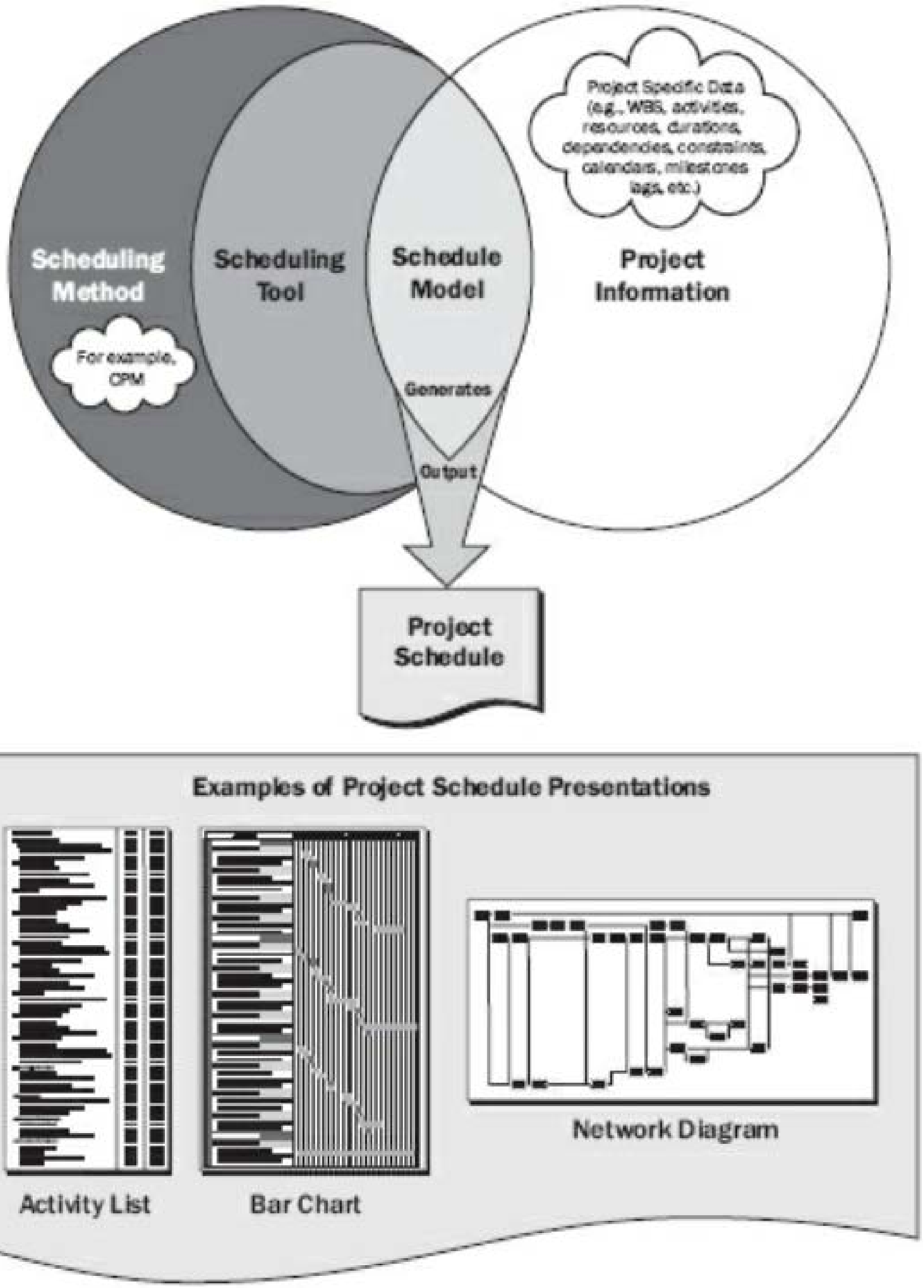
2019, İzmir

YAŞAR ÜNİVERSİTESİ
Mühendislik Fakültesi

Agenda today

- Project Schedule Management Overview
- Network Techniques
  - PERT (Program Evaluation and Review Technique)
  - CPM (Critical Path Method)
- Constructing the Networks
  - AoA (Activity on Arrow)
  - AoN (Activity on Node)
  - Gannt Chart (bar chart)
- Estimating activity times
- Uncertainties in Completion times
- Problem solutions (for Midterm)

Scheduling Overview



A schedule is the conversion of a project work breakdown structure (WBS) into an operating timetable.

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Overview

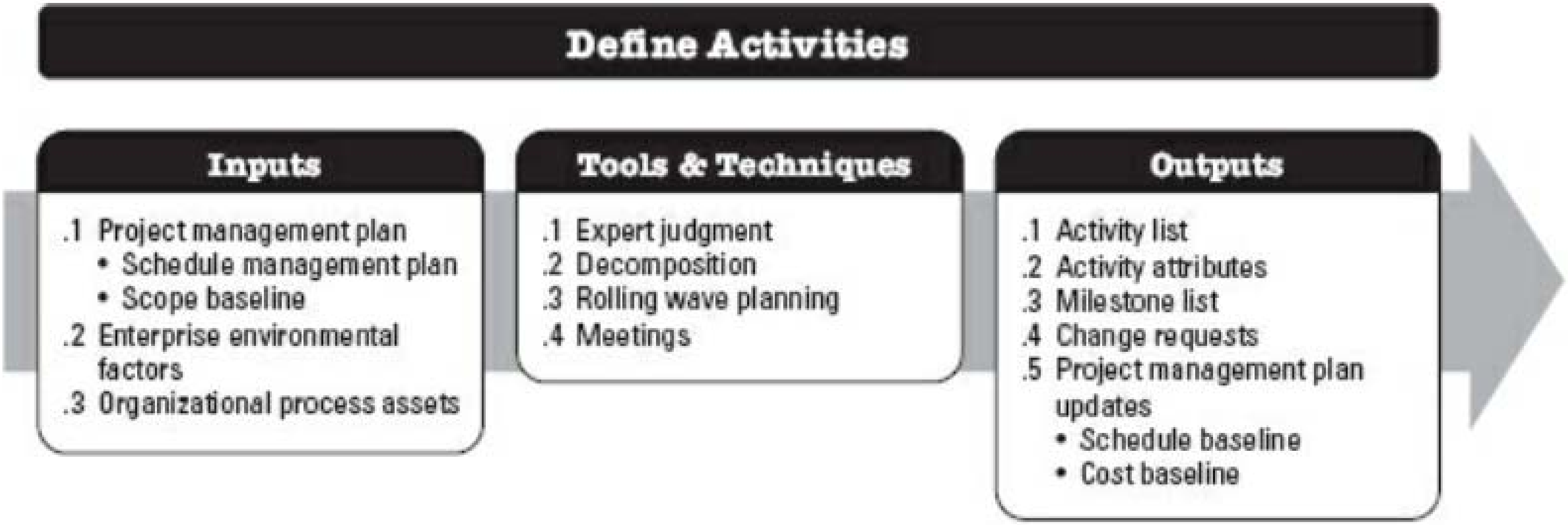


Figure 6-5. Define Activities: Inputs, Tools & Techniques, and Outputs

Overview

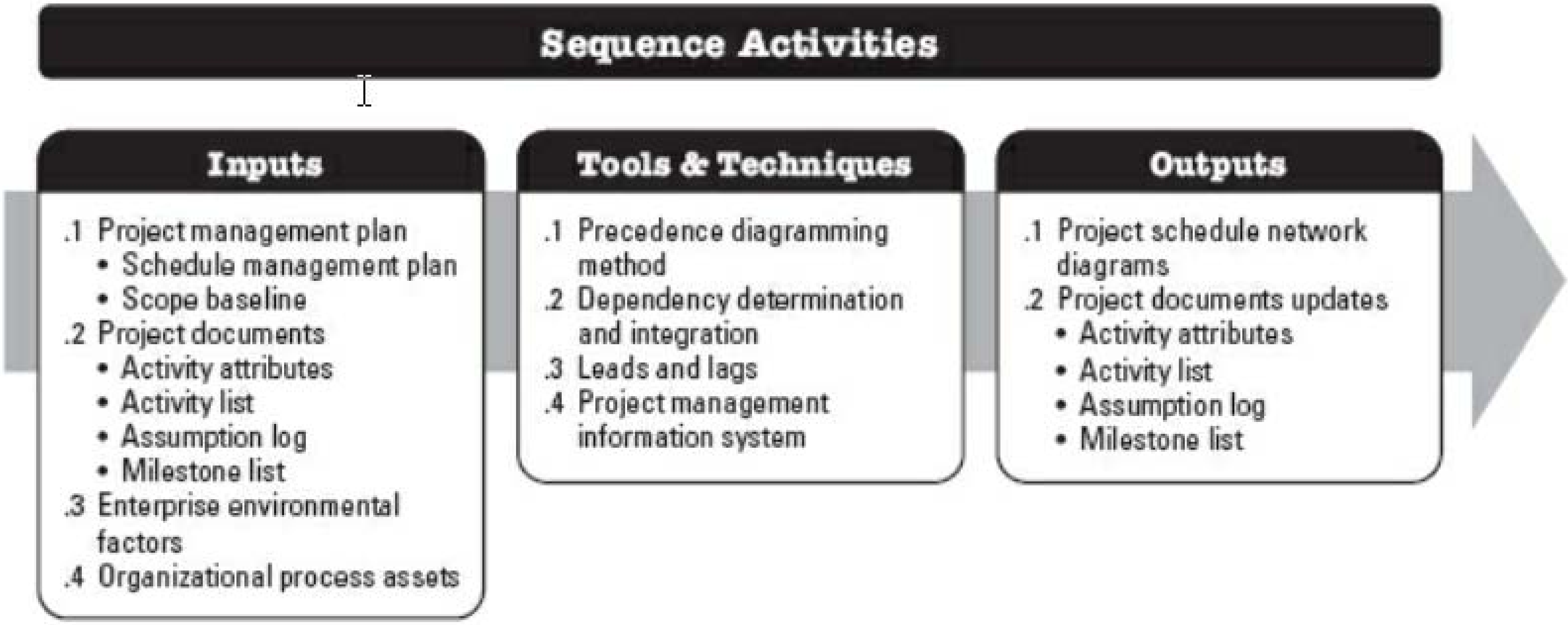


Figure 6-7. Sequence Activities: Inputs, Tools & Techniques, and Outputs

Sequence activities

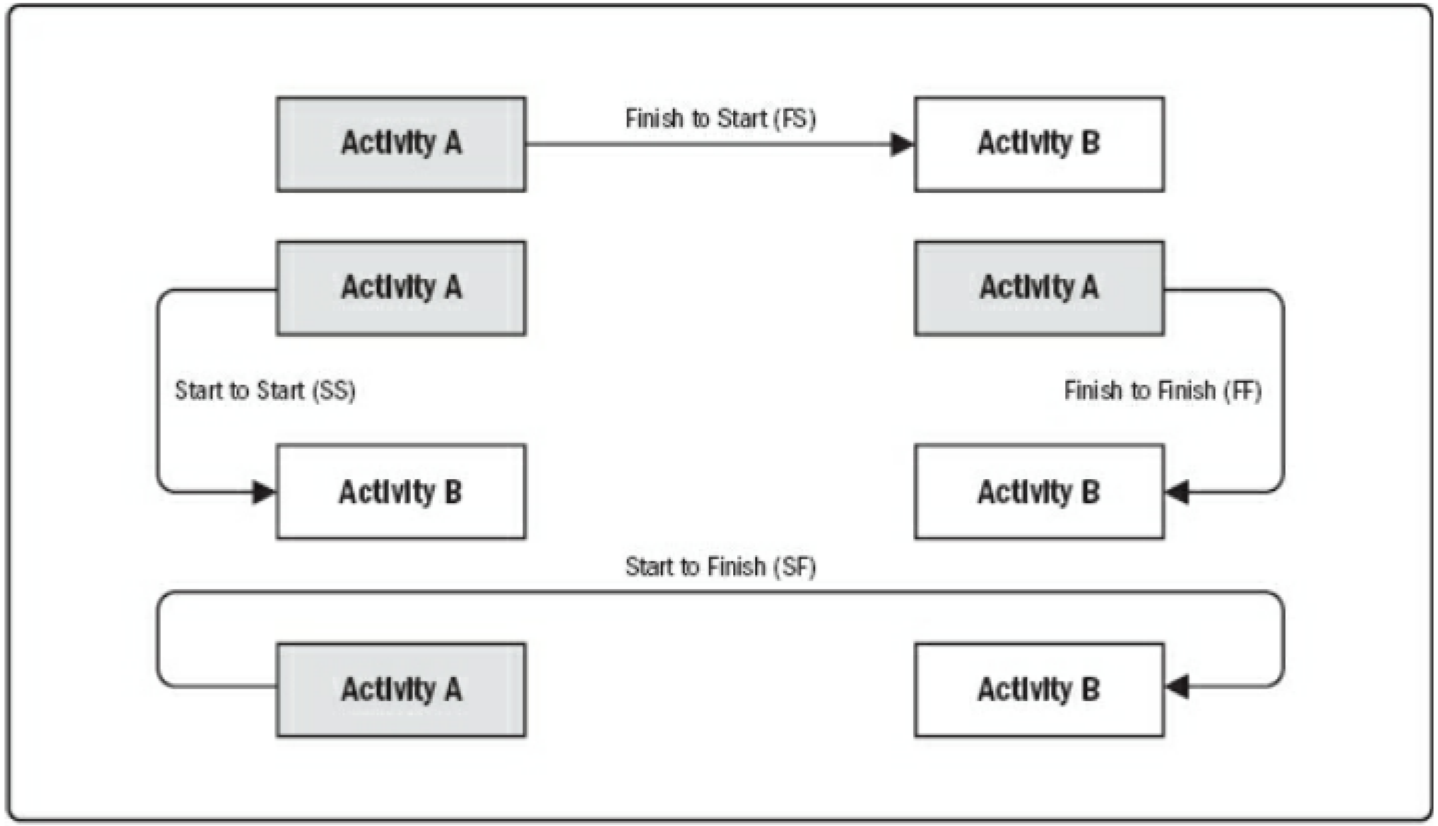


Figure 6-9. Precedence Diagramming Method (PDM) Relationship Types

PMBOK®

Sequence activities

- It is a consistent framework for planning, scheduling, monitoring, and controlling the project.
- It illustrates the interdependence of all tasks, work packages, and work elements.
- It denotes the times when specific individuals and resources must be available for work on a given task.
- It aids in ensuring that the proper communications take place between departments and functions.
- It determines an expected project completion date.
- It identifies so-called critical activities that, if delayed, will also delay the project completion time.
- It also identifies activities with slack that can be delayed for specified periods without penalty, or from which resources may be temporarily borrowed without harm.
- It determines the dates on which tasks may be started—or must be started if the project is to stay on schedule.
- It illustrates which tasks must be coordinated to avoid resource or timing conflicts.
- It also illustrates which tasks may be run, or must be run, in parallel to achieve the predetermined project completion date.
- It relieves some interpersonal conflict by clearly showing task dependencies.
- It may, depending on the information used, allow an estimate of the probability of project completion by various dates, or the date corresponding to a particular a priori probability.

Network Techniques

PERT and CPM

- PERT
  - Probabilistic (Mostly for R&D projects)
  - Three time estimates
  - Unpredictable activities
  - Only uses FS relationship
- CPM
  - Deterministic (Mostly for Construction projects)
  - Used by Softwares
  - One time estimate
  - Predictable activities
  - Uses 4 possible relationships

Network Techniques

PERT and CPM Terminology

- Activity

  A specific task or set of tasks that are required by the project, use up resources, and take time to complete.

- Event

  The result of completing one or more activities. An identifiable end state that occurs at a particular time. Events use no resources.

- Network

  The arrangement of all activities (and, in some cases, events) in a project arrayed in their logical sequence and represented by arcs and nodes. This arrangement (network) defines the project and the activity precedence relationships. Networks are usually drawn starting on the left and proceeding to the right. Arrowheads placed on the arcs are used to indicate the direction of flow—that is, to show the proper precedences. Before an event can be realized— that is, achieved—all activities that immediately precede it must be completed. These are called its predecessors. Thus, an event represents an instant in time when each and every predecessor activity has been finished.

- Path

  The series of connected activities (or intermediate events) between any two events in a network.

- Critical

  Activities events, or paths which, if delayed, will delay the completion of the project. A project’s critical path is understood to mean that sequence of critical activities (and critical events) that connects the project’s start event to its finish event and which cannot be delayed without delaying the project.

Constructing the Networks

- AoN (Activity on Node)
  - Easier to draw
  - Emphasizes Activities
  - Used in softwares
  - Does not show timeline

- AoA (Activity on Arrow)
  - Dummy activities are used
  - Emphasizes Events (Milestones)
  - Can only represent FS relationship
  - No Lag or lead is supported

- Gannt Chart (Bar Chart)
  - Easy to read
  - Provides timeline
  - Difficult to follow activity paths

AoN Format

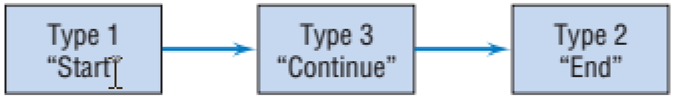


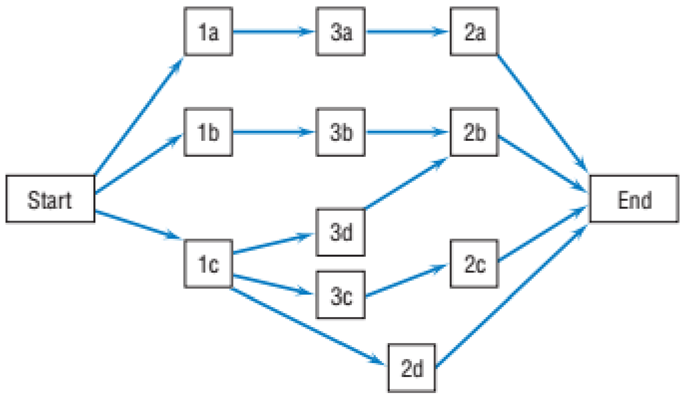
Figure 8-1 Three sequential activities, AON format.

AoN Format

WBS

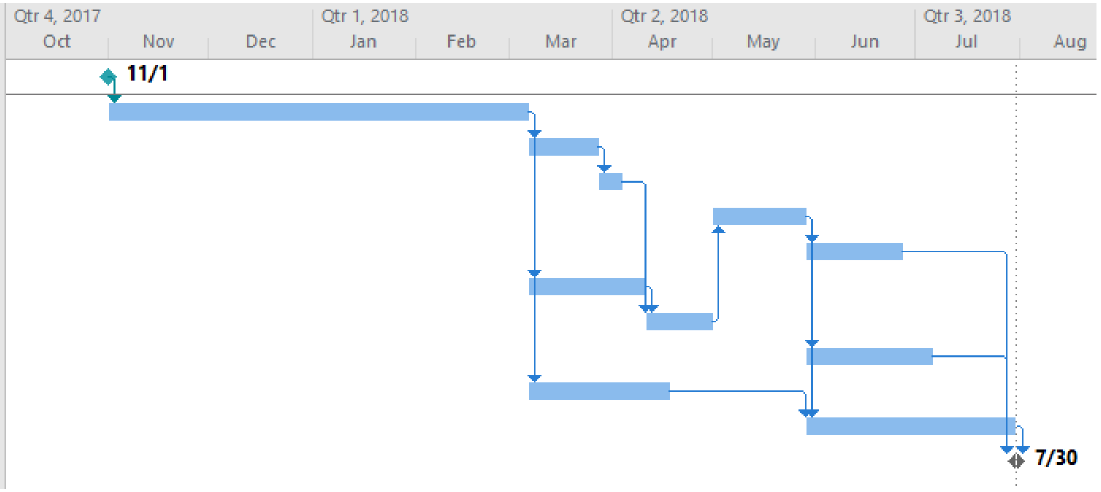
Career Day				
Steps	**Responsibility**	**Time (weeks)**	**Prec.**	**Resources**
1. Contact Organizations				
a. Print form	Secretary	6	–	Print shop
b. Contact organizations	Program manager	15	1.a	Word processing
c. Collect display information	Office manager	4	1.b	
d. Gather college particulars	Secretary	4	1.b	
e. Print programs	Secretary	6	1.d	Print shop
f. Print participants' certificates	Graduate assistant	8	–	Print Shop
2. Banquet and Refreshments				
a. Select guest speaker	Program manager	14	–	
b. Organize food	Program manager	3	1.b	Caterer
c. Organize liquor	Director	10	1.b	Dept. of Liquor Control
d. Organize refreshments	Graduate assistant	7	1.b	Purchasing
3. Publicity and Promotion				
a. Send invitations	Graduate assistant	2	–	Word processing
b. Organize gift certificates	Graduate assistant	5.5	–	
c. Arrange banner	Graduate assistant	5	1.d	Print shop
d. Contact faculty	Program manager	1.5	1.d	Word processing
e. Advertise in college paper	Secretary	5	1.d	Newspaper
f. Class announcements	Graduate assistant	1	3.d	Registrar's office
g. Organize posters	Secretary	4.5	1.d	Print shop
4. Facilities				
a. Arrange facility for event	Program manager	2.5	1.c	
b. Transport materials	Office manager	.5	4.a	Movers

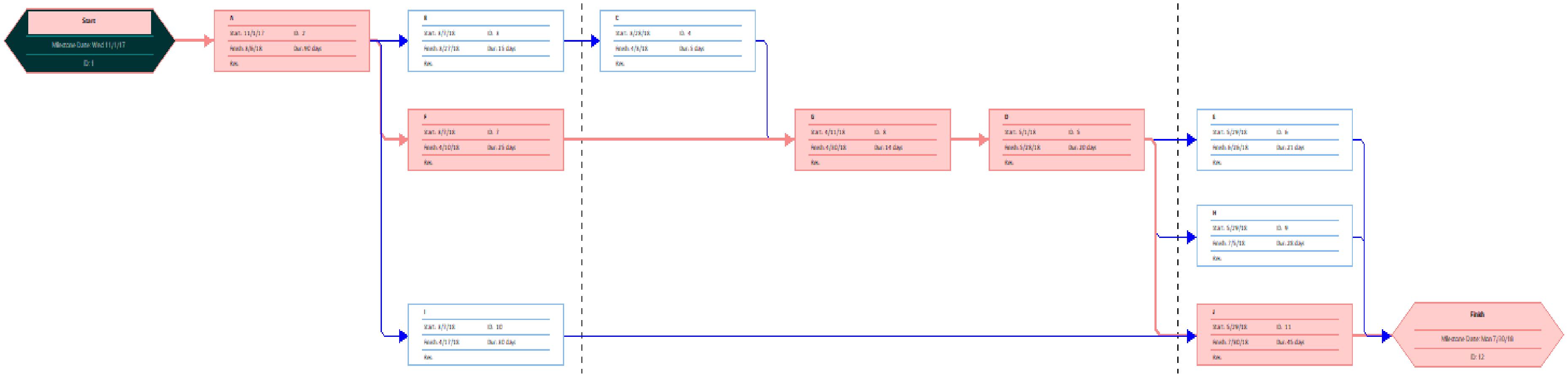
Figure 6-6 Partial WBS for college "Career Day."



AoN

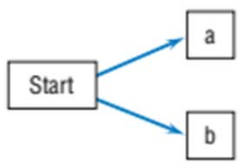
	Task Mode	Task Name	Duration	Start	Finish	Pre
1		Start	0 days	Wed 11/1/17	Wed 11/1/17	
2		A	90 days	Wed 11/1/17	Tue 3/6/18	1
3		B	15 days	Wed 3/7/18	Tue 3/27/18	2
4		C	5 days	Wed 3/28/18	Tue 4/3/18	3
5		D	20 days	Tue 5/1/18	Mon 5/28/18	8
6		E	21 days	Tue 5/29/18	Tue 6/26/18	5
7		F	25 days	Wed 3/7/18	Tue 4/10/18	2
8		G	14 days	Wed 4/11/18	Mon 4/30/18	4,7
9		H	28 days	Tue 5/29/18	Thu 7/5/18	5
10		I	30 days	Wed 3/7/18	Tue 4/17/18	2
11		J	45 days	Tue 5/29/18	Mon 7/30/18	5,1
12		Finish	0 days	Mon 7/30/18	Mon 7/30/18	6,9

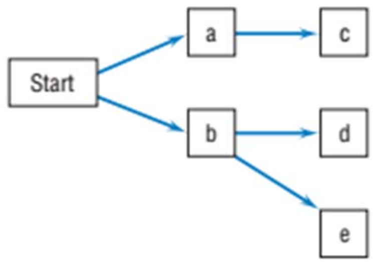


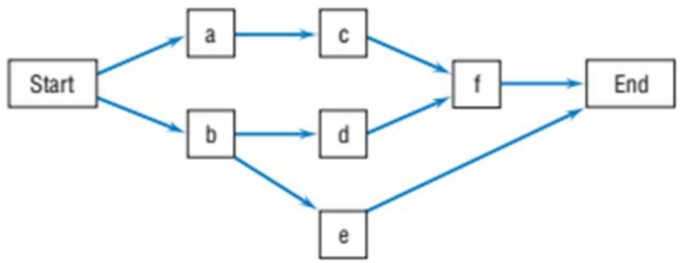


AoN

Tasks	*Precedence*	*Time*	*Cost*	*Who Does*
a	—	5 days	—	—
b	—	4 days	—	—
c	a	6 days	—	—
d	b	2 days	—	—
e	b	5 days	—	—
f	c,d	8 days	—	—

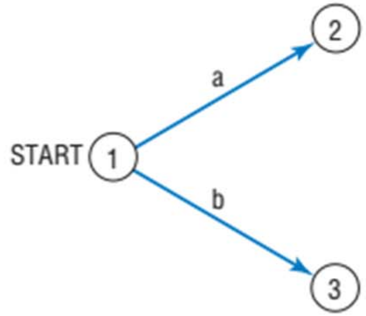


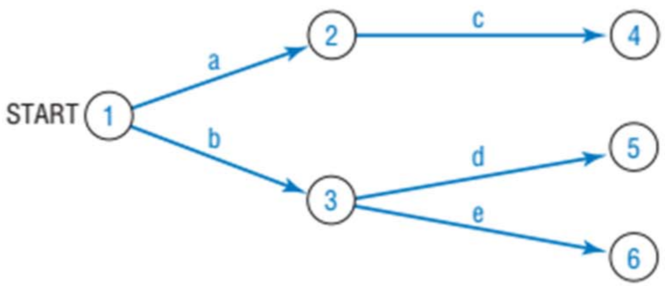


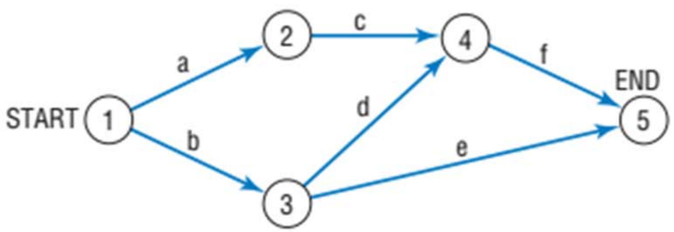


AoA

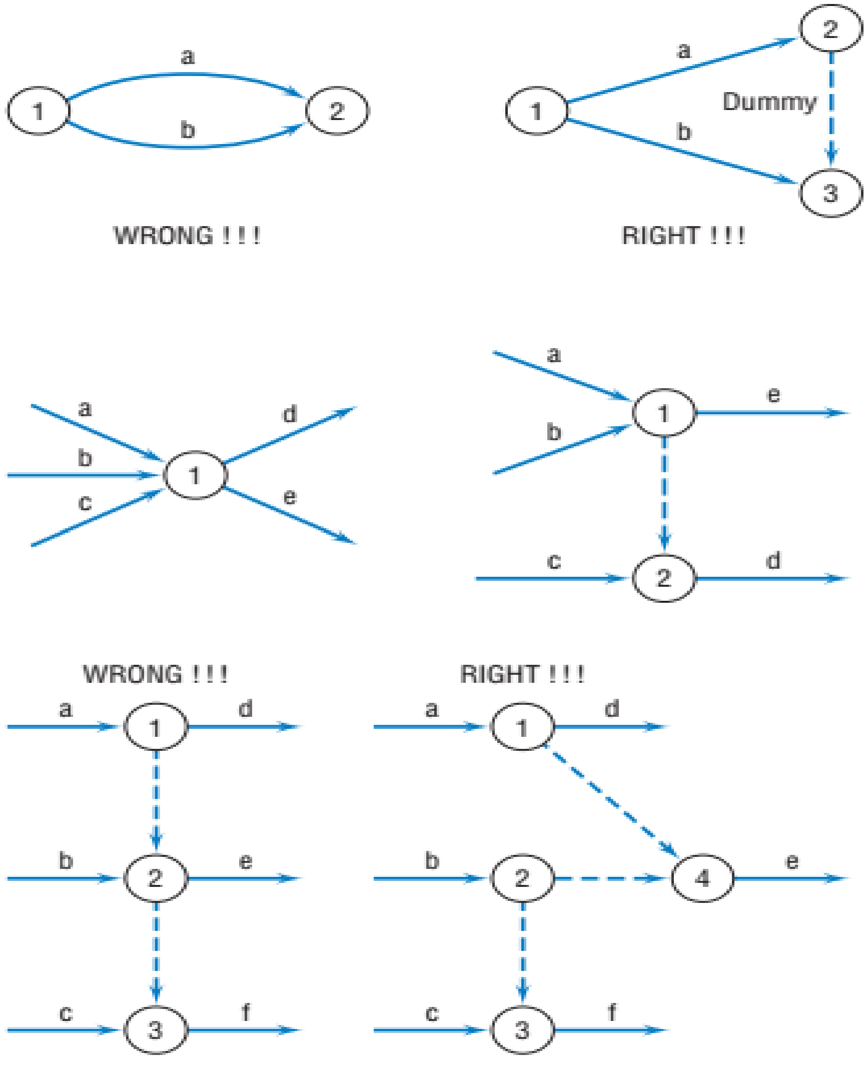
Tasks	*Precedence*	*Time*	*Cost*	*Who Does*
a	—	5 days	—	—
b	—	4 days	—	—
c	a	6 days	—	—
d	b	2 days	—	—
e	b	5 days	—	—
f	c,d	8 days	—	—





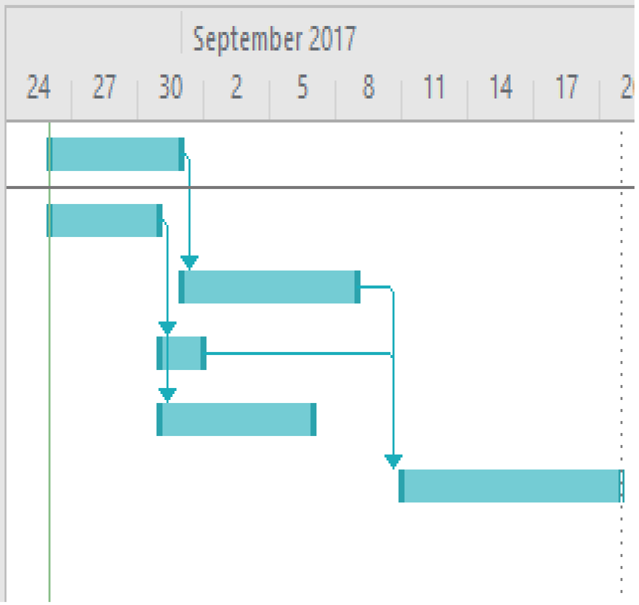


AoA


a
b
1
2
WRONG !!!
a
b
Dummy
1
2
3
RIGHT !!!
a
b
c
d
e
1
a
b
c
d
e
1
2
WRONG !!!
a
b
c
d
e
f
1
2
3
RIGHT !!!
a
b
c
d
e
f
1
2
3
4

Gannt Chart – Bar Chart

		Task Mode	Task Name	Duration	Start	Finish	Predece	Resource Names
1			a	5 days	Sat 26.08.17	Thu 31.08.17		
2			b	4 days	Sat 26.08.17	Wed 30.08.1		
3			c	6 days	Fri 1.09.17	Fri 8.09.17	1	
4			d	2 days	Thu 31.08.17	Fri 1.09.17	2	
5			e	5 days	Thu 31.08.17	Wed 6.09.17	2	
6			f	8 days	Mon 11.09.1	Wed 20.09.1	3;4	

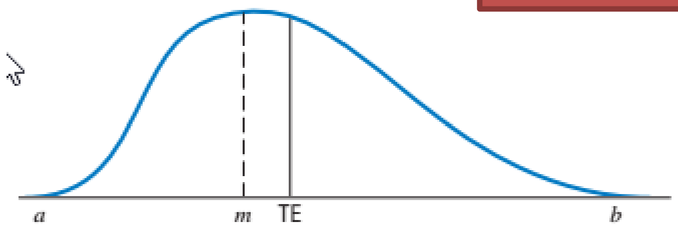


1917 – Henry Gannt

Estimating Activity Times

Pessimistic – Skew left

Usually a beta distribution is assumed



A, b and m are found by discussions
But PM should cut out at the end.

$$TE = (a+4m+b) / 6$$

TE: Time estimate (Expected Time)
a: Optimistic time estimate
b: Pessimistic time estimate
m: Most likely time estimate, the mode

Three-point Estimating

A technique used in estimating activity durations.
PERT: Program Evaluation and Review Technique

Most Likely (M): Activity duration based on realistic expectations
Optimistic (O): Activity duration based on best-case scenario
Pessimistic (P): Activity duration based on worst-case scenario

1. Triangular Distribution
2. Beta Distribution

Three-point Estimating

Triangular distribution

$$\text{Activity Duration} = \frac{O+M+P}{3}$$

Beta distribution

$$\text{Activity Duration} = \frac{O+4M+P}{6}$$

We will assume beta for our examples. İt is some better approach.

Three-point Estimating Sample

You are a Project Manager of a software project. You are in the estimate activity durations process of your project. You ask a software developer to estimate, optimistic, most likely, and pessimistic durations of a specific screen. He gives the following information:

	Optimistic	Most Likely	Pessimistic
Duration (days)	5	7	15

Based on these estimates, calculate the activity duration by using triangular and beta distributions of PERT technique .

$$\text{Triangular Distribution Activity Duration} = \frac{O+M+P}{3} = \frac{5+7+15}{3} = 9 \text{ days}$$

$$\text{Beta Distribution Activity Duration} = \frac{O+4M+P}{6} = \frac{5+4x7+15}{6} = 8 \text{ days}$$

PERT Exercise

A sample small Project

Table 8-1 Project Activity Times and Precedences

Activity	*Optimistic Time*	*Most Likely Time*	*Pessimistic Time*	*Immediate Predecessor Activities*
a	10	22	22	—
b	20	20	20	—
c	4	10	16	—
d	2	14	32	a
e	8	8	20	b, c
f	8	14	20	b, c
g	4	4	4	b, c
h	2	12	16	c
i	6	16	38	g, h
j	2	8	14	d, e

Small may mean agile too

A sample small Project

Activity	Immediate Predecessor Activities
a	—
b	—
c	—
d	a
e	b, c
f	b, c
g	b, c
h	c
i	g, h
j	d, e

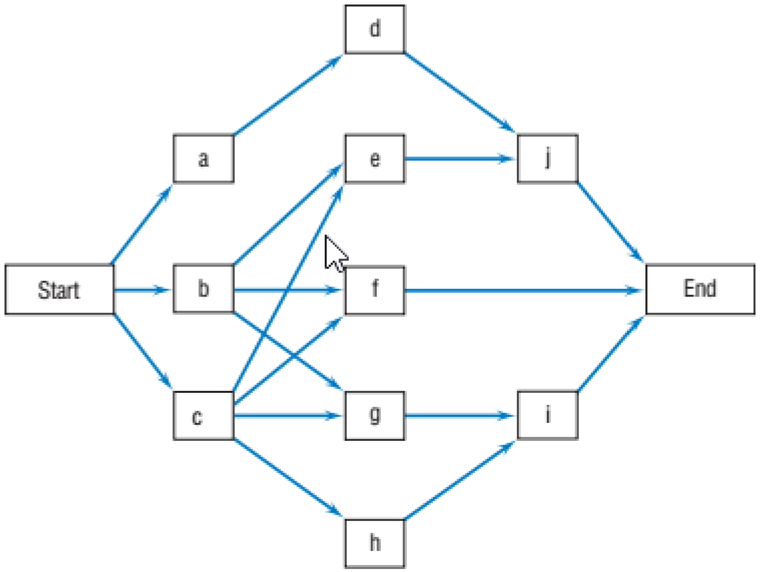


Figure 8-13 The AON network from Table 8-1.

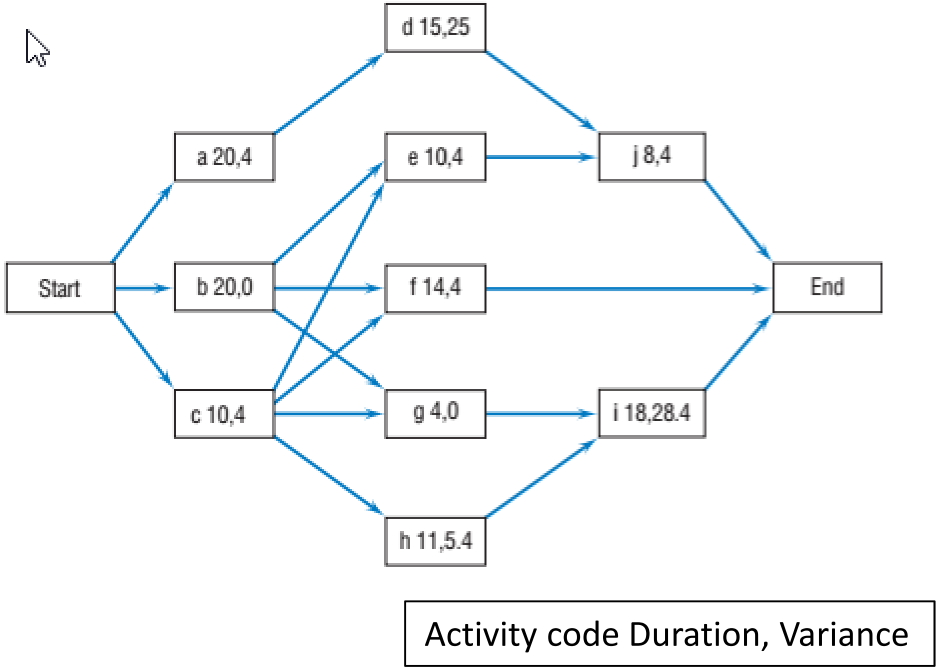
A sample small Project

Table 8-2 Expected Activity Times (TE), Variances (σ^2), and Standard Deviations (σ)

Activity	*Expected Time, TE*	*Variance, σ^2*	*Standard Deviation, σ*
a	20	4	2
b	20	0	0
c	10	4	2
d	15	25	5
e	10	4	2
f	14	4	2
g	4	0	0
h	11	5.4	2.32
i	18	28.4	5.33
j	8	4	2

$$TE = (a + 4m + b)/6$$

$$\sigma^2 = ((b - a)/6)^2$$



Critical Path Method and Floats

Critical Path Method

Determines;

- Longest path in the network diagram
- Earliest and latest an activity can start
- Earliest and latest an activity can be completed

Critical Path

- Longest duration through a network diagram
- Shortest time to complete the project

Near Critical Path

- Closest path to critical path in terms of duration

Critical Path Method and Floats

Critical Path Method

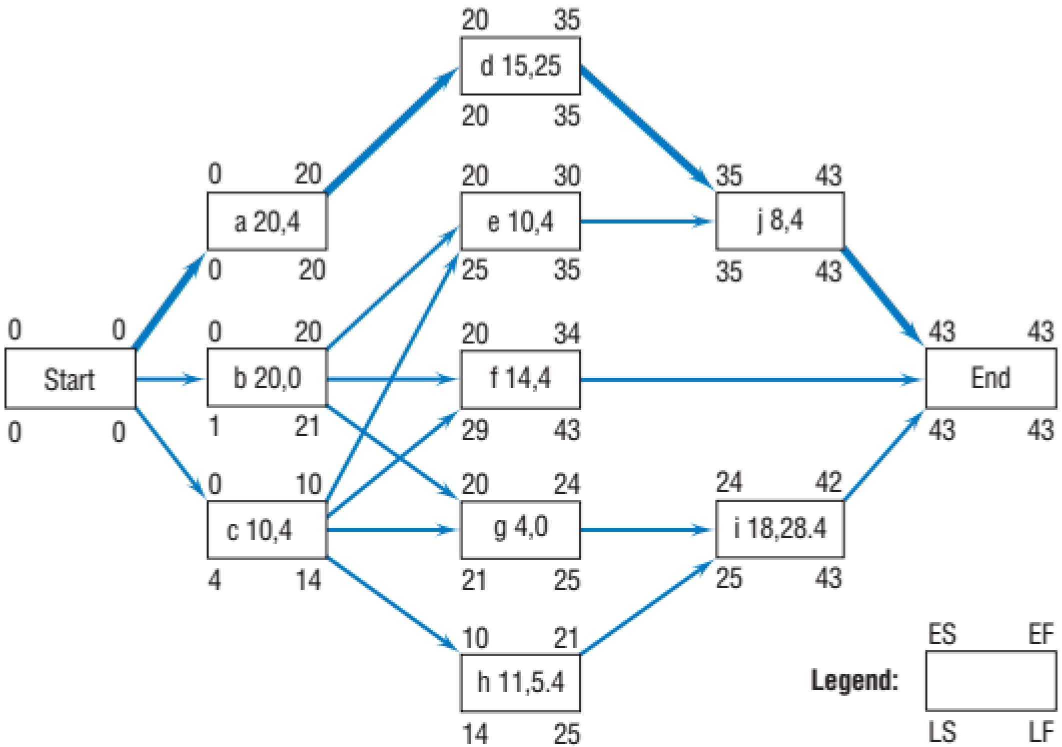
Float (Slack)

- **Total Float:** Delay time without affecting the project end date
- **Free Float:** Delay time without affecting the early start date
- **Project Float:** Delay time without affecting the externally imposed project completion date

✓ Critical path activities should have "0" float !!!

1. Float = Late Start (LS) – Early Start (ES)
2. Float = Late Finish (LF) – Early Finish (EF)

Critical path, time and slacks
A sample small Project



Activity Code, Duration, Variance

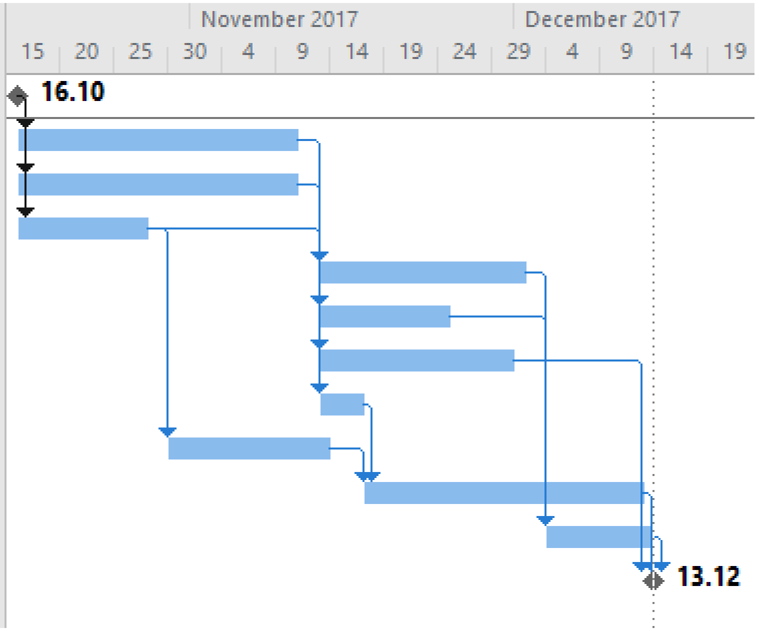
Slack, aka or float are the same thing

Activity	*LS*	*ES*	*Slack*
a	0	0	0
b	1	0	1
c	4	0	4
d	20	20	0
e	25	20	5
f	29	20	9
g	21	20	1
h	14	10	4
i	25	24	1
j	35	35	0

MS Project way-CPM

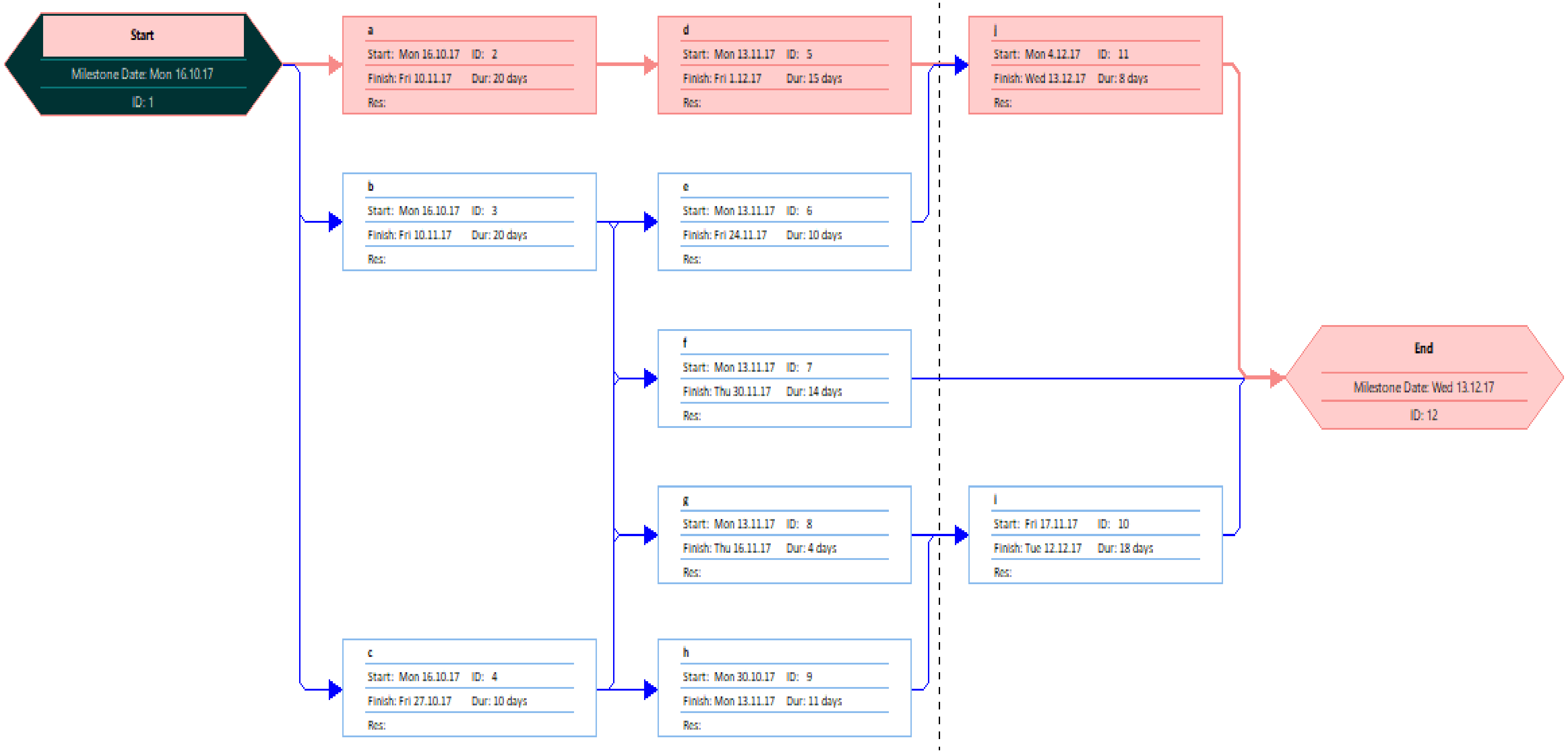
A sample small Project

		Task Mode	Task Name	Duration	Start	Finish	Predecessors
1			Start	0 days	Mon 16.10.1	Mon 16.10.1	
2			a	20 days	Mon 16.10.1	Fri 10.11.17	1
3			b	20 days	Mon 16.10.1	Fri 10.11.17	1
4			c	10 days	Mon 16.10.1	Fri 27.10.17	1
5			d	15 days	Mon 13.11.1	Fri 1.12.17	2
6			e	10 days	Mon 13.11.1	Fri 24.11.17	3;4
7			f	14 days	Mon 13.11.1	Thu 30.11.17	3;4
8			g	4 days	Mon 13.11.1	Thu 16.11.17	3;4
9			h	11 days	Mon 30.10.1	Mon 13.11.1	4
10			i	18 days	Fri 17.11.17	Tue 12.12.17	8;9
11			j	8 days	Mon 4.12.17	Wed 13.12.1	5;6
12			End	0 days	Wed 13.12.1	Wed 13.12.1	11;10;7



MS Project way-CPM

A sample small Project



MS Project way-CPM

A sample small Project

Task Name	Duration	Start	Finish	Predec	Early Start	Early Finish	Late Start	Late Finish	Free Slack
Start	0 days	Mon 16.10.1	Mon 16.10.1		Mon 16.10.17	Mon 16.10.17	Mon 16.10.17	Mon 16.10.17	0 days
a	20 days	Mon 16.10.1	Fri 10.11.17	1	Mon 16.10.17	Fri 10.11.17	Mon 16.10.17	Fri 10.11.17	0 days
b	20 days	Mon 16.10.1	Fri 10.11.17	1	Mon 16.10.17	Fri 10.11.17	Tue 17.10.17	Mon 13.11.17	0 days
c	10 days	Mon 16.10.1	Fri 27.10.17	1	Mon 16.10.17	Fri 27.10.17	Fri 20.10.17	Thu 2.11.17	0 days
d	15 days	Mon 13.11.1	Fri 1.12.17	2	Mon 13.11.17	Fri 1.12.17	Mon 13.11.17	Fri 1.12.17	0 days
e	10 days	Mon 13.11.1	Fri 24.11.17	3;4	Mon 13.11.17	Fri 24.11.17	Mon 20.11.17	Fri 1.12.17	5 days
f	14 days	Mon 13.11.1	Thu 30.11.17	3;4	Mon 13.11.17	Thu 30.11.17	Fri 24.11.17	Wed 13.12.17	9 days
g	4 days	Mon 13.11.1	Thu 16.11.17	3;4	Mon 13.11.17	Thu 16.11.17	Tue 14.11.17	Fri 17.11.17	0 days
h	11 days	Mon 30.10.1	Mon 13.11.1	4	Mon 30.10.17	Mon 13.11.17	Fri 3.11.17	Fri 17.11.17	3 days
i	18 days	Fri 17.11.17	Tue 12.12.17	8;9	Fri 17.11.17	Tue 12.12.17	Mon 20.11.17	Wed 13.12.17	1 day
j	8 days	Mon 4.12.17	Wed 13.12.1	5;6	Mon 4.12.17	Wed 13.12.17	Mon 4.12.17	Wed 13.12.17	0 days
End	0 days	Wed 13.12.1	Wed 13.12.1	11;10;7	Wed 13.12.17	Wed 13.12.17	Wed 13.12.17	Wed 13.12.17	0 days

MS Project take care about Holidays or weekends – SO Be Careful

Precedence Last Review

- Finish-to-start (FS).

  A logical relationship in which a successor activity cannot start until a predecessor activity has finished. For example, installing the operating system on a PC (successor) cannot start until the PC hardware is assembled (predecessor).
- Finish-to-finish (FF).

  A logical relationship in which a successor activity cannot finish until a predecessor activity has finished. For example, writing a document (predecessor) is required to finish before editing the document (successor) can finish.
- Start-to-start (SS).

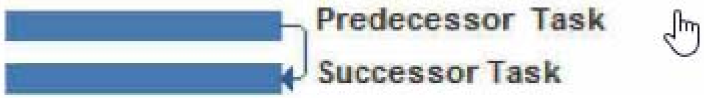
  A logical relationship in which a successor activity cannot start until a predecessor activity has started. For example, level concrete (successor) cannot begin until pour foundation (predecessor) begins.
- Start-to-finish (SF).

  A logical relationship in which a successor activity cannot finish until a predecessor activity has started. For example, a new accounts payable system (successor) has to start before the old accounts payable system can be shut down (predecessor).

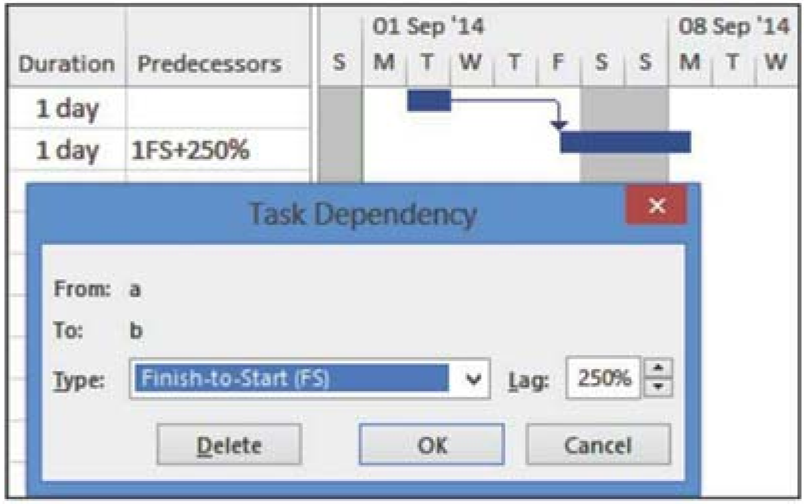
Precedence Diagraming

While the **SS** dependency is like this:

The **FF** dependency would be:

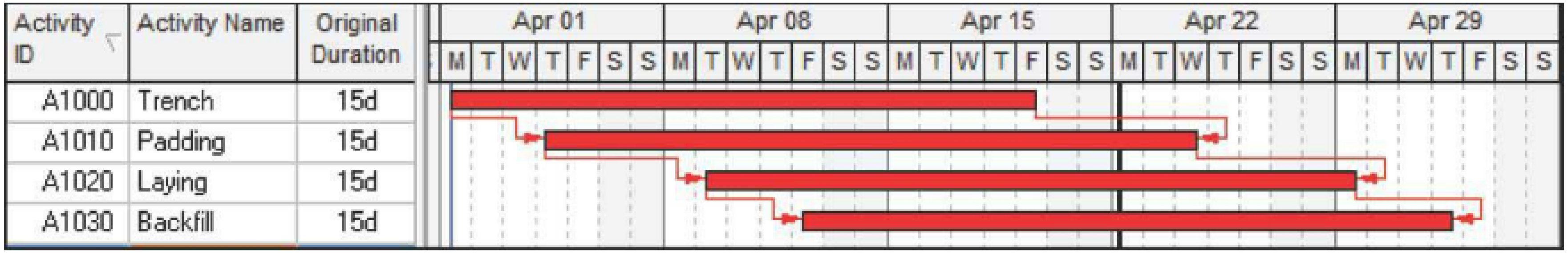


The **SF** dependency looks like:



Be careful:
MS-Project gets week-ends.

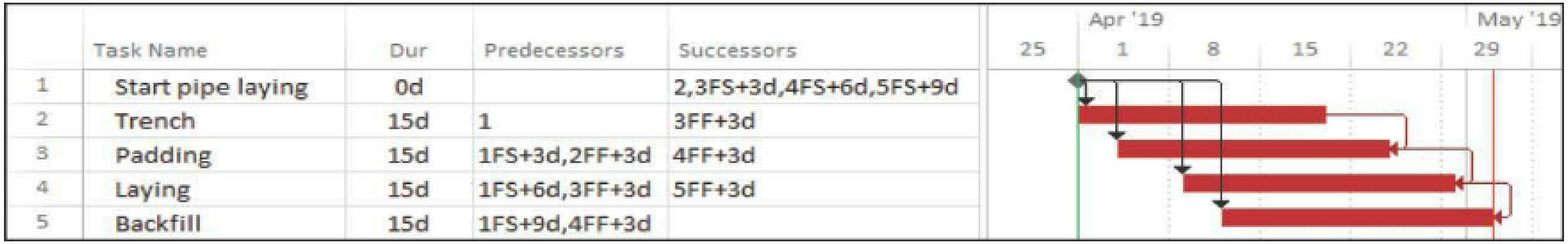
Precedence Diagraming



Activity ID	Activity Name	Original Duration
A1000	Trench	15d
A1010	Padding	15d
A1020	Laying	15d
A1030	Backfill	15d

Microsoft Project does not allow two relationships between tasks. Ladder Scheduling may be achieved by:

- Commencing a chain of tasks with a Start Milestone,
- Connect the Start Milestone to each task with a Start to Start plus the appropriate lag and
- Connect each task to their successor with a Finish to Finish relationship plus the appropriate lag:



	Task Name	Dur	Predecessors	Successors
1	Start pipe laying	0d		2,3FS+3d,4FS+6d,5FS+9d
2	Trench	15d	1	3FF+3d
3	Padding	15d	1FS+3d,2FF+3d	4FF+3d
4	Laying	15d	1FS+6d,3FF+3d	5FF+3d
5	Backfill	15d	1FS+9d,4FF+3d	

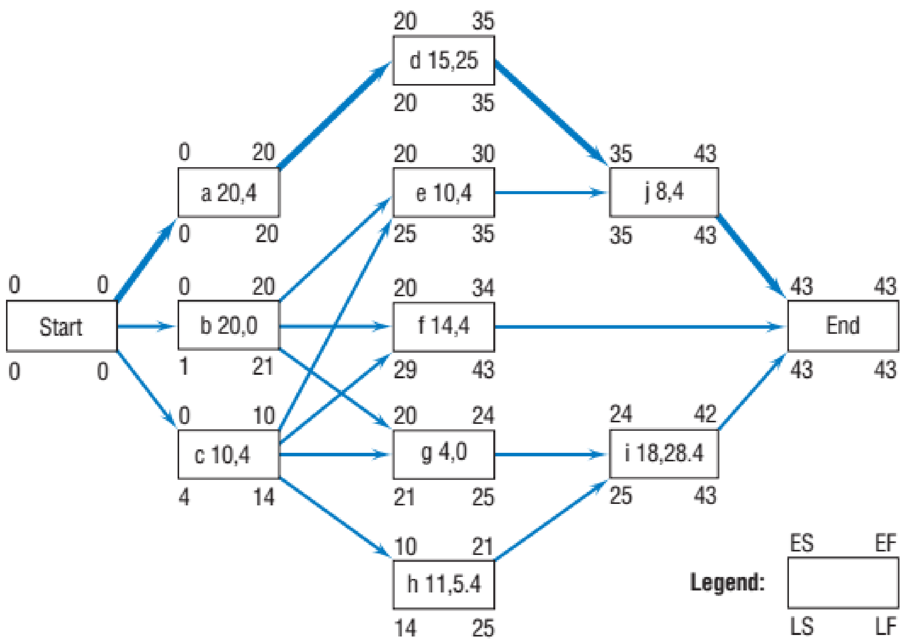
Notes for CPM

Important Notes about Critical Path Method

- There can be more than one critical paths
- Having several critical paths or having several near critical paths mean project has high risk
- Critical path of the project can change over time
- There can be negative float, it means schedule is behind than the planned
- If there is negative float, you should compress the schedule.
- If you need to cut an activity duration in critical path, cut the earlier activity's duration

Uncertainties in Completion Times

When discussing project completion dates with senior management, the PM should try to determine the probability that a project will be completed by the suggested deadline—or find the completion time associated with a predetermined level of risk.



We should do some assumptions to use normal distribution.
(Out of topic – Simply use it)

Using it;
You will gain time as PM

Meredith

Uncertainties in Completion Times

Table 8-2 Expected Activity Times (TE), Variances (σ^2), and Standard Deviations (σ)

Activity	*Expected Time, TE*	*Variance, σ^2*	*Standard Deviation, σ*
a	20	4	2
b	20	0	0
c	10	4	2
d	15	25	5
e	10	4	2
f	14	4	2
g	4	0	0
h	11	5.4	2.32
i	18	28.4	5.33
j	8	4	2

$$Z = (D - \mu)/\sqrt{\sigma_\mu^2}$$

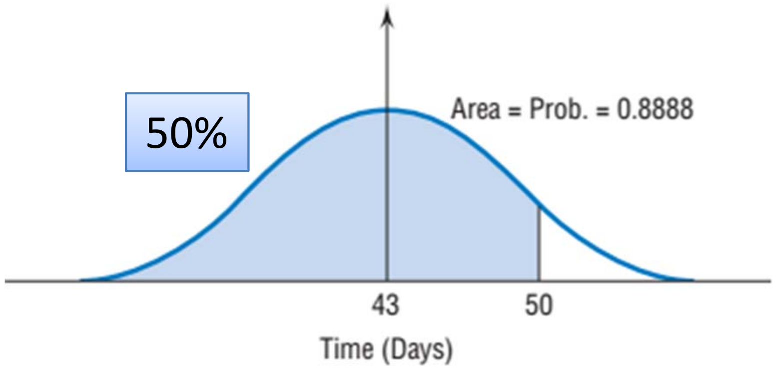


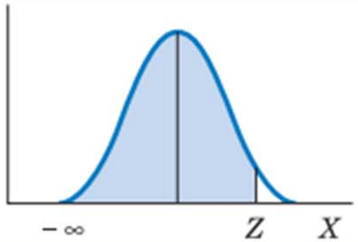
Figure 8-25 Probability distribution of project completion times.

D = the desired project completion time (this time 50 days)
μ= the critical time of the project, the sum of the TEs for activities on the critical path
σ^2_μ = the variance of the critical path, the sum of the variances of activities on the critical path
Z = the number of standard deviations of a normal distribution (the standard normal deviate)

$Z = (50 - 43)/5.745$
$= 1.22$ standard deviations

You will use on the Exam

Table 8-5 Cumulative (Single Tail) Probabilities of the Normal Probability Distribution (Areas under the Normal Curve from $-\infty$ to Z)



Example: the area to the left of $Z = 1.34$ is found by following the left Z column down to 1.3 and moving right to the .04 column. At the intersection read .9099. The area to the right of $Z = 1.34$ is $1 - .9099 = .0901$. The area between the mean (center line) and $Z = 1.34$ is $.9099 - .5 = .4099$.

z	00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
	[illegible]57	.7291	.7[illegible]4	[illegible]357	.73[illegible]	[illegible]22	.745[illegible]	.7[illegible]6	[illegible]517	.75[illegible]
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8880
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319

Uncertainties in Completion Times

N4 =NORM.INV(M4,E$12,G$12)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Activity	Optimistic	Most Likely	Pesimistic	Mean μ	σ^2	Std Dev σ		Durations	P of Comp. Bef.	P of Comp. Later		P of Comp. Bef.	Durations
2	a	10	22	22	20.00	4.00			50	88.85%	11.15%		90%	50
3	b	20	20	20	20.00	-			55	98.16%	1.84%		80%	48
4	c	4	10	16	10.00	4.00			60	99.85%	0.15%		70%	46
5	d	2	14	32	15.00	25.00							60%	44
6	e	8	8	20	10.00	4.00							50%	43
7	f	8	14	20	14.00	4.00								
8	g	4	4	4	4.00	-								
9	h	2	12	16	11.00	5.44								
10	i	6	16	38	18.00	28.44								
11	j	2	8	14	8.00	4.00								
12					43.00	33.00	5.74							

$$\text{Norm.Dist}(50, 43, 5.745, \text{True}) = 0.888$$

= Norm.Dist(D, μ, σ_μ , True)

=NORMINV(P, μ, σ) in EXCEL

Problems
Exam Questions

1. Given the following information, draw the AON diagram:

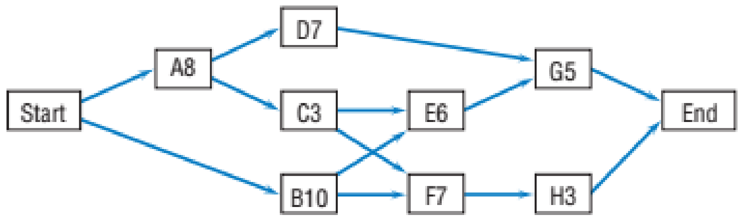
Activity	***Immediate Predecessor***
1	—
2	—
3	1, 4
4	2
5	2
6	3, 5

7. Given the following activities and precedences, draw an AOA or AON diagram:

Activity	***Immediate Predecessor***
A	—
B	—
C	A
D	A, B
E	A, B
F	C
G	D, F
H	E, G

8. Given the following network,

First letter is Activity code
Second is duration



(a) What is the critical path?
(b) How long will it take to complete this project?
(c) Can activity B be delayed without delaying the completion of the project? If so, how many days?

Problems
Exam Questions

12. The Denver Iron & Steel Company is expanding its operations to include a new drive-in weigh station. The weigh station will be a heated/air-conditioned building with a large floor and small office. The large room will have the scales, a 15-foot counter, and several display cases for its equipment.

Before erection of the building, the project manager evaluated the project using AON analysis. The activities with their corresponding times were recorded in Table A.

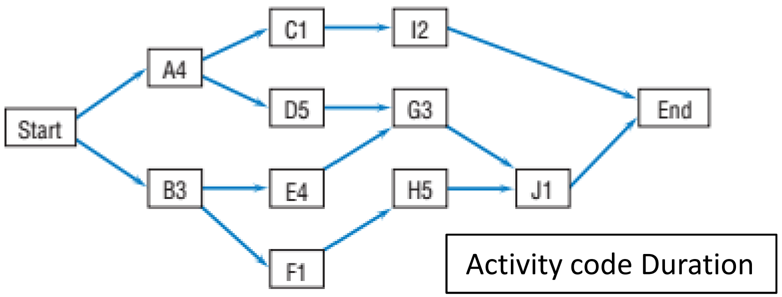
Using AON analysis, find the path with the longest expected duration, the slack times, and the expected completion time.

Table A

		Times			
#	**Activity**	**Optimistic**	**Most Likely**	**Pessimistic**	**Preceding Tasks**
1	Lay foundation	8	10	13	—
2	Dig hole for scale	5	6	8	—
3	Insert scale bases	13	15	21	2
4	Erect frame	10	12	14	1, 3
5	Complete building	11	20	30	4
6	Insert scales	4	5	8	5
7	Insert display cases	2	3	4	5
8	Put in office equipment	4	6	10	7
9	Finishing touches	2	3	4	8, 6

Problems
Exam Questions

14. The following chart was prepared at the beginning of a HRM (Human Resource Management) crash hiring project. The project begins with two activities: Assemble interview team (A) and Budget resources (B).



The duration, in days, follows the letter of each activity. What is the critical path? Which activities should be monitored most closely?

At the end of the first week, it was noted that activity **A** was completed in 2.5 days, but activity **B** required 4.5 days. What impact does this have on the project? Are the same activities critical?

16. Given an auditing project with the following activities,

Activity	*Standard Deviation*	*Critical?*	*Duration*
a, add	2	yes	2
b, balance	1		3
c, count	0	yes	4
d, deduct	3		2
e, edit	1	yes	1
f, finance	2		6
g, group	2	yes	4
h, hold	0	yes	2

find:

(a) The probability of completing the critical path in 12 weeks (or less), as the client desires.

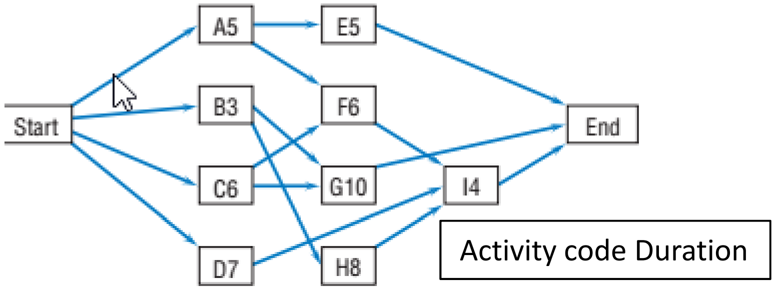
(b) The probability of completing the critical path in 13 weeks (or less).

(c) The probability of completing the critical path in 16 weeks (or less), the client's drop-dead date.

(d) The number of weeks required to assure a 92.5 percent chance of completing the critical path, as guaranteed by the auditing firm.

Problems
Exam Questions

17. The following network is a compressed representation of the prospectus of a start-up firm that plans to develop a new, bioelectronic computer chip.



Note that four activities, the biological elements, can start immediately.
Find:

(a) The critical path.

(b) The earliest time to complete the project.

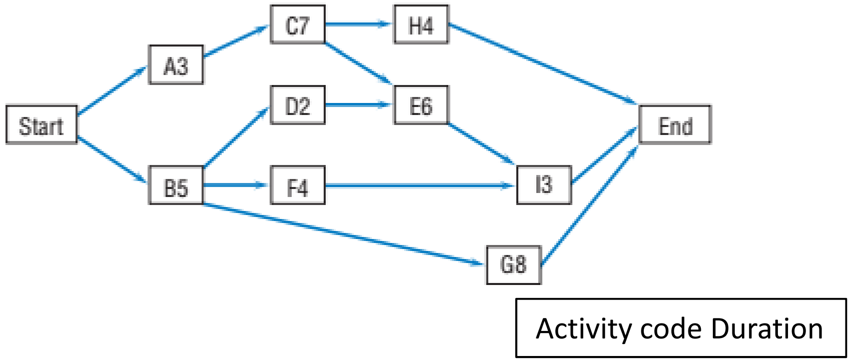
(c) The slack on activities **E**, **F**, and **H**.

19. Given the following network (times are in weeks), determine:

(a) The ES, LS, EF, and LF for each activity.

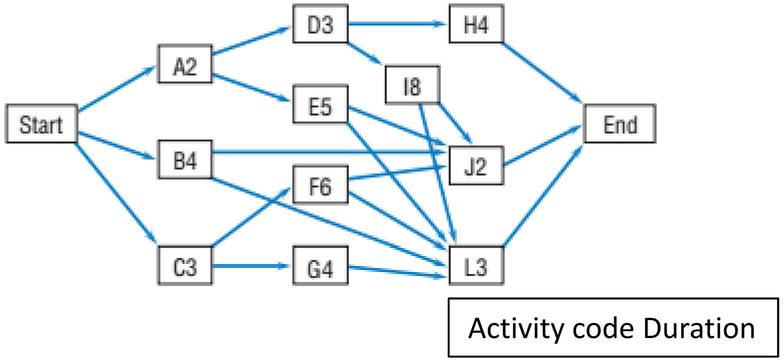
(b) The slacks on all activities.

(c) The critical activities and path.



Problems
Exam Questions

21. In the website development project network shown in the following figure, the number alongside each activity designates the activity duration (TE) in weeks.



Determine:
(a) The ES and LS for each activity.
(b) The earliest time that the website can be completed.
(c) The slack on all activities.
(d) The critical activities.
(e) The critical path.

20. Given the schedule in Table B for a liability work package done as part of an accounting audit in a corporation, find:
(a) The critical path.
(b) The slack time on "process confirmations."
(c) The slack time on "test pension plan."
(d) The slack time on "verify debt restriction compliance."

Table B

Activity	*Duration (days)*	*Preceding Activities*
a. Obtain schedule of liabilities	3	none
b. Mail confirmation	15	a
c. Test pension plan	5	a
d. Vouch selected liabilities	60	a
e. Test accruals and amortization	6	d
f. Process confirmations	40	b
g. Reconcile interest expense to debt	10	c, e
h. Verify debt restriction compliance	7	f
i. Investigate debit balances	6	g
j. Review subsequent payments	12	h, i

Problems

Exam Questions

22. Given the following information regarding a project concerning an initial public offering (IPO),

Activity	*TE (weeks)*	*Preceding Activities*
a: Check feasibility	3	none
b: Determine funding	1	none
c: Find possible banks	3	a
d: Select two possibles	4	a
e: Interview two banks	4	b
f: Analyze funding costs	5	b
g: What chance of success?	2	c, e
h: Sign contract	3	f

(a) Draw the network.

(b) What is the critical path?

(c) When will the offering be available (completion of the project)?

(d) What is the effect on the project if activity **e** (approvals) takes an extra week? Two extra weeks? Three extra weeks?

23. Construct a network for the aerospace launch project below and find its critical path.

Activity	*TE (weeks)*	*Preceding Activities*
a: Check controls	3	none
b: Check propellants	5	a
c: Check personnel	3	a
d: Assemble items	1	c
e: Move to launch pad	3	h
f: Run system tests	4	b, d
g: Check astronauts	2	c
h: Ground stations go?	3	g, f
i: Countdown	1	e, h

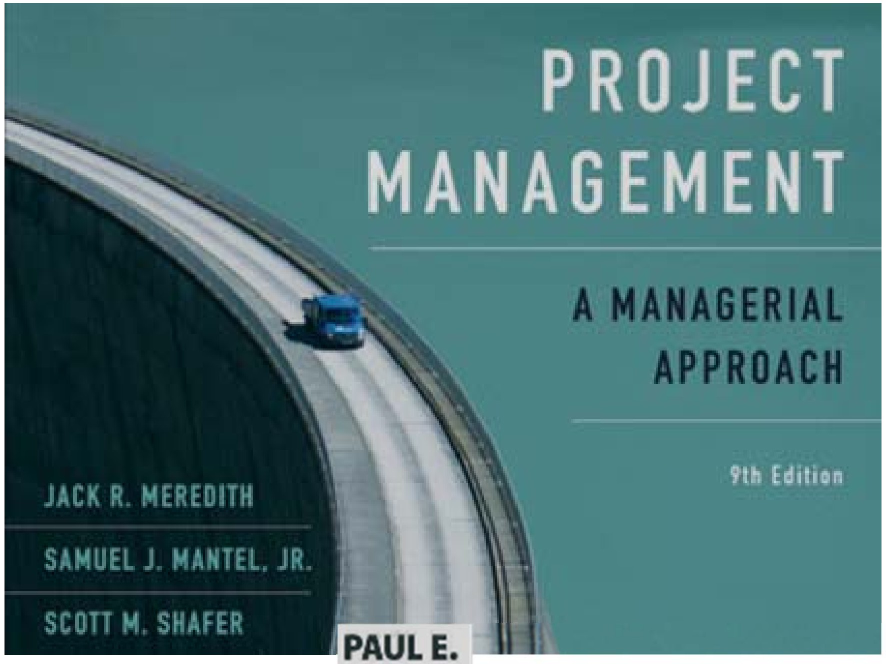
Problems
Exam Questions

28. Draw an AON network using the following data and find the probability of completing the path with the longest expected duration in 44 days, the official opening date.

		Time (days)		
Activity	***Predecessor***	***a***	***m***	***b***
1	—	6	10	14
2	1	0	1	2
3	1	16	20	30
4	2	3	5	7
5	4	2	3	4
6	3	7	10	13
7	4	1	2	3
8	7	0	2	4
9	3, 7	2	2	2
10	9	2	3	4
11	8	0	1	2
12	10, 11	1	2	3

Assume Beta distribution

Resources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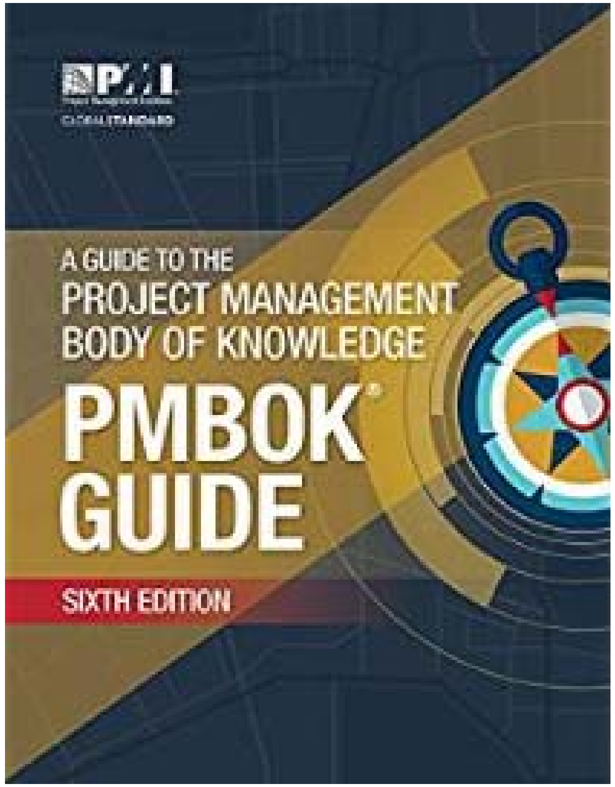
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Questions

- Questions

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NEXT WEEK: Problem Solutions
MIDTERM

The WEEK AFTER: Project Planning – Resource Allocation
CPM Crashing – Fast Tracking

ENGR3450 – Project Management

Week 8

The Project Planning

Resource Allocation

Halil POSACI – Dr. Esra Ekinci

2018, İzmir

YAŞAR ÜNİVERSİTESİ
Mühendislik Fakültesi

Agenda today

- CPM – Schedule Compression
  - Crashing and Fast Tracking a project
- Creating and Allocating Resources
- Resource loading and leveling
- Constrained resource allocation
  - Heuristic methods and optimization models
- Resource Management summary of PMI

  - The last Workshop – 5 Pts.
  - Problems from Ch 9.

Schedule Compression

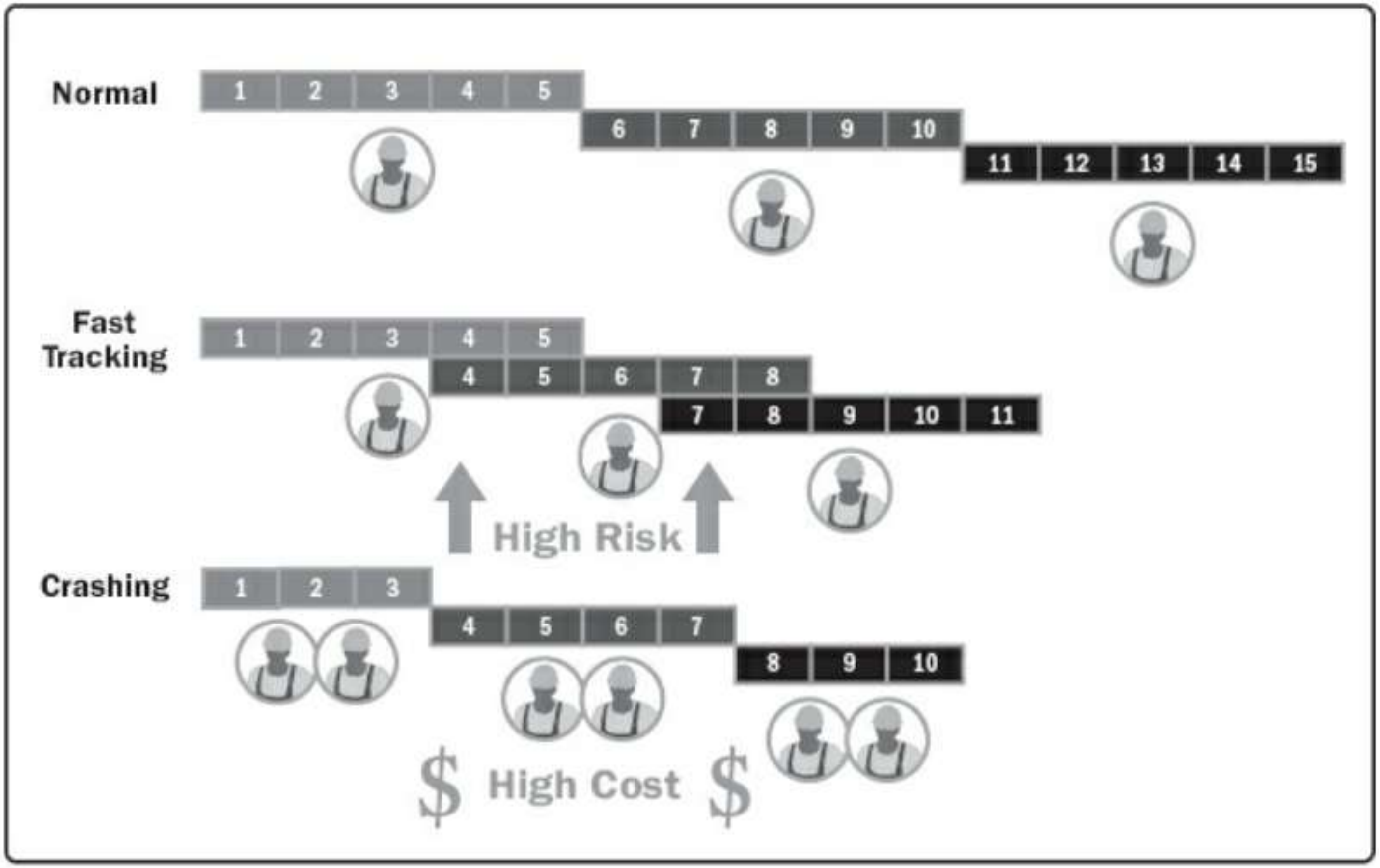


Figure 6-19. Schedule Compression Comparison

Schedule Compression

Crashing

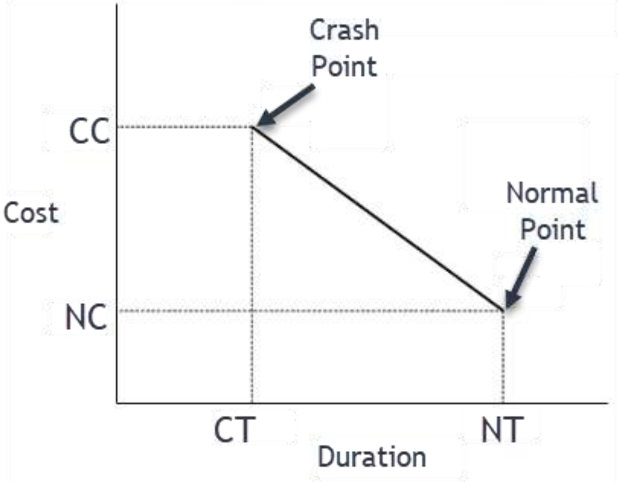
Table 9-1 An Example of Two-Time CPM

Activity	*Precedence*	*Duration, Days (normal, crash)*	*Cost (normal, crash)*
a	—	3, 2	$40, 80
b	a	2, 1	20, 80
c	a	2, 2	20, 20
d*	a	4, 1	30, 120
e**	b	3, 1	10, 80

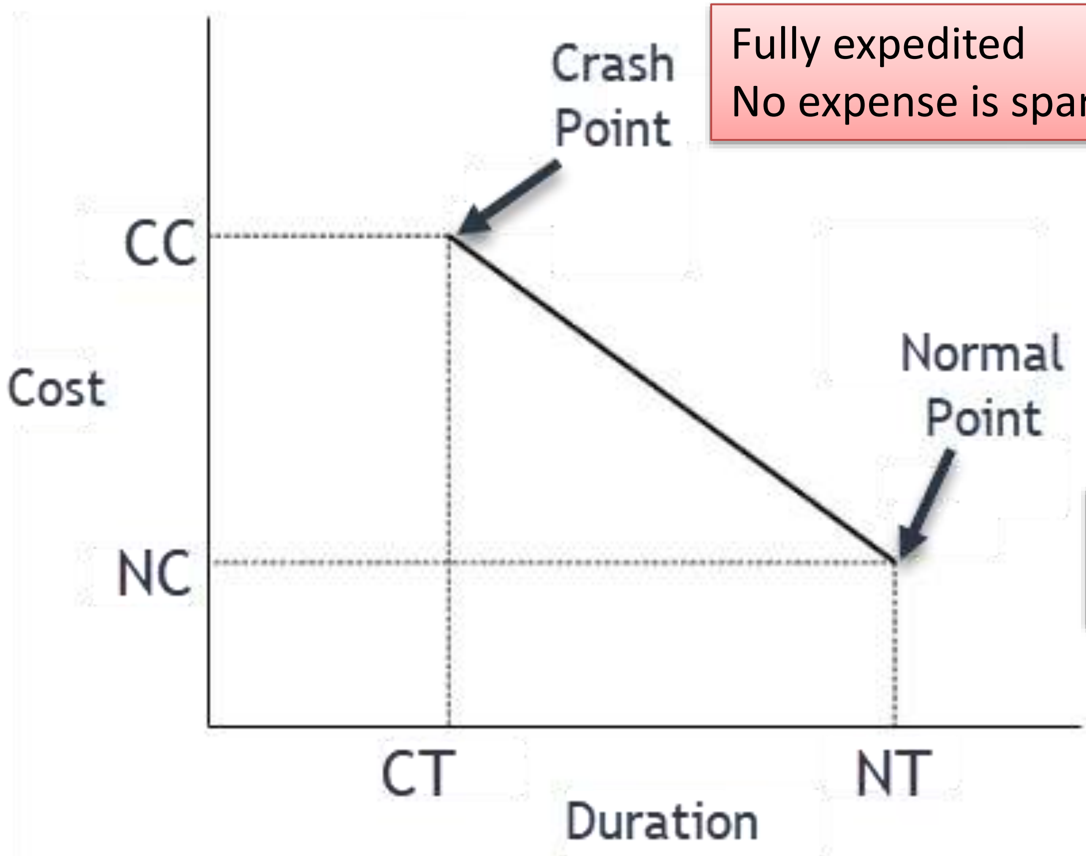
* Partial crashing allowed
** Partial crashing *not* allowed

Table 9-2 Activity Slopes–Cost per Period for Crashing

Activity	*Slope ($/day)*
a	40/−1 = −40
b	60/−1 = −60
c	—
d	90/−3 = −30
e	−70 (2 days)



Schedule Compression
Crashing



Fully expedited
No expense is spared

$$\text{Slope} = \frac{\text{crash cost} - \text{normal cost}}{\text{crash time} - \text{normal time}}$$

Normal duration
No extra cost

Schedule Compression

Crashing – A CPM Example

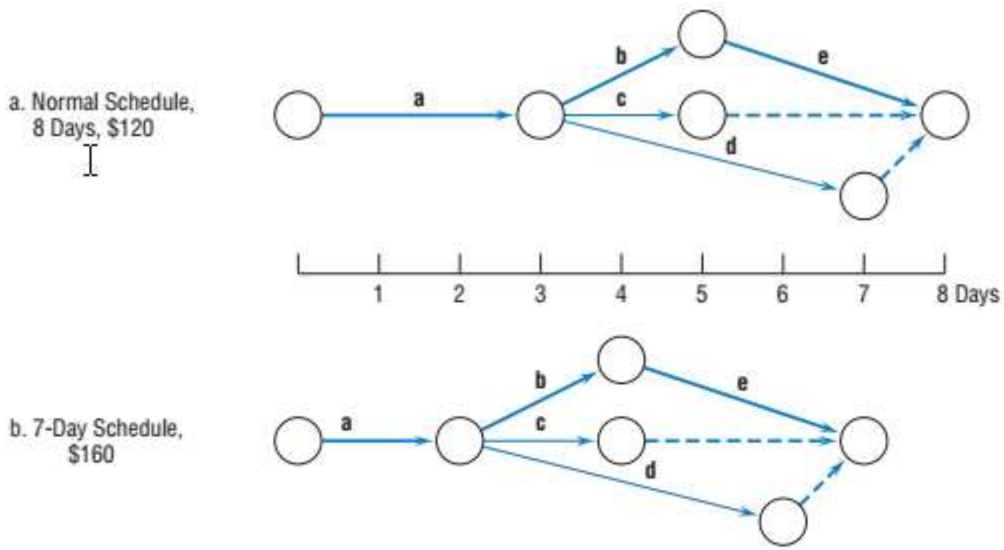
Table 9-1 An Example of Two-Time CPM

Activity	*Precedence*	*Duration, Days (normal, crash)*	*Cost (normal, crash)*
a	—	3, 2	$40, 80
b	a	2, 1	20, 80
c	a	2, 2	20, 20
d*	a	4, 1	30, 120
e**	b	3, 1	10, 80

*Partial crashing allowed
**Partial crashing *not* allowed

Table 9-2 Activity Slopes–Cost per Period for Crashing

Activity	*Slope ($/day)*
a	$40/-1 = -40$
b	$60/-1 = -60$
c	—
d	$90/-3 = -30$
e	-70 (2 days)



Schedule Compression Crashing – CPM Example

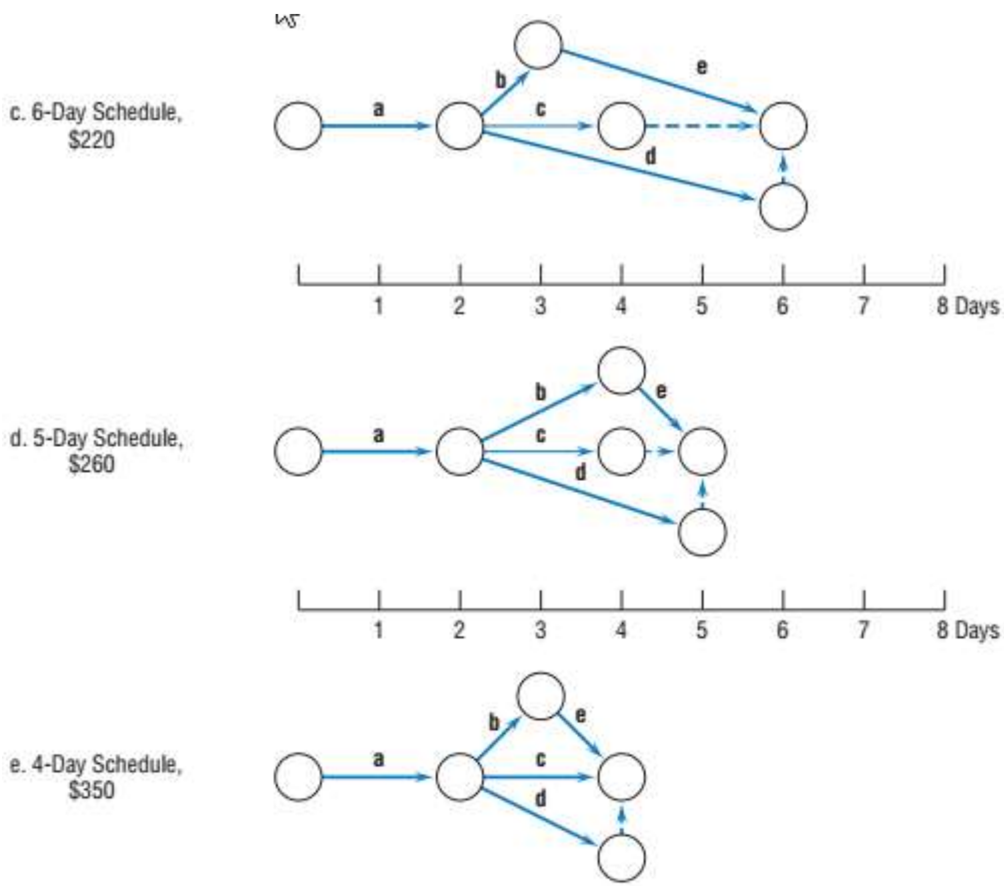


Table 9-2 Activity Slopes–Cost per Period for Crashing

Activity	Slope ($/day)
a	40/−1 = −40
b	60/−1 = −60
c	—
d	90/−3 = −30
e	−70 (2 days)

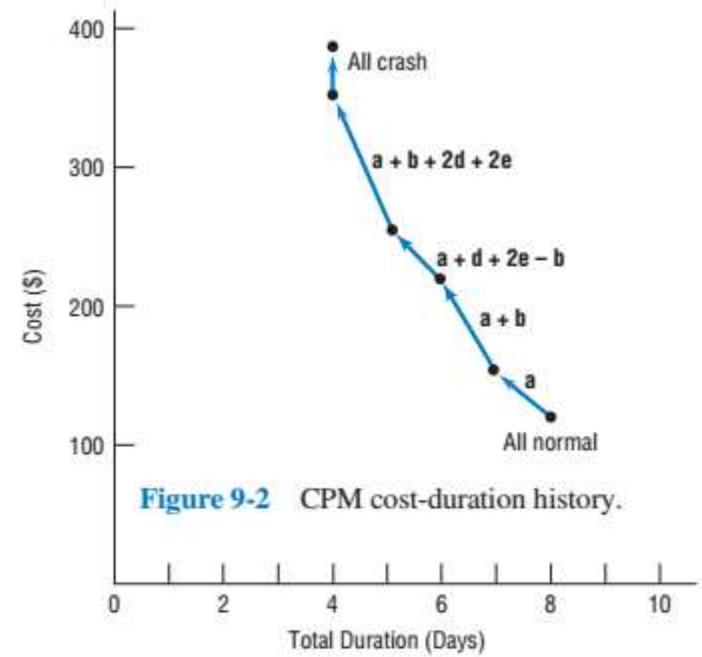
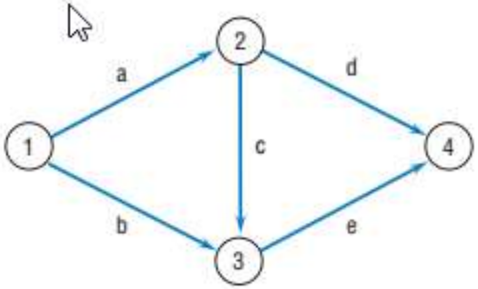


Figure 9-2 CPM cost-duration history.

Schedule Compression
Crashing – A solved problem

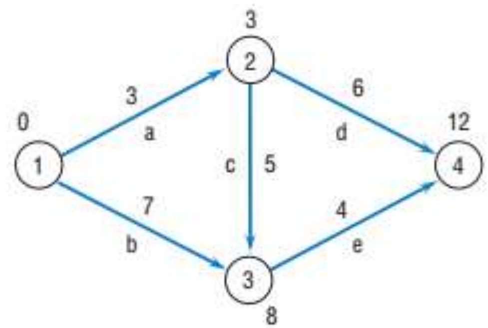
Given the following network (time in days):



Activity	*Crash Time, Cost*	*Normal Time, Cost*	*Partial Crashing?*
a	3, $60	3, $60	No
b	6, 80	7, 30	Yes
c	2, 90	5, 50	No
d	5, 50	6, 30	No
e	2, 100	4, 40	Yes

Find the lowest cost to complete the project in 10 days.

Answer:



Current time and cost: 12 days and $210

Since the critical path is **a-c-e**, we only initially need to consider these three activities:

a: cannot be crashed

c: can cut 3 days at an extra cost of $40 but, due to **b**, only results in project completion by day 11. To reach 10 days, cut **b** by 1 day, total extra cost $90.

e: can cut **e** by 2 days for an extra cost of $60 and results in project completion by day 10.

Thus, cut **e** 2 days at a cost of $60.

Schedule Compression
Fast Tracking

Fast Tracking: A schedule compression technique in which activities or phases normally done in sequence are performed in parallel for at least a portion of their duration.

Notes for CPM again

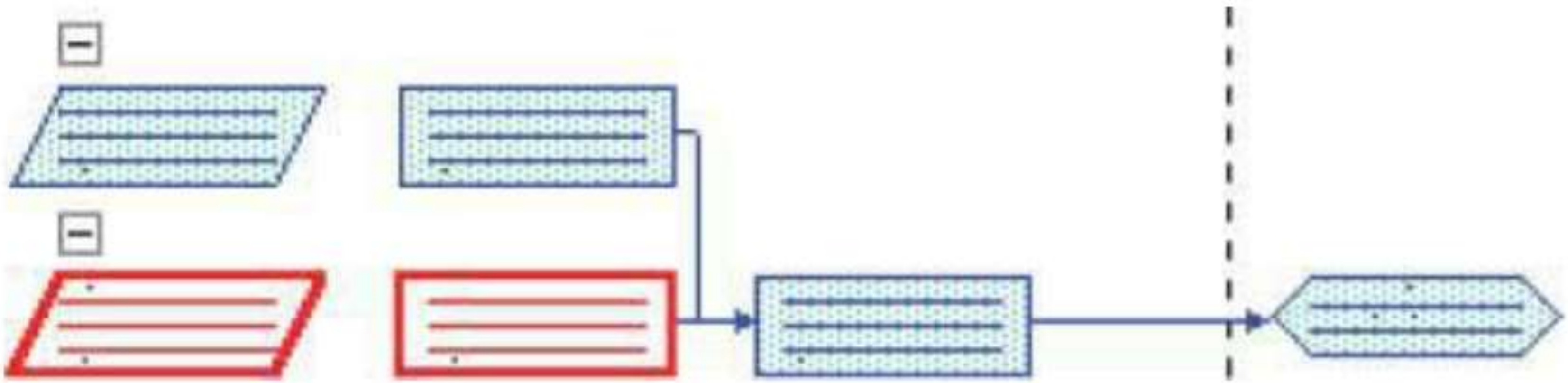
Important Notes about Critical Path Method

- There can be more than one critical paths
- Having several critical paths or having several near critical paths mean project has high risk
- Critical path of the project can change over time
- There can be negative float, it means schedule is behind than the planned
- If there is negative float, you should compress the schedule.
- If you need to cut an activity duration in critical path, cut the earlier activity's duration

Understanding Network Diagram

For your projects

- Summary tasks are trapezoidal – 
- Detail tasks are rectangular – 
- The Milestone Task is an elongated diamond – 



- Summary tasks are positioned to the left at the same level or above detail tasks.
- Summary tasks may be rolled up by clicking on the ⊟ above the task and expanded by clicking on the ⊞ above a rolled up summary task.

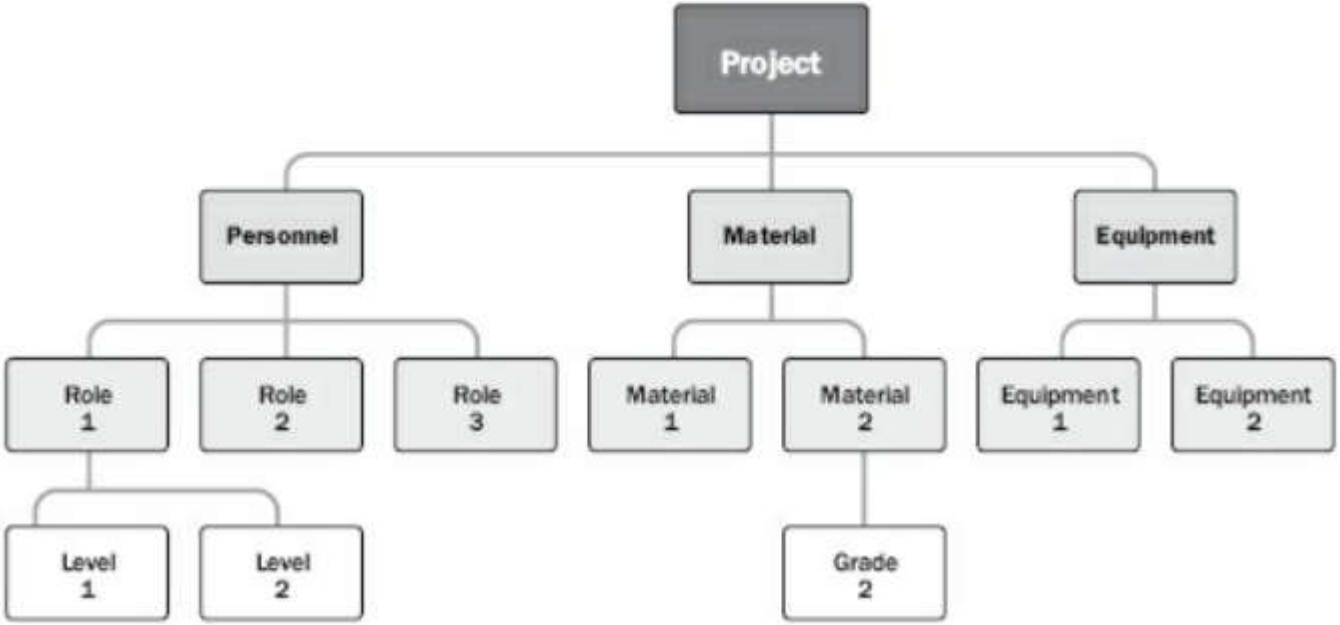
Creating Resources for your project

- A shortcoming of the scheduling procedures covered in the previous chapter is that they do not address the issues of resource utilization and availability.
  - The focus is on time rather than physical resources.
  - Also, in the discussion that follows it will not be sufficient to refer to resource usage simply as “costs”.
  - Instead, we must refer to
    - individual types of labor,
    - specific facilities,
    - kinds of materials,
    - individual pieces of equipment,
    - other discrete inputs that are relevant to an individual project but are limited in availability.

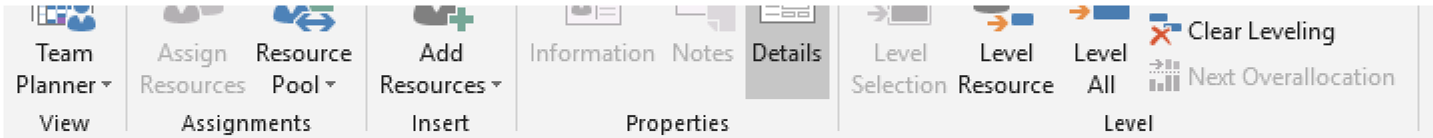
Resource Allocation Problem

- Resources used as Input Resources – Those that are required to complete the work:
  - Individual people by name.
  - Groups of people by trade or skill.
  - Individual equipment or machinery by name.
  - Groups of resources such as Crews or Teams made up of equipment and machinery.
  - Materials or Money.

Resource Breakdown Structure



Creating Resources
for your project

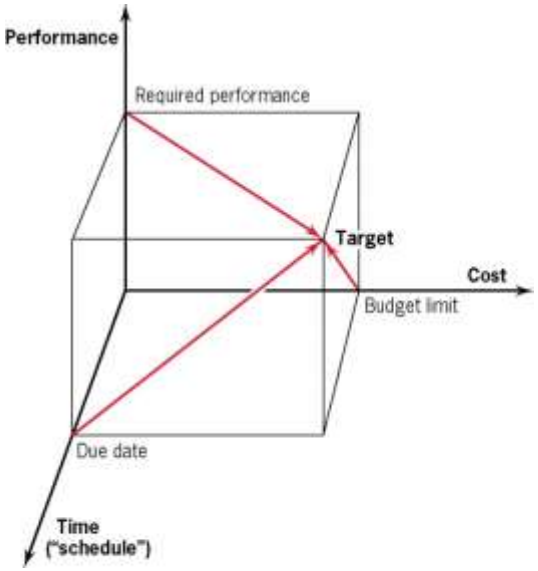


		Resource Name	Type	Material	Initials	Group	Max. Units	Std. Rate	Ovt. Rate
		Group: No Value							
7		Report Binding	Material	Each	RB			$100.00	
		Group: Contractor				**Contrac**			
6		Specialist Consultan	Cost		SC	Contractc			
		Group: Office				**Office**	**400%**		
1		Project Manager	Work		PM	Office	100%	$120.00/h	$0.00
2		Systems Engineer	Work		SE	Office	100%	$90.00/h	$0.00
4		Purchasing Officer	Work		PO	Office	100%	$70.00/h	$0.00
5		Clerical Support	Work		CS	Office	100%	$50.00/h	$0.00
		Group: Site				**Site**	**100%**		
3		Project Support	Work		PS	Site	100%	$80.00/h	$0.00

ESOURCE SHEET

Resource Allocation

One cannot save time—one can only spend more or less of it.



- The PM should be able to do trade offs between TCP
- Otherwise, if TCP are fixed means
  the **project is overdetermined**

A system-constrained task requires a fixed amount of time and known quantities of resources.
Ex : The material "cook-time" is fixed. No trade-offs are possible.
Required resources should be available when needed.

Resource Loading

Assign Resources
To WBS

Career Day Project
Resource Usage Calendar

ID	Resource Name	Work		May				June				July			
			25	2	9	16	23	30	6	13	20	27	4	11	18	25
1	**Secretary**	**1,020 hrs**	24h	40h	40h	40h	88h	120h	102h	40h	40h	40h	40h	40h	40h	40h
	Print forms	240 hrs														
	Gather college particulars	160 hrs	24h	40h	40h	40h	16h									
	Print programs	240 hrs					24h	40h	40h	40h	40h	40h	16h			
	Advertise in college paper	200 hrs					24h	40h	36h	0h	0h	0h	24h	40h	36h	
	Organize posters	180 hrs					24h	40h	26h	0h	0h	0h	0h	0h	4h	40h
2	**Program Manager**	**1,440 hrs**	40h	40h	40h	16h	24h	40h	40h	40h	16h					
	Contact organizations	600 hrs	16h													
	Select guest speaker	560 hrs														
	Organize food	120 hrs	24h	40h	40h	16h										
	Contact faculty	60 hrs					24h	36h								
	Arrange facility for event	100 hrs						4h	40h	40h	16h					
3	**Office Manager**	**180 hrs**	24h	40h	40h	40h	16h				20h					
	Collect display information	160 hrs	24h	40h	40h	40h	16h									
	Transport materials	20 hrs									20h					
4	**Graduate Assistant**	**1,140 hrs**	24h	40h	40h	40h	64h	80h	80h	56h	40h	40h	16h			
	Print participants' certificates	320 hrs														
	Organize refreshments	280 hrs	24h	40h	40h	40h	40h	40h	40h	16h						
	Send invitations	80 hrs														
	Organize gift certificates	220 hrs														
	Arrange banner	200 hrs					24h	40h	40h	40h	40h	16h				
	Class announcements	40 hrs										24h	16h			
5	**Director**	**400 hrs**	24h	40h	40h	40h	40h	40h	40h	40h	40h	40h	16h			
	Organize liquor	400 hrs	24h	40h	40h	40h	40h	40h	40h	40h	40h	40h	16h			

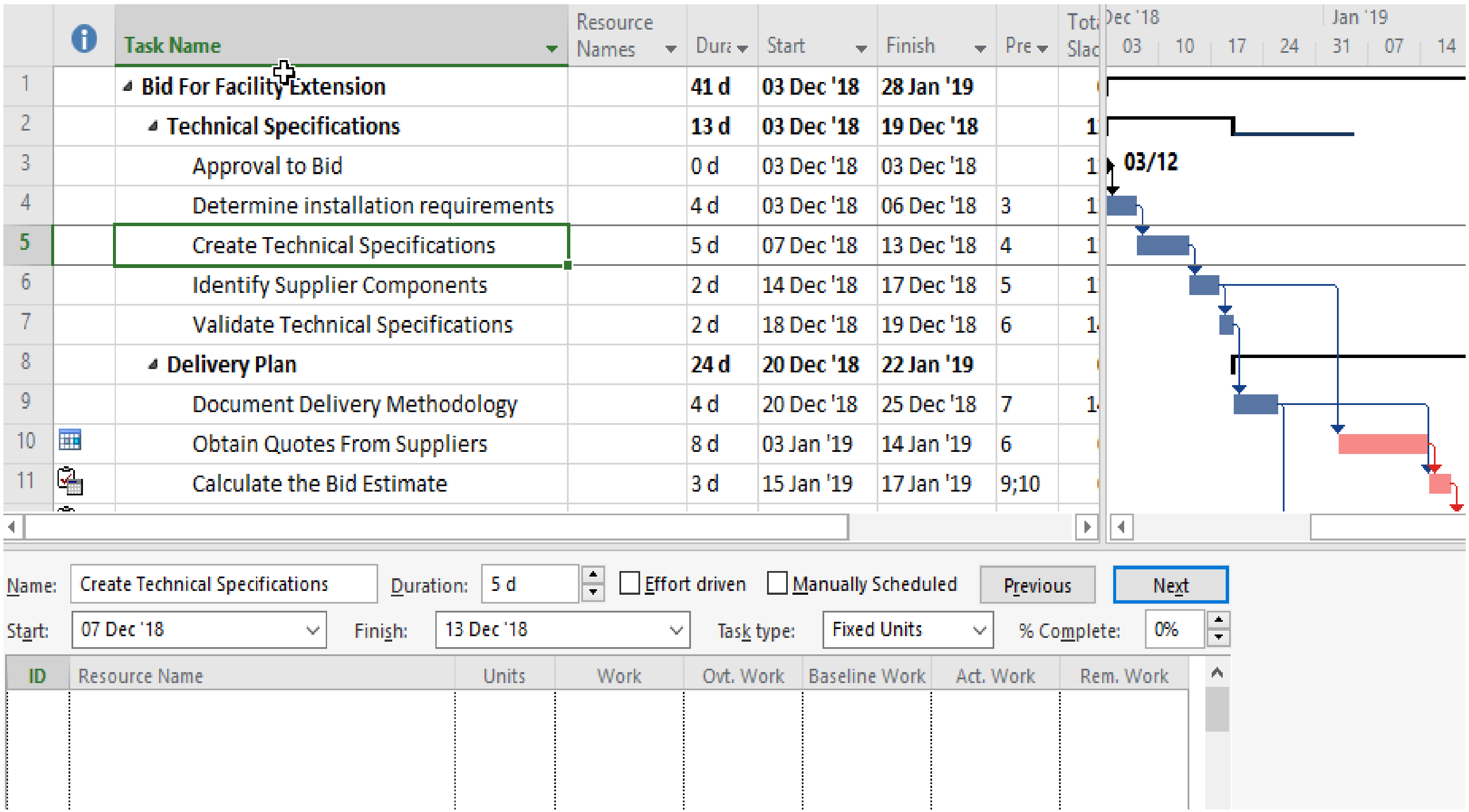
RACI Chart
Responsible – Accountable – Consult – Inform

RACI Chart	Person				
Activity	Ann	Ben	Carlos	Dina	Ed
Create charter	A	R	I	I	I
Collect requirements	I	A	R	C	C
Submit change request	I	A	R	R	C
Develop test plan	A	C	I	I	R

R = Responsible A = Accountable C = Consult I = Inform

Figure 9-4. Sample RACI Chart

Resource Loading
in MS-Project



	Task Name	Resource Names	Dura	Start	Finish	Pre	Tota Slac
1	**Bid For Facility Extension**		**41 d**	**03 Dec '18**	**28 Jan '19**		
2	**Technical Specifications**		**13 d**	**03 Dec '18**	**19 Dec '18**		1
3	Approval to Bid		0 d	03 Dec '18	03 Dec '18		1
4	Determine installation requirements		4 d	03 Dec '18	06 Dec '18	3	1
5	Create Technical Specifications		5 d	07 Dec '18	13 Dec '18	4	1
6	Identify Supplier Components		2 d	14 Dec '18	17 Dec '18	5	1
7	Validate Technical Specifications		2 d	18 Dec '18	19 Dec '18	6	1
8	**Delivery Plan**		**24 d**	**20 Dec '18**	**22 Jan '19**		
9	Document Delivery Methodology		4 d	20 Dec '18	25 Dec '18	7	1
10	Obtain Quotes From Suppliers		8 d	03 Jan '19	14 Jan '19	6	
11	Calculate the Bid Estimate		3 d	15 Jan '19	17 Jan '19	9;10	

Name: Create Technical Specifications | Duration: 5 d | Effort driven | Manually Scheduled | Previous | Next

Start: 07 Dec '18 | Finish: 13 Dec '18 | Task type: Fixed Units | % Complete: 0%

ID	Resource Name	Units	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work

Resource Loading in AoA

Table 8-2 Expected Activity Times (TE), Variances (σ^2), and Standard Deviations (σ)

Activity	*Expected Time, TE*	*Variance, σ^2*	*Standard Deviation, σ*
a	20	4	2
b	20	0	0
c	10	4	2
d	15	25	5
e	10	4	2
f	14	4	2
g	4	0	0
h	11	5.4	2.32
i	18	28.4	5.33
j	8	4	2

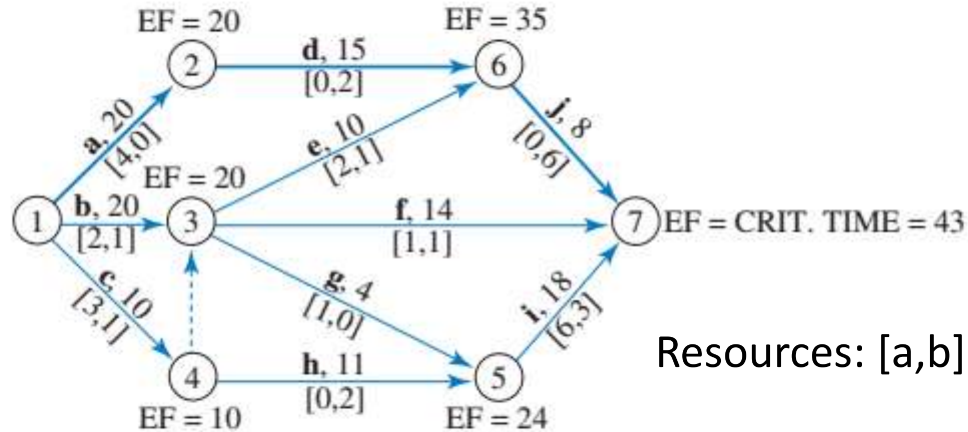
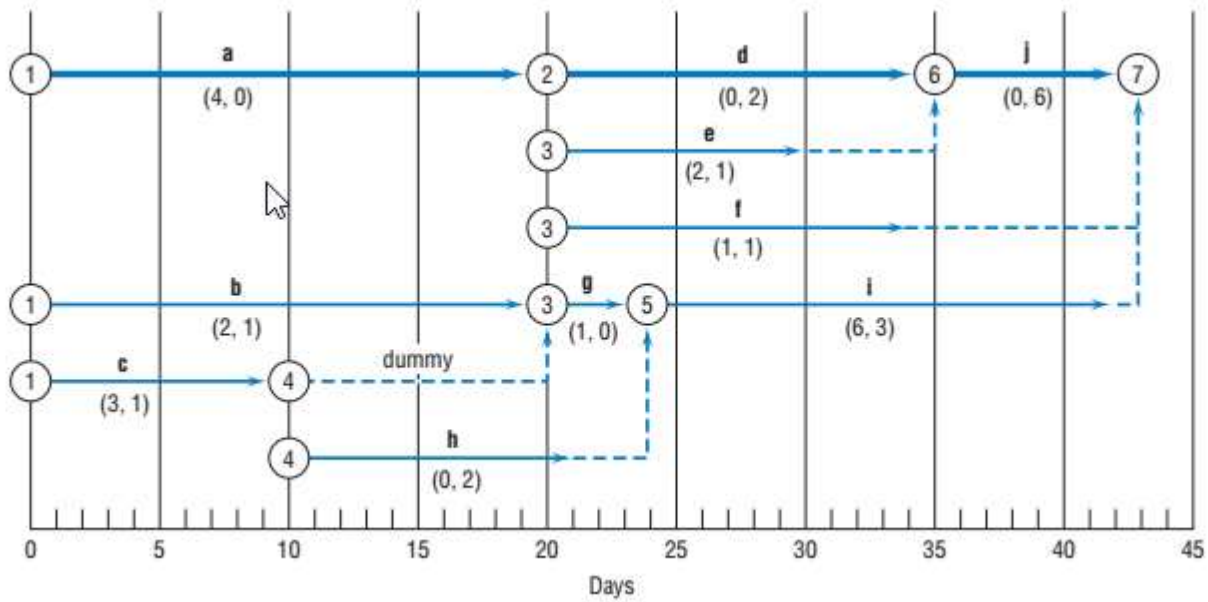


Figure 9-4 The AOA network of Table 8-2.

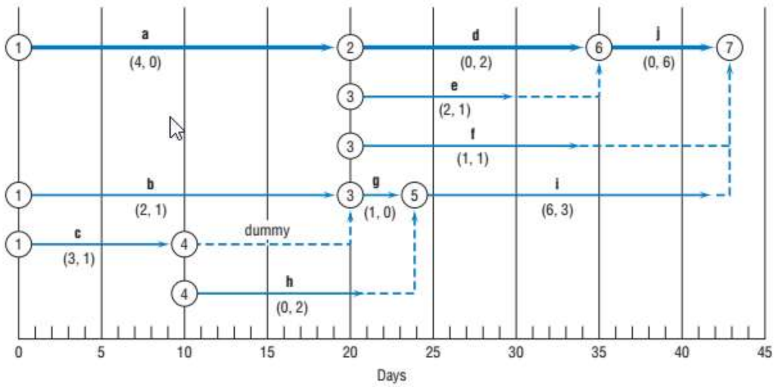
Resources: [a,b]

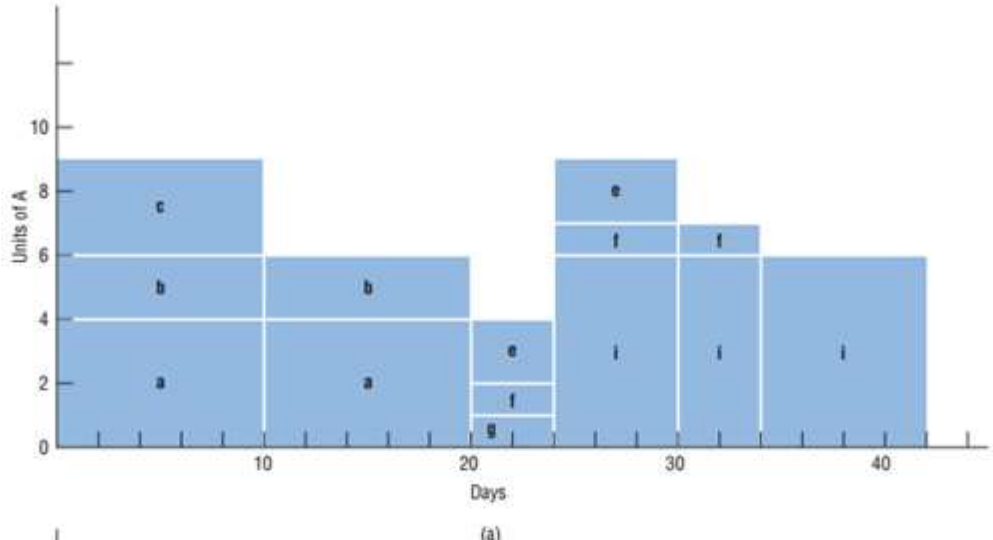
Modified AoA

Resources: (a, b)

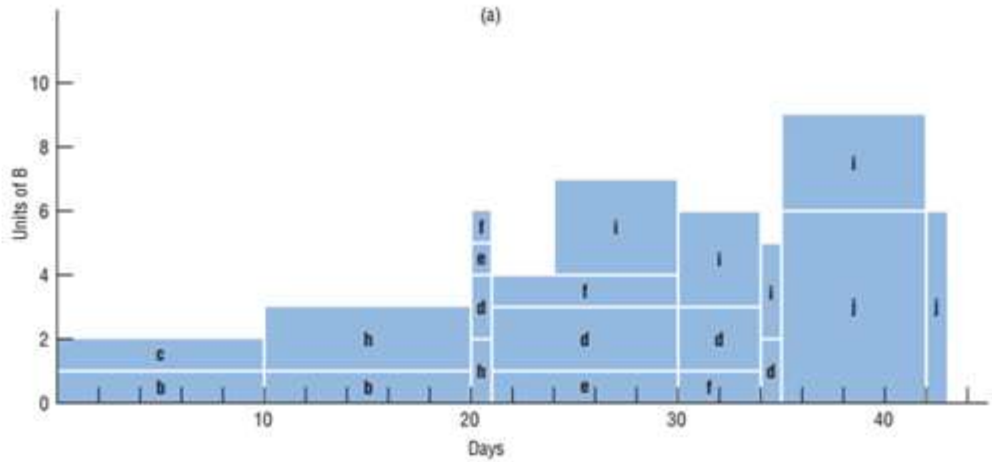


Resource Leveling





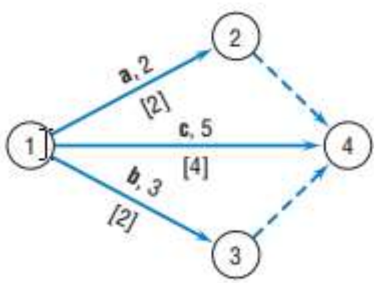
Try to level over time
Meaning smother usage



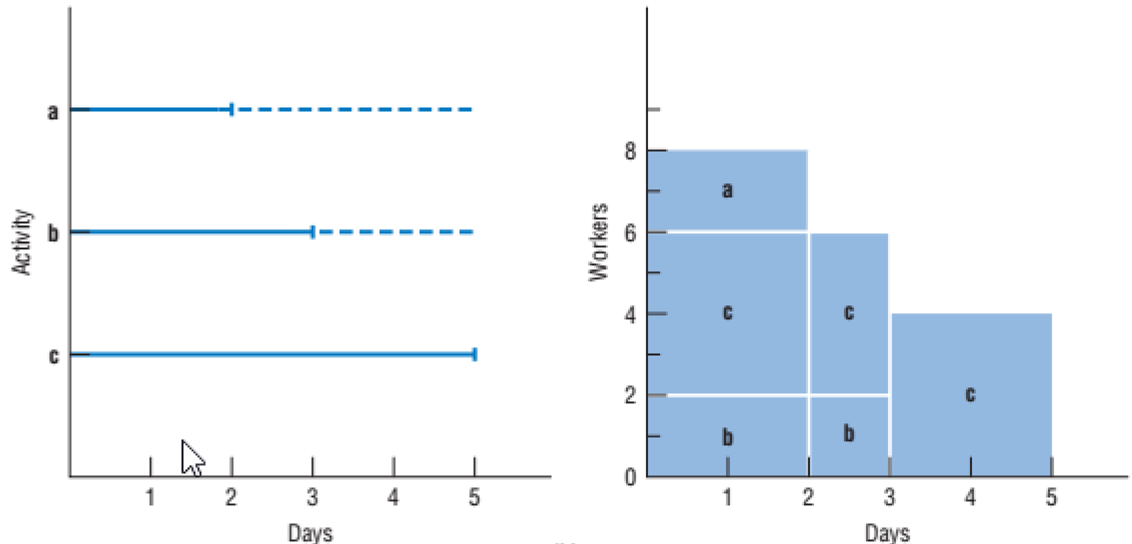
What are the advantages of
Smooth resource usage:

Resource Leveling example

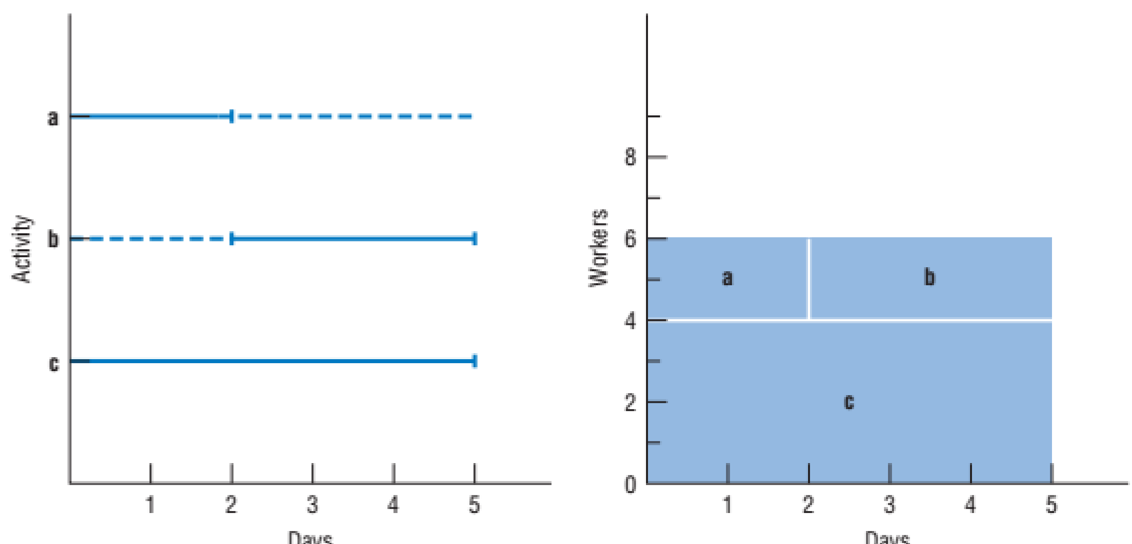
One resource
Road workers



(a)



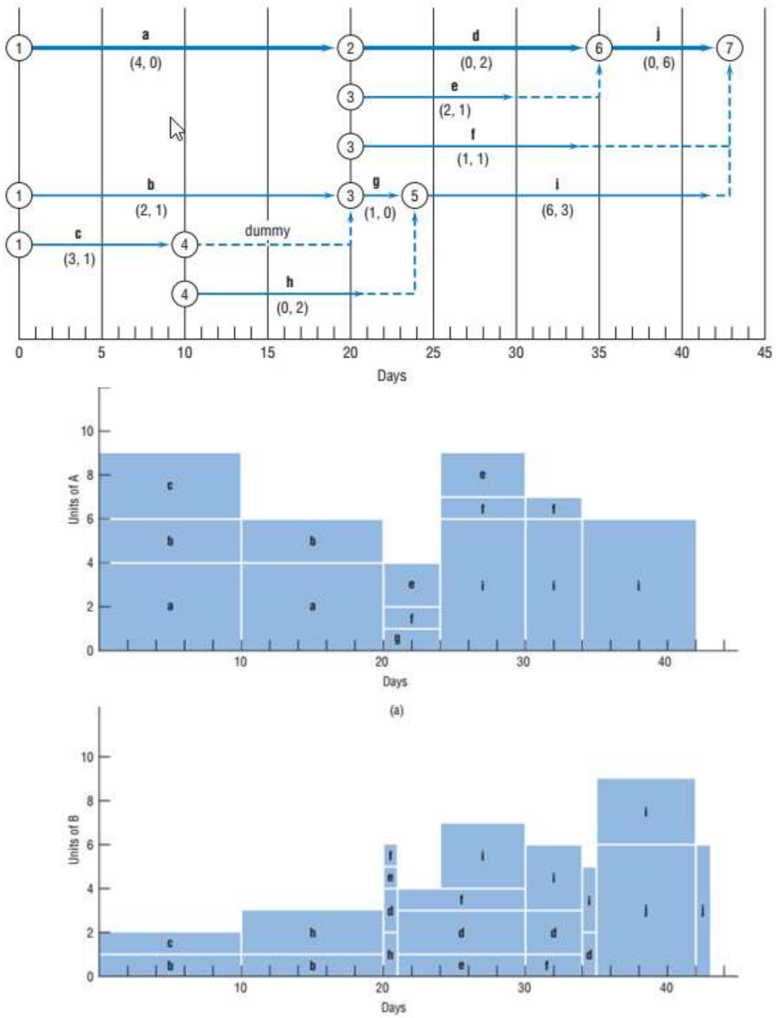
(b)



(c)

Meredith

Resource Leveling example



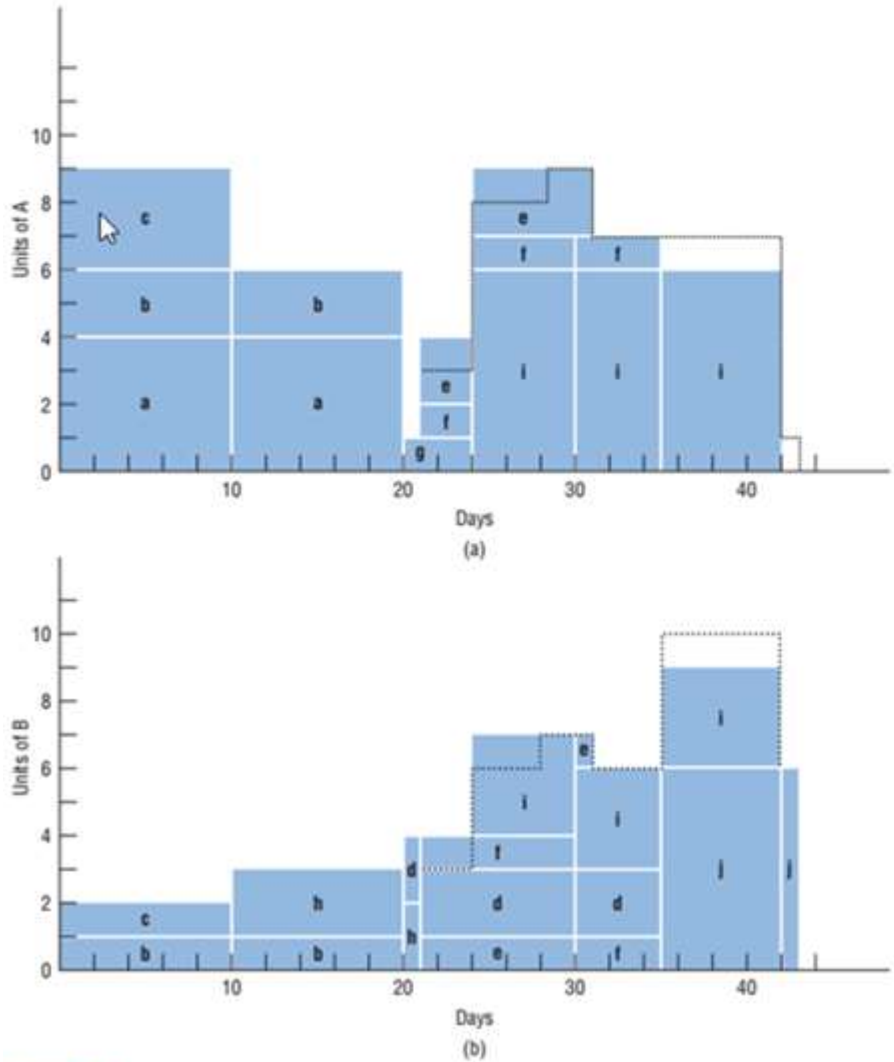


Figure 9-8 (a) Load diagram for resource A with activities e and f delayed by 1 day each. (b) Load diagram for resource B with activities e and f delayed by 1 day each.

Resource Loading/Leveling Uncertainty

PM should use its operational abilities against uncertainties

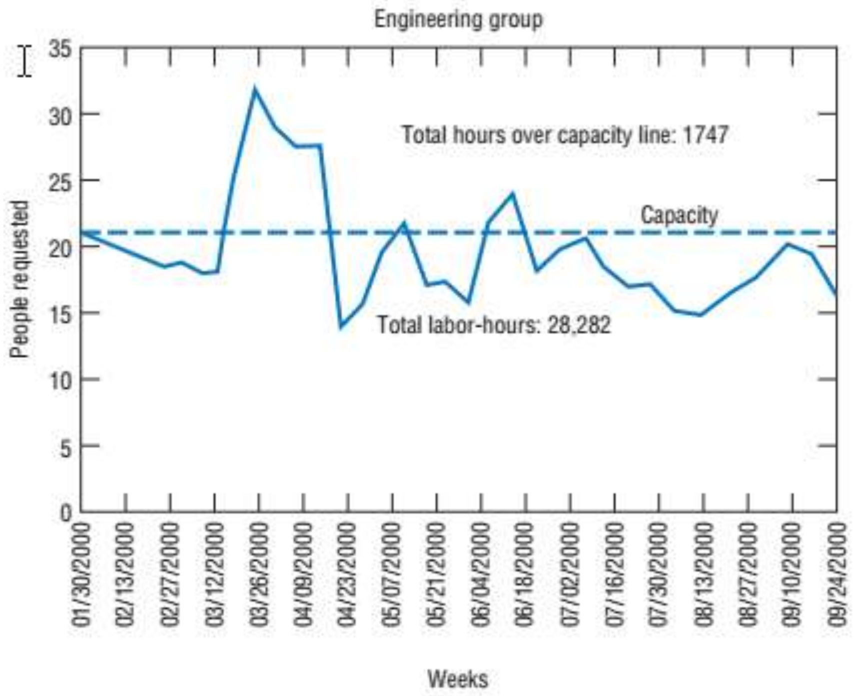


Figure 9-9 Thirty-four-week resource logging chart for a software engineering group.

Constrained Resource Scheduling

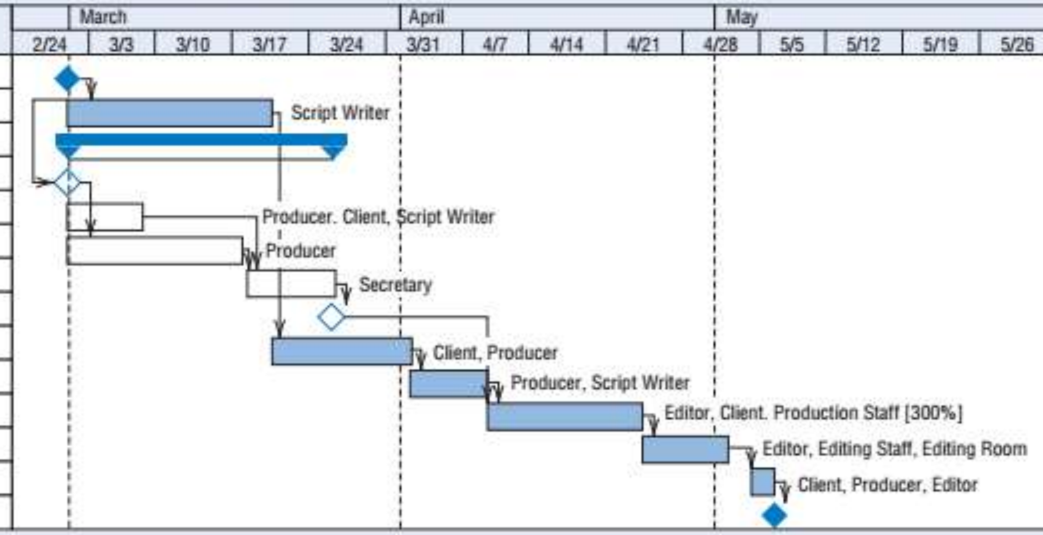
- Heuristic methods
  - Most suitable for large, complex, real life projects
    - Shift some activities according to some rules
      - Minimum slack first gives best result usually
- Optimization models

Heuristic Methods

Only feasible method for large and complex problems of the Real World

Producing a Video

WBS	Task Name	Duration	Start	Finish
1	**Project approval**	0 days	03/01	03/01
2	**Script writing**	14 days	03/01	03/20
3	Schedule shoots	17 days	03/01	03/25
3.1	Begin scheduling	0 days	03/01	03/01
3.2	Propose shoots	5 days	03/01	03/07
3.3	Hire secretary	12 days	03/01	03/18
3.4	Schedule shoots	5 days	03/19	03/25
3.5	Scheduling complete	0 days	03/25	03/25
4	**Script approval**	8 days	03/21	04/01
5	**Revise script**	5 days	04/02	04/08
6	**Shooting**	10 days	04/09	04/22
7	**Editing**	7 days	04/23	05/01
8	**Final approval**	2 days	05/02	05/03
9	**Deliver video to client**	0 days	05/03	05/03



Project: Producing a Video
Project Manager: S. Spielberg
Start Date: 03/01

Critical Task — Noncritical Task — Critical Milestone — Noncritical Milestone — Summary

Critical Tasks Highlighted

Figure 9-10 MSP Gantt chart of video project showing resource needs.

Heuristic Methods

MS-Project can handle the problem. Result may not be optimal but quite good.

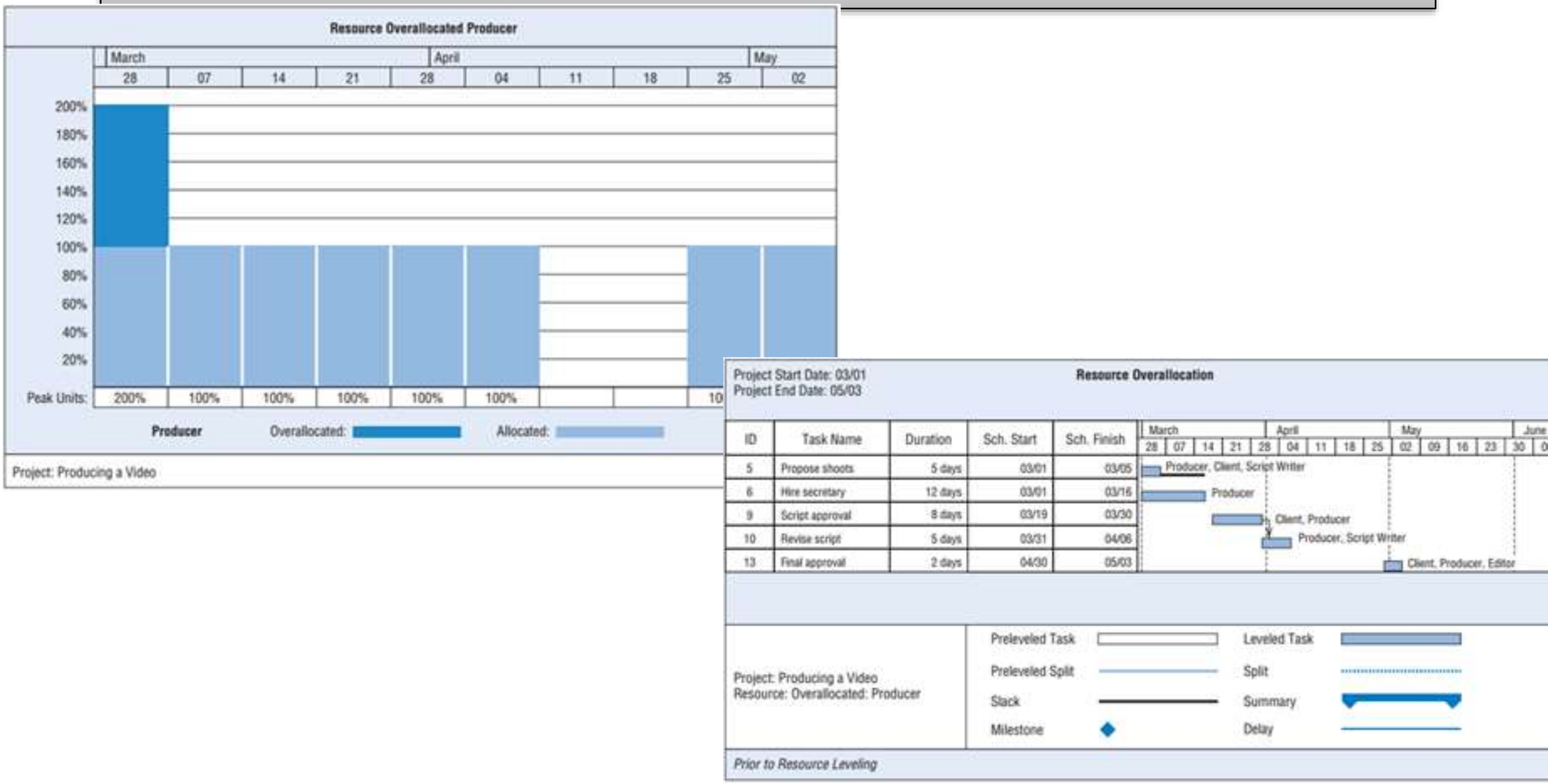


Figure 9-11 MSP load diagram showing resource conflict (producer used beyond capacity).

Heuristic Methods

MS-Project can handle the problem. Result may not be optimal but quite good.

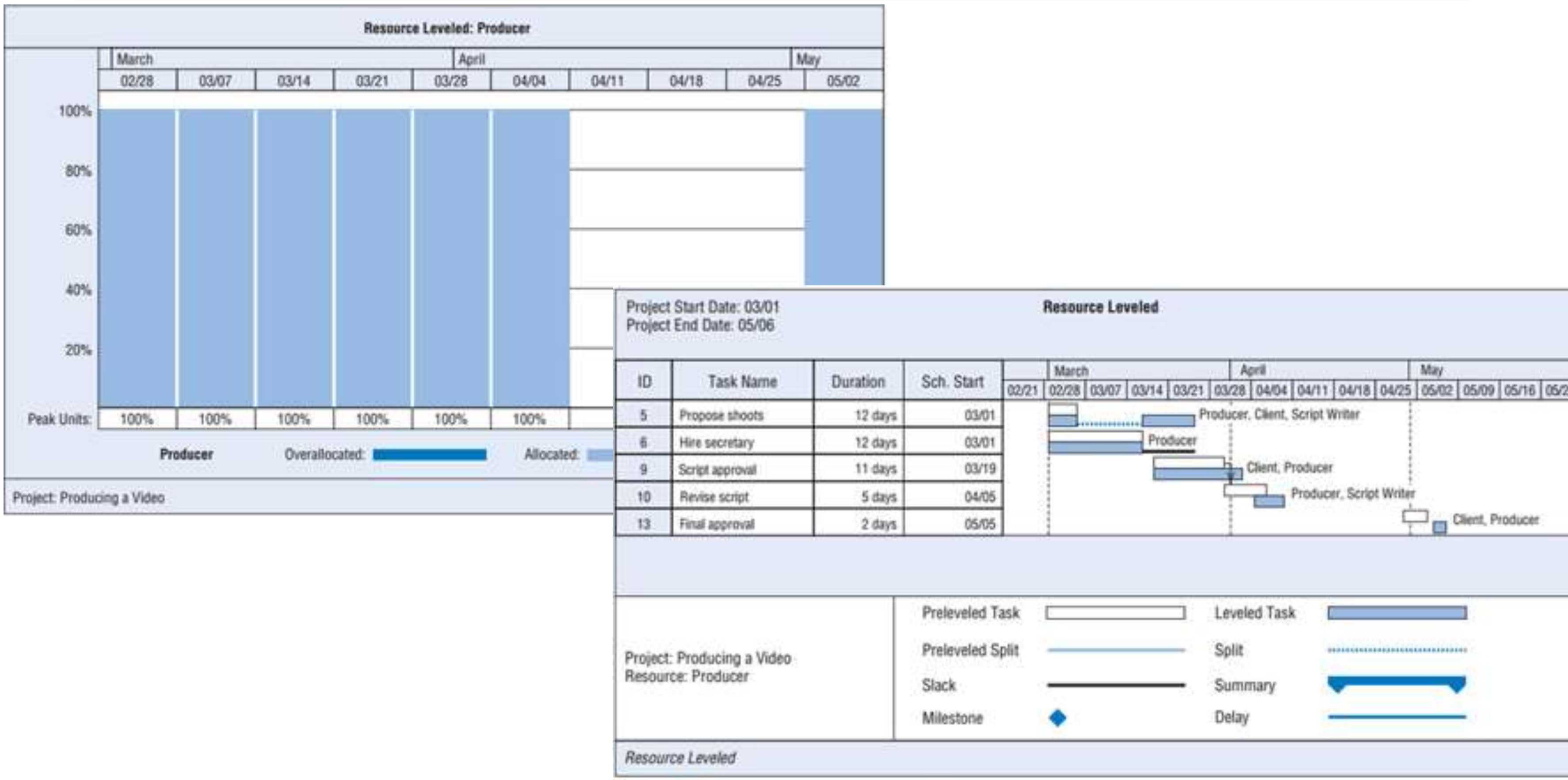


Figure 9-12 MSP rescheduling to level producer resource usage without exceeding capacity.

Priority rules for Heuristic

PM may apply simulation test. If a significant improvement is not the outcome then your first heuristic approach is good for the PM.

- As soon as possible – Default for MS-Project.
- As late as possible – Use slacks to defer payments.
- Shortest task first – Maximizes number of tasks that can be completed.
- Most resources first – Assumes most important tasks use highest resources.
- Minimum slack first – Reduces risk on project duration.

  Gives best result usually.
- Most critical followers – Reduces risk of the PM.
- Most successors – Similar to previous but not only for the critical path.
- Arbitrary – No rule at all. According to the ideas of stakeholders or the boss.

Optimization Models

There were lots of attacks since 1970ies.
Do not create better results in most practical cases against Heuristic yet.

- Linear programming
- Programming and Enumeration techniques

Multi project approach

Then you may shift resources between projects.

Also you may decompose one big project task into smaller and manageable ones.
And you may shift resources between.
It is an optimization too.
Dividing too much may cause increase in managerial and other costs.

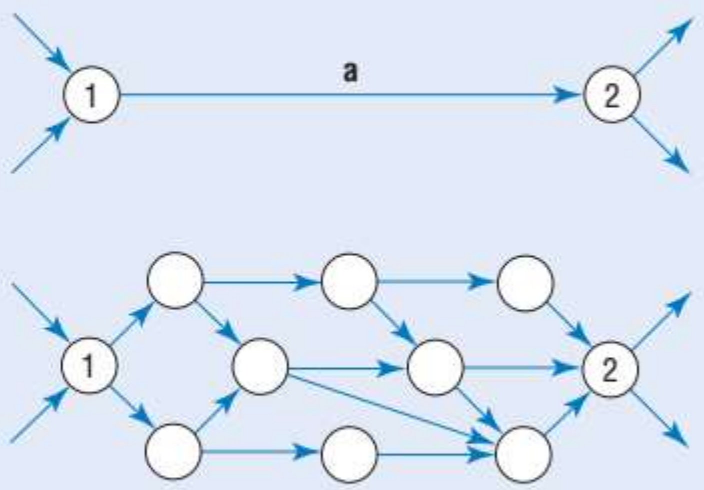


Figure 9-13 Task **a** decomposed into a network of subtasks.

Dividing projects into sub-projects

How much to decompose is an optimization too and needs Expert Judgement.

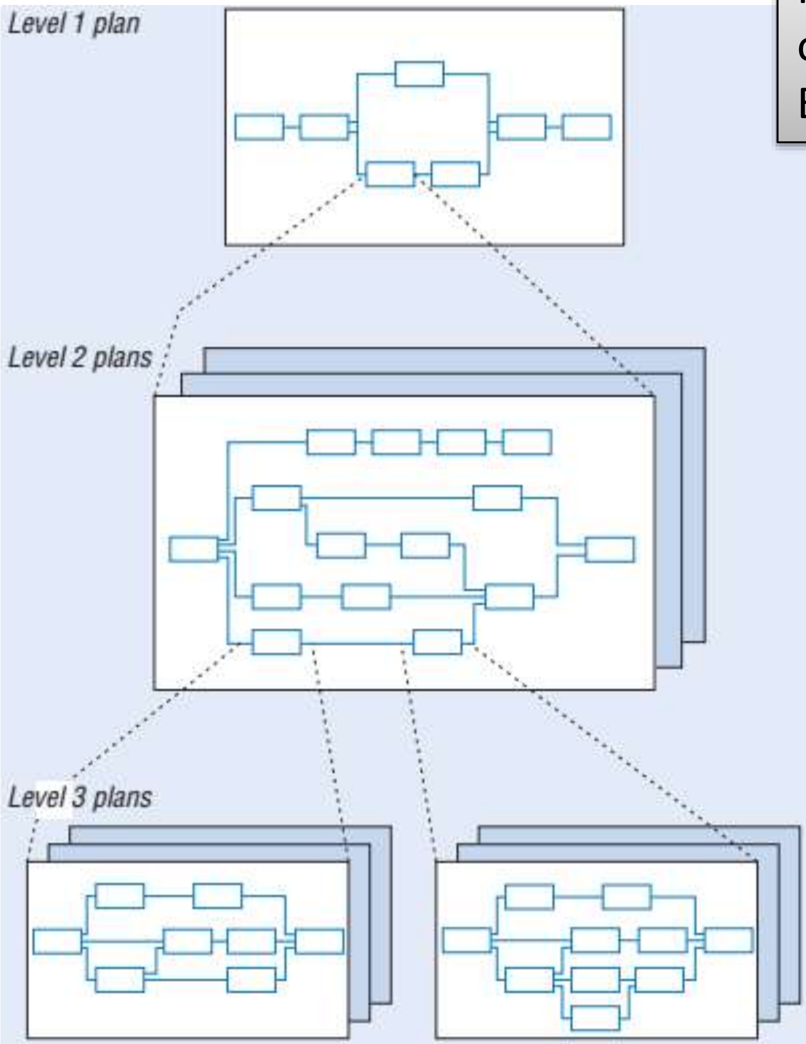


Figure 9-14 Hierarchy of Gantt charts. *Source*: F. L. Harrison (1983). *Advanced Project Management*. Hants, U.K.: Gower.

Project Planning Completed

Next is Execution

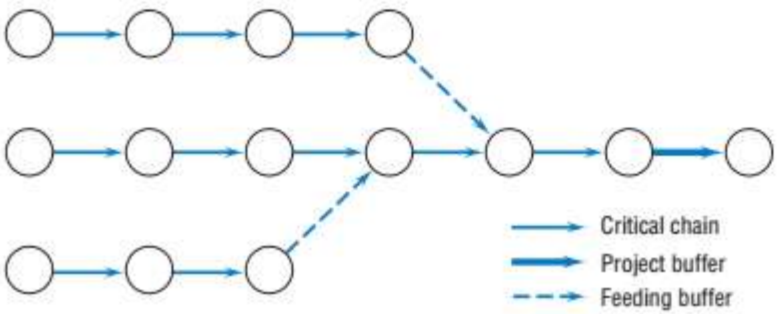


Figure 9-18 Project and feeder buffers.

- Be aware of human complex psychology and try to be a leader not manager.
- Keep buffer high if you meet complexity. (And do not tell to any body)
- Use motivation factors high if you are able.
  (Use anything to motivate, never punish with salary cut)
- Keep it simple to be able to manage
  Do not bother your team with complexity
  (which makes them afraid and working less).
- Share the success with visible numbers.
- Try to use tools to manage projects,
  but do not advertise before feeling the comfort and success with them.

Resource Management Overview

Figure 9-1. Project Resource Management Overview

The Last Workshop

Do not forget to complete the last workshop – 5 Pts.

Problems – Ch 9

4. Given the following highway rerouting project,

Activity	***Immediate Predecessor***	***Activity Time (months)***
A: Schedule crew	—	4
B: Schedule equipment	—	6
C: Plan new route	A	2
D: Costs meet budget?	B	6
E: Inform public	C, B	3
F: Put out signs	C, B	3
G: Begin rerouting	D, E	5

(a) Draw the network.

(b) Find the ESs, LSs, and slacks.

(c) Find the critical path.

(d) If the project has a 1 1/2-year deadline for reopening, should we consider crashing some activities? Explain.

6. Consider the following activity information and the constraint that the project must be completed in 16 weeks.

Activity	***Prec. Evt.***	***Suc. Evt.***	***TE (weeks)***	***Prec. Activ.***
a	1	2	3	none
b	1	3	6	none
c	1	4	8	none
d	2	5	7	a
e	3	5	5	b
f	4	5	10	c
g	4	6	4	c
h	5	7	5	d,e,f
i	6	7	6	g

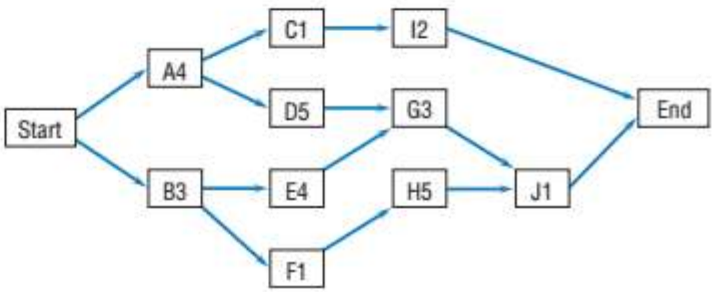
In addition, activities **c, f, h**, and **i** may be crashed as follows. Assume partial crashing.

Activity	***Crash Time (weeks)***	***Additional Cost per Week***
c	7	$40
f	6	20
h	2	10
I	3	30

Find the best schedule and its cost

Problems – Ch 9

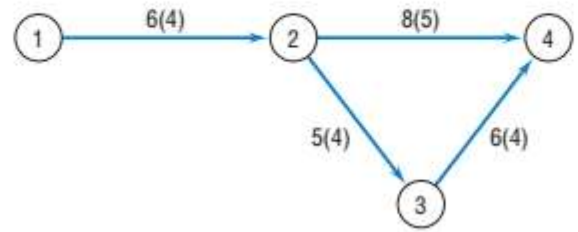
9. Consider the project network below. Suppose the duration of both activities **A** and **D** can be reduced to one day, at a cost of $15 per day of reduction. Also, activities **E**, **G**, and **H** can be reduced in duration by one day at a cost of $25 per day of reduction. What is the least-cost approach to crash the project two days? What is the shortest "crashed" duration, the new critical path, and the cost of crashing?



Task Code Duration

10. Given a network for an HR training project with normal times and crash times (in parentheses), find the cost-duration history. Assume indirect costs for facilities and equipment are $100 per day. The data are:

Activity	Time Reduction, Direct Cost per Day
1–2: Obtain room	$30 first, $50 second
2–3: Select trainer	$80
3–4: Invite personnel	$25 first, $60 second
2–4: Check budget	$30 first, $70 second, $90 third



12. The network for shooting a TV commercial as shown in the table has a fixed cost of $90 per day, but money can be saved by shortening the project duration. Find the least-cost schedule.

Activity	Normal Time	Crash Time	Cost Increase (1st, 2nd, 3rd day)
1–2: Contract personnel	7	4	$30, 50, 70
2–3: Obtain stage props	9	6	40, 45, 65
1–3: Rent equipment	12	10	60, 60
2–4: Contract studio	11	9	35, 60
3–4: Set time and date	3	3	—

Problems – Ch 9

13. Given the following project to landscape a new building site,

Activity	***Immediate Predecessor***	***Activity Duration (days)***	***Resource Used***
A: Get plants	—	2	X, Y
B: Get flowers	A	2	X
C: Obtain soil	A	3	X
D: Obtain fertilizer	B, C	4	X, Y
E: Select labor	D	3	W, X
F: Set date	D	1	W, X, Y
G: Begin	E, F	2	X, Y

(a) Draw a Gantt chart using MSP.

(b) Find the critical path and project duration in days.

(c) Given that each resource is assigned 100 percent to each task, identify the resource constraints.

(d) Level the resources and determine the new project duration and critical path.

(e) Identify what alternative solutions can be used to shorten the project duration and not over-allocate the resources.

15. Given the following project (all times are in days):

Activity	***Pre-decessor***	***Normal Time***	***Normal Cost***	***Crash Time***	***Crash Cost***
a	—	5	$50	3	$150
b	—	4	40	2	200
c	b	7	70	6	160
d	a, c	2	20	1	50
e	a, c	3	30	—	—
f	b	8	80	5	290
g	d	5	50	4	100
h	e, f	6	60	3	180

(a) Draw the network and find the critical path, time, and cost for an all-normal level of project activity.

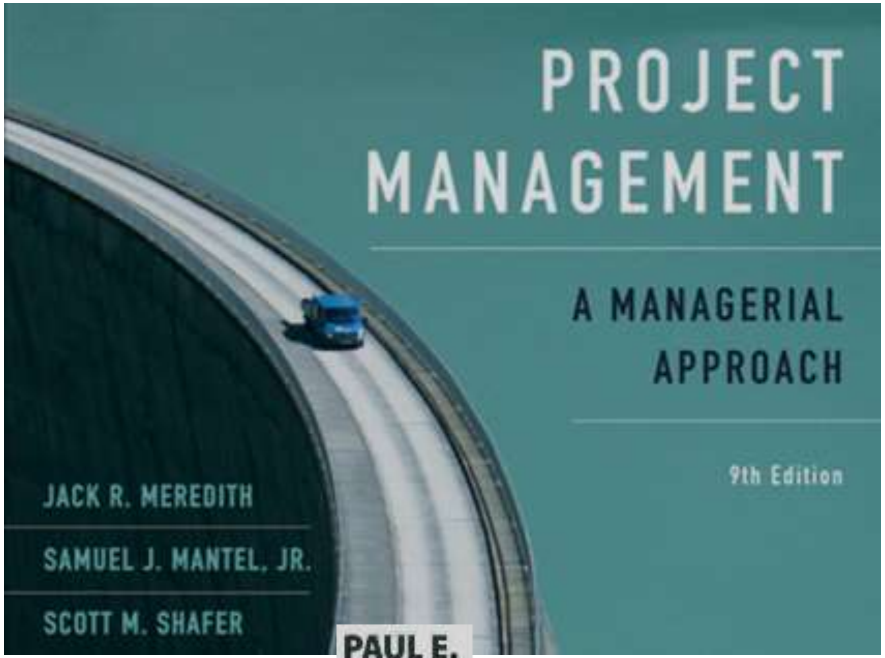
(b) Calculate the crash cost-per-day (all activities may be partially crashed).

(c) Find the optimal way of getting an 18-day delivery time. What is the project cost?

(d) Find the optimal way of getting a 16-day delivery time. What is the project cost?

(e) Calculate the shortest delivery time for the project. What is the cost?

Resources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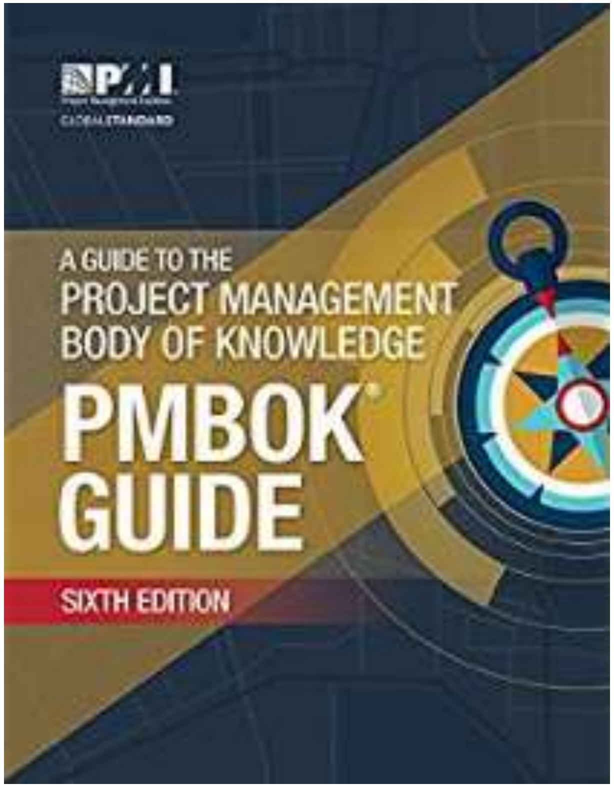
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Questions

- Questions

hp@quiztechnology.com

NEXT WEEK: Project Execution – Monitoring and Control

ENGR 3450
Project Scheduling

CRASHING
(TIME-COST TRADE-OFF)

AGENDA Today

- Crash Time and Cost
  - Computing crash data
- Minimum Cost schedule
- Minimum Time Schedule

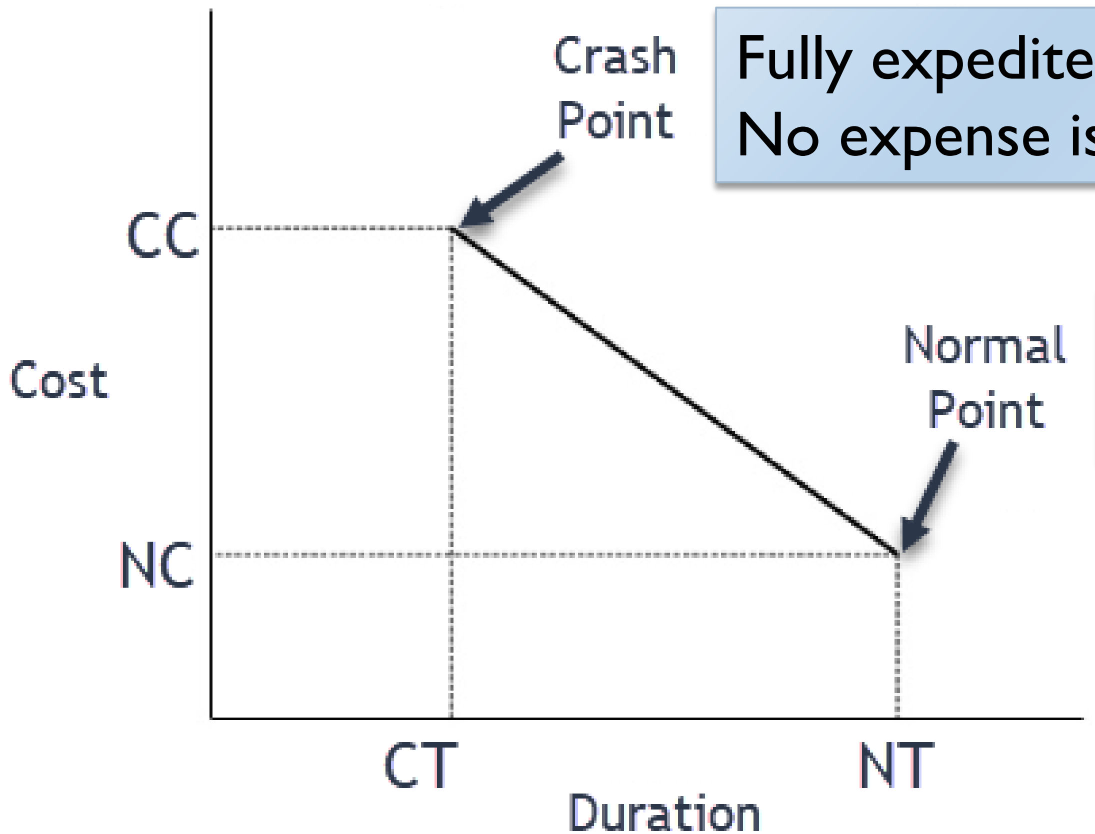
CRASHING

- When we say that an activity will take a certain number of days or weeks, what we really mean is: this activity takes **normally** that many days or weeks.

- We could make it take less time
  - but it would cost more money (resources).

- To spend more money so as to get something done more quickly is called "crashing" the activity.

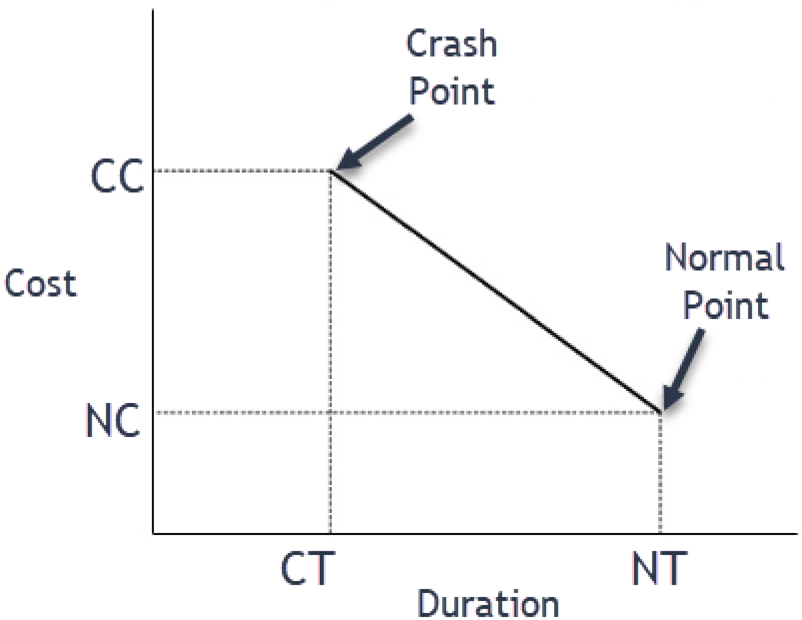
Time – Cost trade offs for crashing activities



Fully expedited
No expense is spared

Normal duration
No extra cost

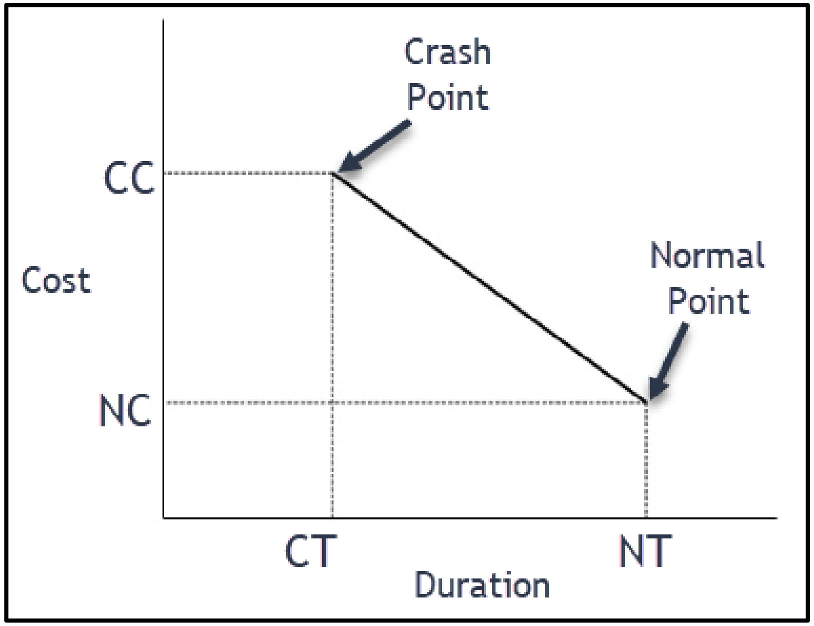
Time – Cost trade offs for crashing activities



- NT = normal time to complete an activity
- NC = normal cost to complete an activity
- CT = crash time to complete an activity, that is, the shortest possible time it could be completed in.
- CC = crash cost = the cost to complete the activity if it is performed in its shortest possible time (CT).

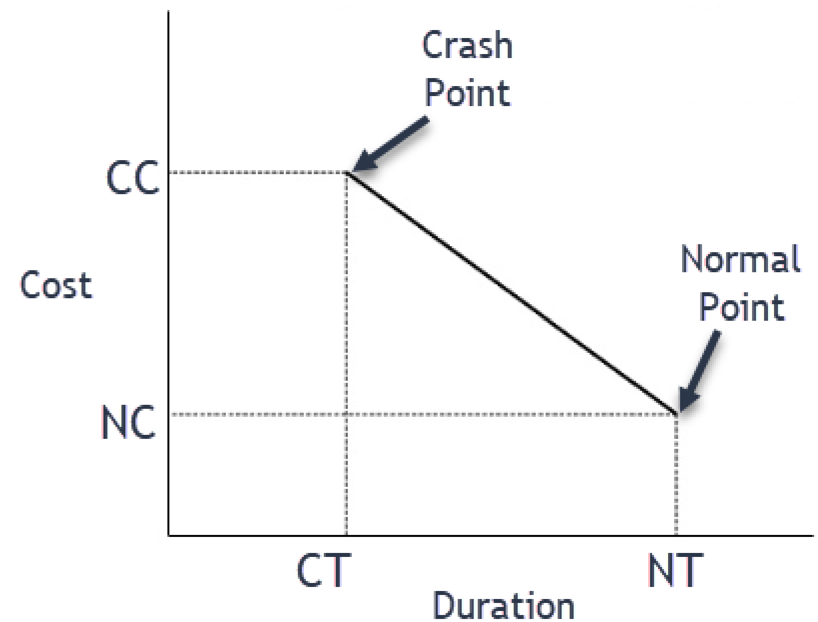
Parameters for crashing

- Maximum time reduction for an activity = NT – CT
- Cost to crash per period = $\dfrac{CC - NC}{NT - CT}$
- Note that the cost to crash per period assumes that the relationship between adding more money to the activity and reducing the time is **linear:**
- Spend half of the money, and get half the time reduction
- This is not always true in practice, but works alright for a rough planning technique.



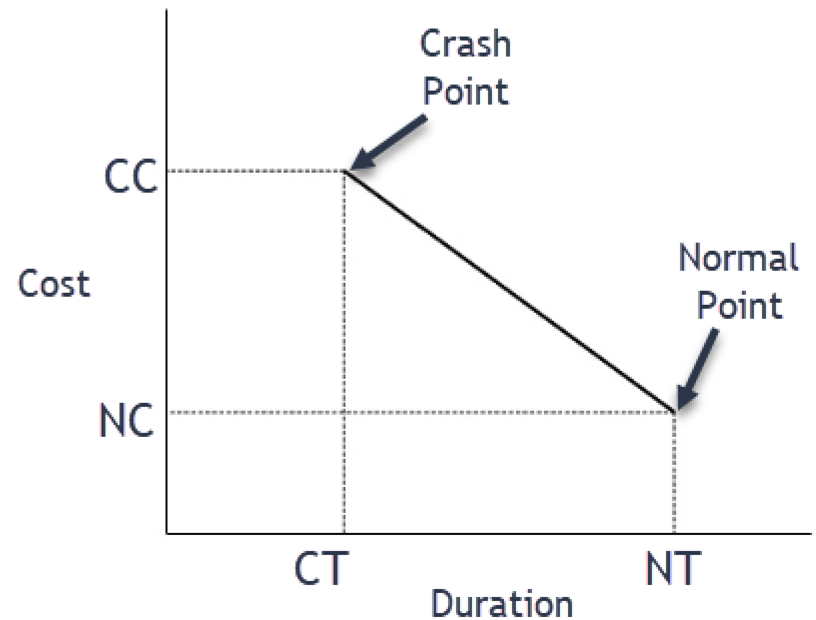
Computing crash data

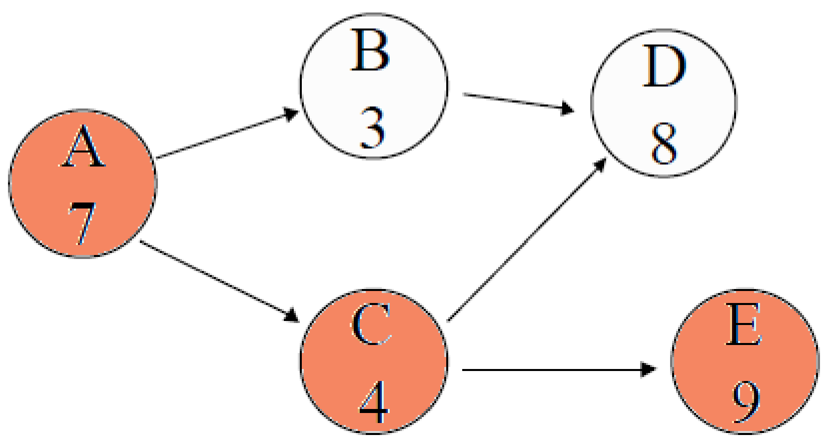
- Given:
  - activities
    - NT
    - NC
    - CT
    - CC
- Compute:
    - 1.maximum time reduction
    - 2.cost to crash per period



Example

Act.	NT	NC	CT	CC
A	7	3000	4	6000
B	3	4000	2	5500
C	4	15000	2	20000
D	8	10000	5	19000
E	9	7000	6	9100

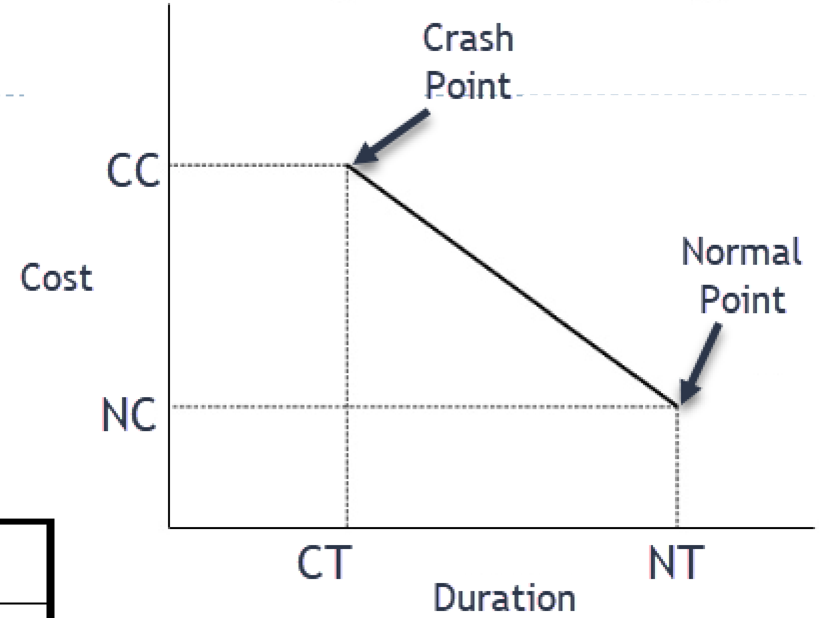




Critical Path: ACE

Example

1. Compute max. time reduction: NT-CT



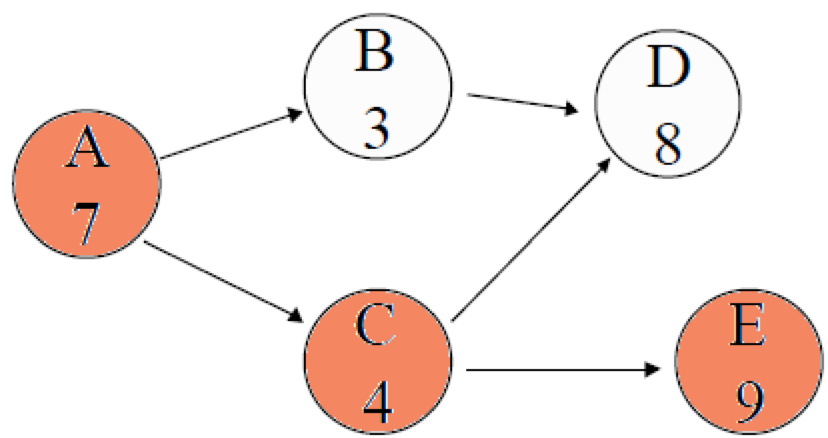
Act.	NT	NC	CT	CC	Max Red
A	7	3000	4	6000	7-4 = 3
B	3	4000	2	5500	3-2 = 1
C	4	15000	2	20000	4-2 = 2
D	8	10000	5	19000	8-5 = 3
E	9	7000	6	9100	9-6 = 3

Example

2. Compute cost to crash per period:

$$\frac{CC - NC}{NT - CT}$$

Act.	NT	NC	CT	CC	Max Red	Cost to crash per period
A	7	3000	4	6000	3	1000
B	3	4000	2	5500	1	1500
C	4	15000	2	20000	2	2500
D	8	10000	5	19000	3	3000
E	9	7000	6	9100	3	700

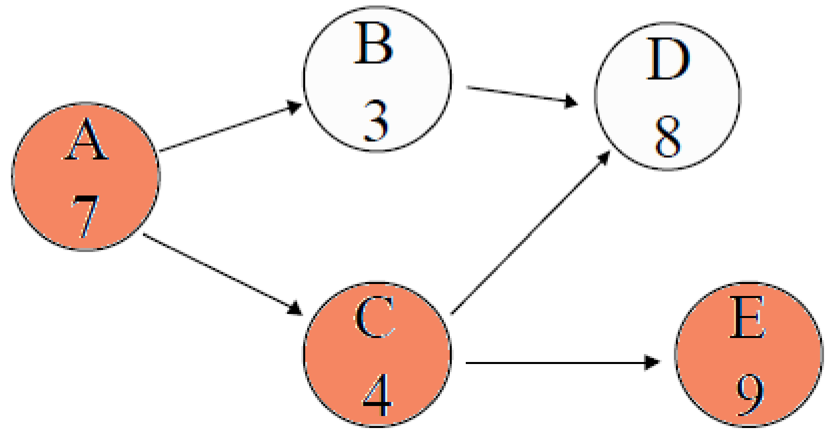


To Find the minimum cost schedule

- To shorten a project, crash only the activities that are critical.
- Crash from the least expensive to the most expensive.
- Each activity can be crashed until
  - it reaches its maximum time reduction
  - it causes another path to also become critical
  - it is more expensive to crash than not to crash
- Continue until no more activities can be crashed.

Example continued

- This project, under normal conditions takes 20 days. Suppose each day the project runs incurs an indirect project cost of **$1400** (overhead).

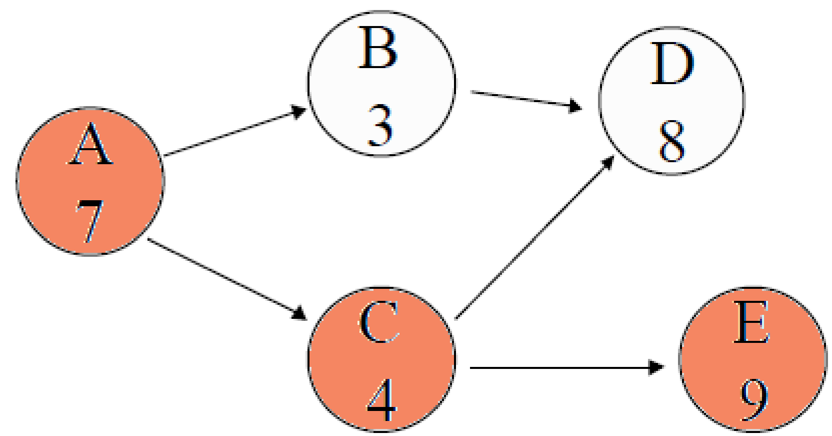


- Current (NT) Costs:
  - Sum of normal costs = 39000
  - Indirect costs = 20 days * 1400 = 28000
  - Total Costs: 67000

Act.	NT	NC	CT	CC	Max Red	Cost to crash per period
A	7	3000	4	6000	3	1000
B	3	4000	2	5500	1	1500
C	4	15000	2	20000	2	2500
D	8	10000	5	19000	3	3000
E	9	7000	6	9100	3	700

Example continued

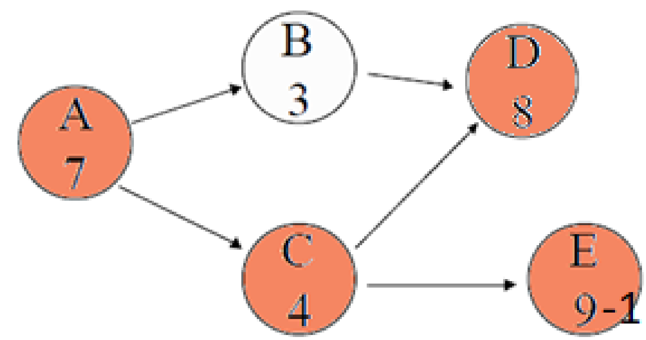
- Which activities should be crashed if any?
  - ABD 18
  - ACD 19
  - ACE 20 *
- Start by looking at activities on the critical path: A, C, and E.
- E is least expensive to crash.



Act.	NT	NC	CT	CC	Max Red	Cost to crash per period
A	7	3000	4	6000	3	1000
B	3	4000	2	5500	1	1500
C	4	15000	2	20000	2	2500
D	8	10000	5	19000	3	3000
E	9	7000	6	9100	3	700

Example continued

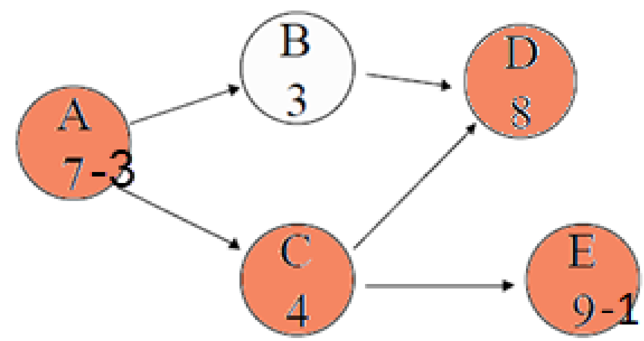
- How much to crash E ?
  - ABD 18
  - ACD 19
  - ACE 20 *
- E has maximum time reduction of 3, but if it is crashed by 1, then ACD also becomes a critical path.
- Also, we save **$1400** per day the project is shortened and would spend **$700** per day to crash E, so it is profitable to crash E.



Act.	NT	NC	CT	CC	Max Red	Cost to crash per period
A	7	3000	4	6000	3	1000
B	3	4000	2	5500	1	1500
C	4	15000	2	20000	2	2500
D	8	10000	5	19000	3	3000
E	9	7000	6	9100	3	700

Example continued

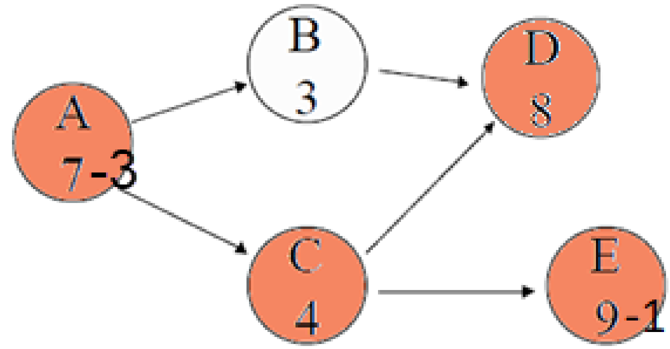
- Now there are two critical paths.
  - ABD : 18
  - ACD : 19 *
  - ACE : 19 *
- To finish the project earlier, we need to shorten both paths.
- Either Crash A or C (those activities are on both paths)
  - C : 2500
  - A : 1000
- Alternately, Crash both D and E together.
  - E-D : 3700
- **Crash A by 3 Since we gain 1400 for each project time gain.**



Act.	NT	NC	CT	CC	Max Red	Cost to crash per period
A	7	3000	4	6000	3	1000
B	3	4000	2	5500	1	1500
C	4	15000	2	20000	2	2500
D	8	10000	5	19000	3	3000
E	9	7000	6	9100	3	700

Stopping condition

- Now there are again two critical paths.
  - ABD : 15
  - ACD : 16 *
  - ACE : 16 *



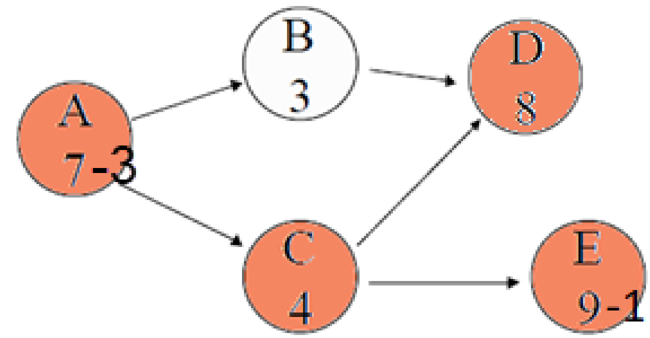
- To continue, we could crash C or both D and E. But in each case, the cost would be greater than the $1400 savings per day. So, we stop at this point.

Act.	NT	NC	CT	CC	Max Red	Cost to crash per period
A	7	3000	4	6000	3	1000
B	3	4000	2	5500	1	1500
C	4	15000	2	20000	2	2500
D	8	10000	5	19000	3	3000
E	9	7000	6	9100	3	700

- We can compute the cost to perform the project in 16 days.

Total Project Cost

- Sum of normal costs = 39,000
- Indirect costs = 16 days * 1400 = 22400
- Crashing cost
  - E by 1 = 700
  - A by 3 = 3000



= 39000 + 22400 + 3700

Min Project Cost = $65100

Act.	NT	NC	CT	CC	Max Red	Cost to crash per period
A	7	3000	4	6000	3	1000
B	3	4000	2	5500	1	1500
C	4	15000	2	20000	2	2500
D	8	10000	5	19000	3	3000
E	9	7000	6	9100	3	700
		39000				

Minimum time schedule

- Sometimes it is necessary to complete a project as short as possible (in min. time rather than min. cost)
- To find the shortest time possible, crash all activities completely and then find the times for all paths.
- The longest path is, of course, critical and tells us how long the project must take.

Minimum time schedule at minimum cost

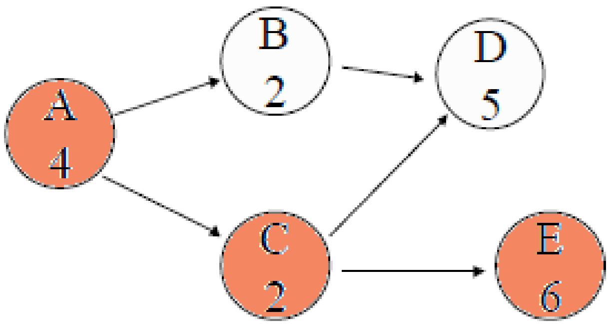
- Activities on non-critical paths may not need to be fully crashed in order for the project to be finished in the shortest possible time.

- These activities can be "**uncrashed**" one at a time, starting from the most expensive one to crash, till there is nothing left to uncrash.

Minimum time schedule at minimum cost

Same problem as earlier.

Act.	NT	NC	CT	CC	Max Red	Cost to crash per period
A	7	3000	4	6000	3	1000
B	3	4000	2	5500	1	1500
C	4	15000	2	20000	2	2500
D	8	10000	5	19000	3	3000
E	9	7000	6	9100	3	700



1. Set all activities to their crash (shortest) times

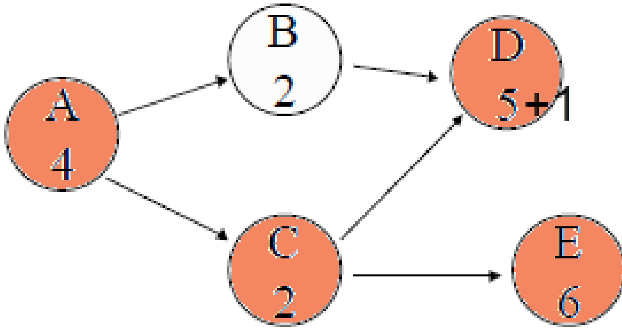
Three paths, but now with shorter times.

2. Critical activities are still A, C and E.
3. B and D are not critical and can be relaxed.

    B costs $1500 to crash.

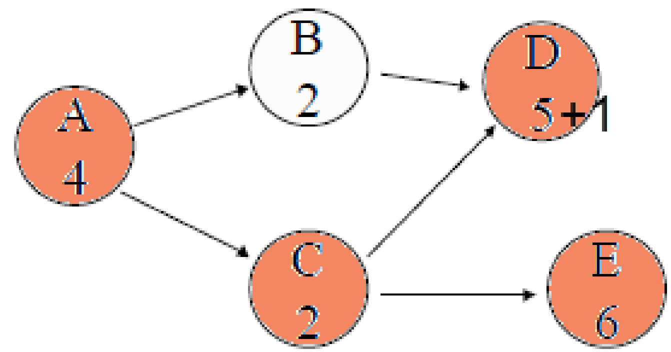
    D costs $3000 to crash.

To save some money, but still complete in 12 days **uncrush** D by 1. It means less cost and the same project time.



Total Cost

Act.	NT	NC	CT	CC	Max Red	Cost to crash per period
A	7	3000	4	6000	3	1000
B	3	4000	2	5500	1	1500
C	4	15000	2	20000	2	2500
D	8	10000	5	19000	3	3000
E	9	7000	6	9100	3	700
				59600		



Best Cost for the Least Project Time (12 days)

= 59600 + 12 * 1400 - 3000 = **$73,400**

Min Project Cost (16 days) = $65100

ENGR3450 – Project Management

Week 9

The Project Execution

Monitoring and Control

Halil POSACI – Dr. Esra Ekinci

2018, İzmir

YAŞAR ÜNİVERSİTESİ
Mühendislik Fakültesi

Agenda today

- Monitoring and Control
  - Report creation and meetings
- Earned Value Analysis
- Other reports and PMIS
- Project Control
- Design of Controls
- Go Back to your project charter

  - Problems from Ch 10-11.

Monitoring and Control

Scope(Performance) – Time(Milestones) – Cost(On Budget)

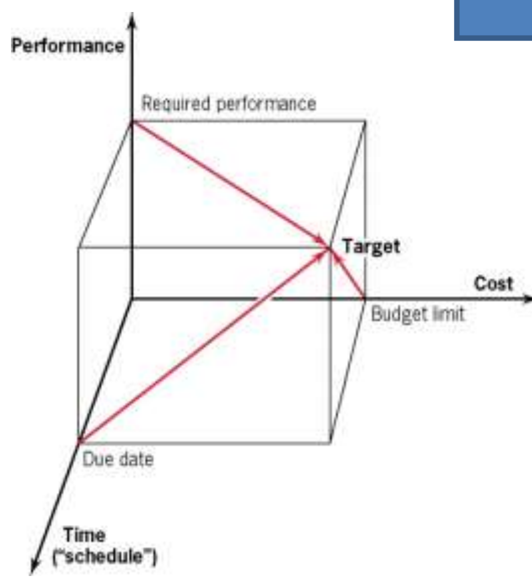
Project Charter

Purpose
Objectives
Schedules
Resources
Stakeholders
Risk Management Plans
Evaluation Methods

Project Management Plan

Control

Execution



Produce Reports

Kill the project

Continue Execution

Complete Execution

Define Scope well

Then you may control well

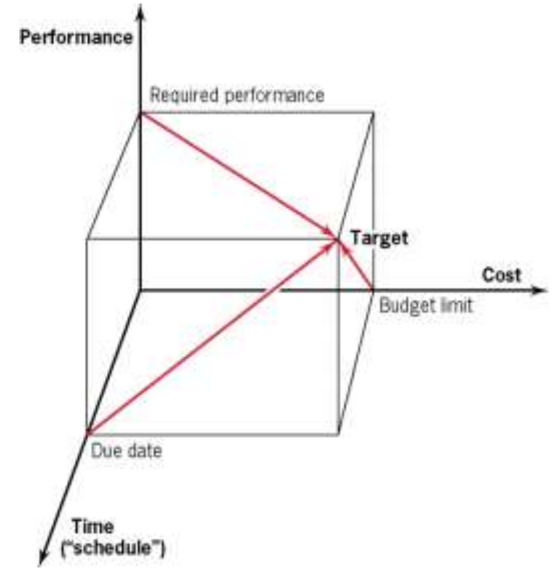
Muddy Waters

Scope not well defined

Project Charter

Purpose
Objectives
Schedules
Resources
Stakeholders
Risk Management Plans
Evaluation Methods

Scope



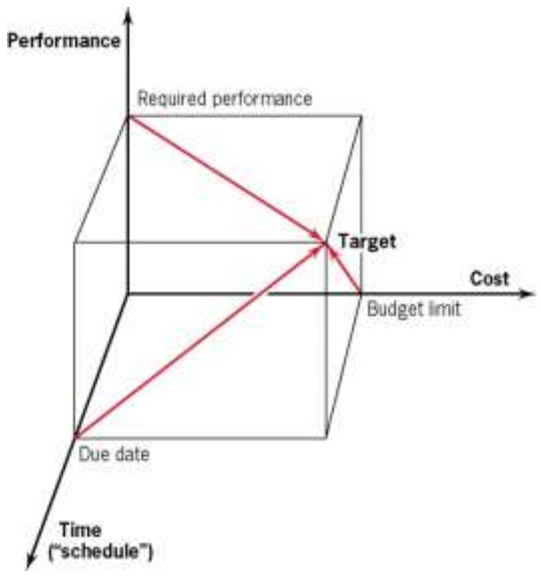
Project Management Plan

Report to whom and when

Control

Project Charter

Execution



Purpose
Objectives
Schedules
Resources
Stakeholders
Risk Management Plans
Evaluation Methods

Project Management Plan

Mysterious Stakeholders

Know the constraints well

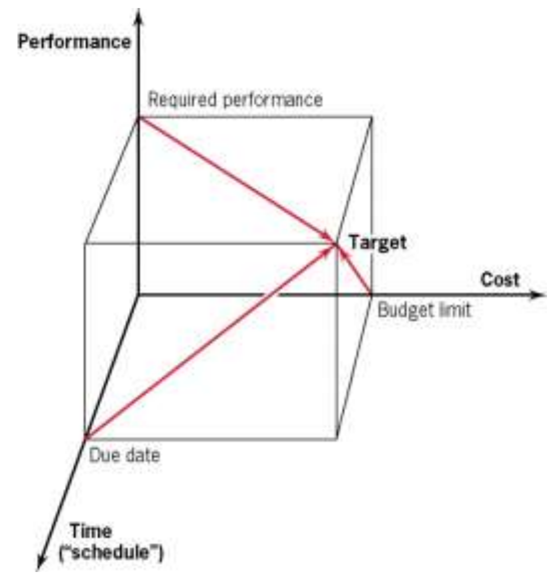
Control

Execution

Project Charter

Unconstrained Constraints

Purpose
Objectives
Schedules
Resources
Stakeholders
Risk Management Plans
Evaluation Methods



Project Management Plan

Poor design of Monitoring Controls

Project Charter

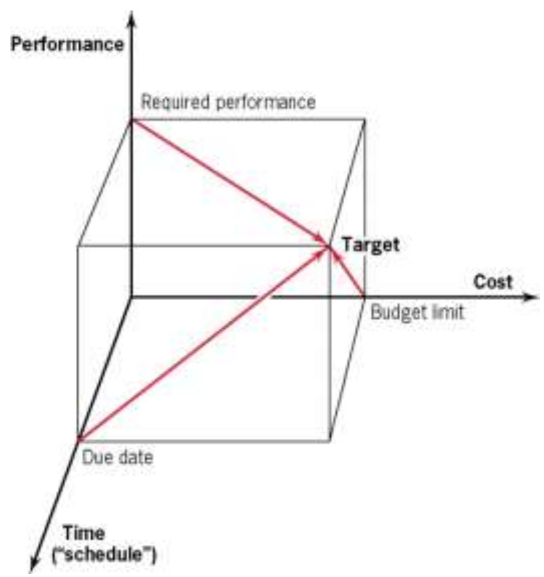
Purpose
Objectives
Schedules
Resources
Stakeholders
Risk Management Plans
Evaluation Methods

Project Management Plan

Poor design of evaluation methods

Control

Execution



Suspicious Status Reports

Suspicious Motivations

Unhappy Team members cause Drama

How to collect data

- Frequency counts

  Bugs in SW, accidents , services, leakages, complaints, etc.

- Raw numbers

  Hours, units, dollars, TLs, kgs, dates or durations, etc.

- Subjective (but numeric) ratings

  Quality, ranking, motivation level, etc.

- Indicators and verbal measures (non numeric)

  (speed of response, good morale etc.)

Data to Information
to report

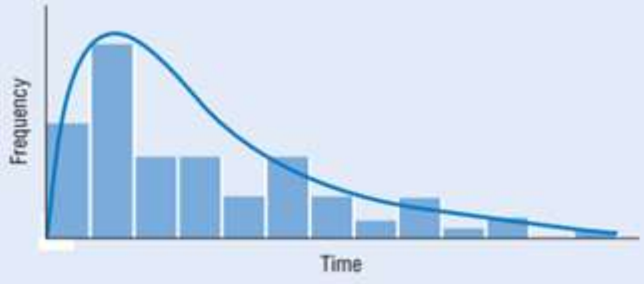


Figure 10-2 Number of bugs found during test of Datamix program.

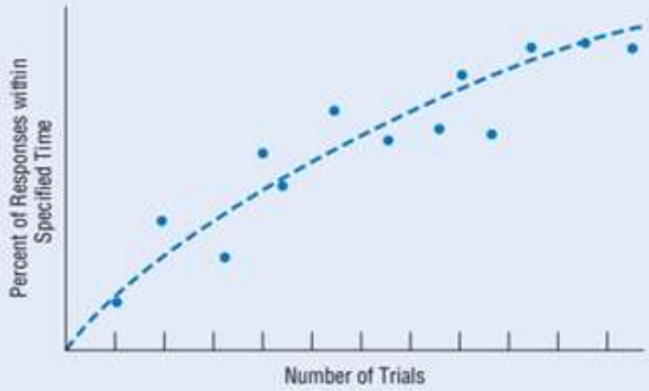


Figure 10-3 Percent of specified performance met during repeated trials.

Information Flow

Raw data → Process → Information

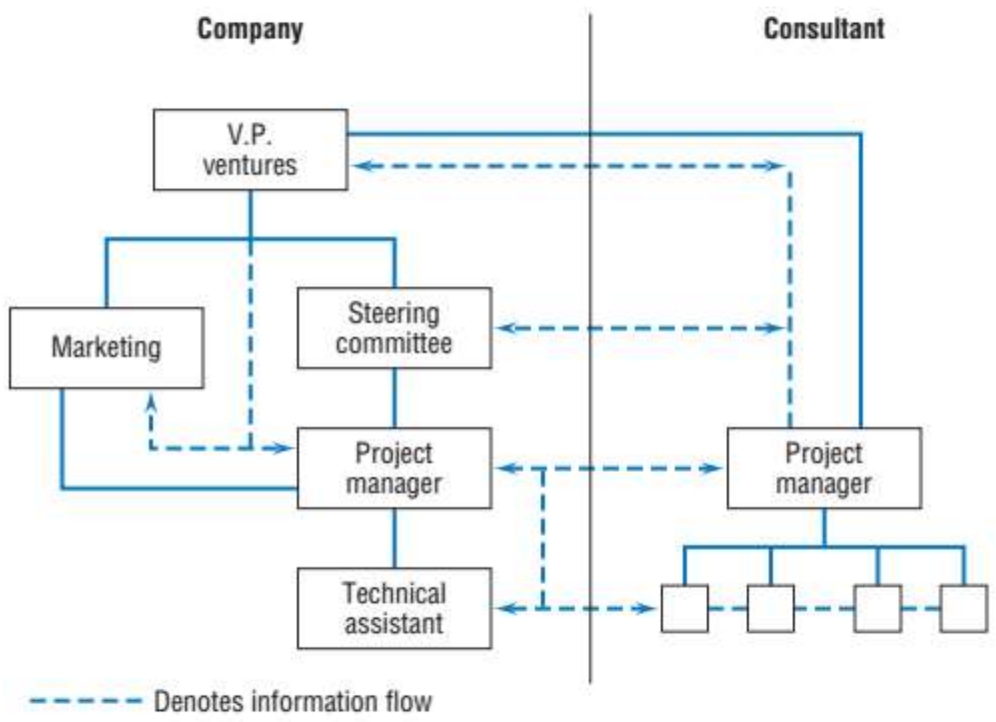


Figure 10-4 Reporting and information flows between organizations working on a common project.

Use more graphics for top managers to make them read fast

Keep security high on sensitive data

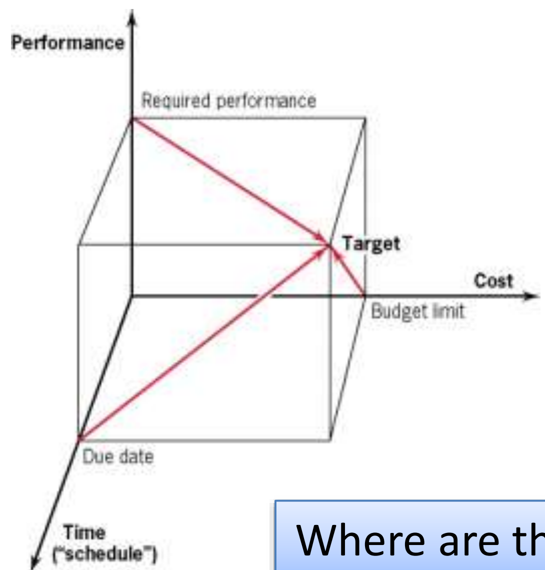
Reporting Process

Project Charter

Project Management Plan

Guidelines

Report



Where are the data

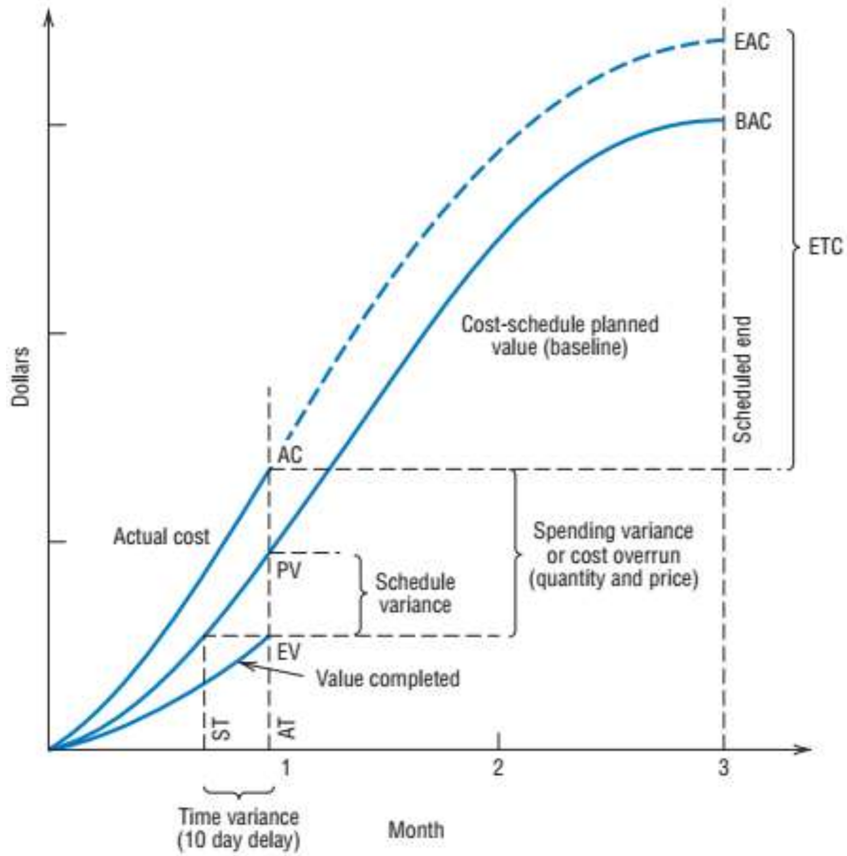
Meetings

Reports are not satisfactory for giving decisions
So plan meetings formal or informal.

- Make your team (and you) do their home-works before meeting.
- Be timely on meetings (Determined start and finish times) with durations about 30 minutes.
- Make everybody talk and use your minutes too.
- Focus on the aim of the meeting
- Don’t be too formal or informal.
- In crisis times do specific meetings with no time limit (unless problem solved). Or close a selected group in a room until they find the solution.
- Sometimes it may be needed to use on-line tools to make distance colligates with you.

Earned Value Analysis

Expert judgement is important for estimates besides analytical measurements



BAC – Budget At Completion

EAC – Estimated cost At Completion

ETC – Estimated cost To Complete

AC – Actual Cost now (on time of measure)

PV – Planned Value for now

EV – Earned Value now

AT – Actual Time now

ST – Scheduled Time for the work completed

Figure 10-5 Earned value chart.

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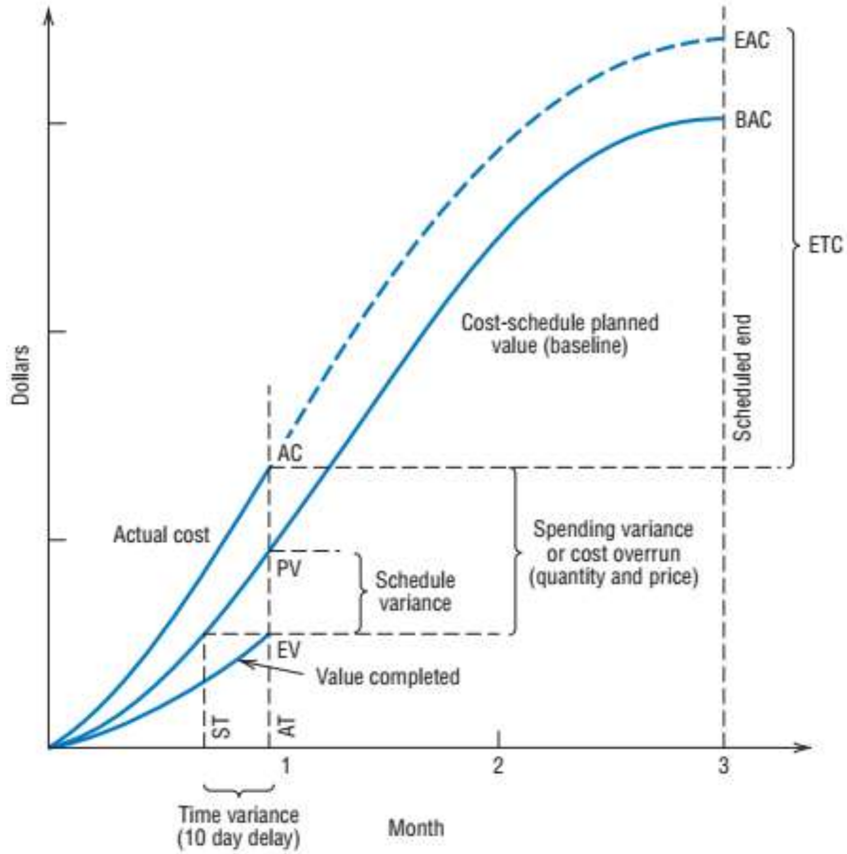
Earned Value Analysis

BAC – Budget At Completion
EAC – Estimated cost At Completion
ETC – Estimated cost To Complete
AC – Actual Cost now (on time of measure)
PV – Planned Value for now
EV – Earned Value now
AT – Actual Time now
ST – Scheduled Time for the work completed



Cost Variance CV = EV – AC

Schedule Variance SV = EV – PV

Time Variance TV = ST – AT

Figure 10-5 Earned value chart.

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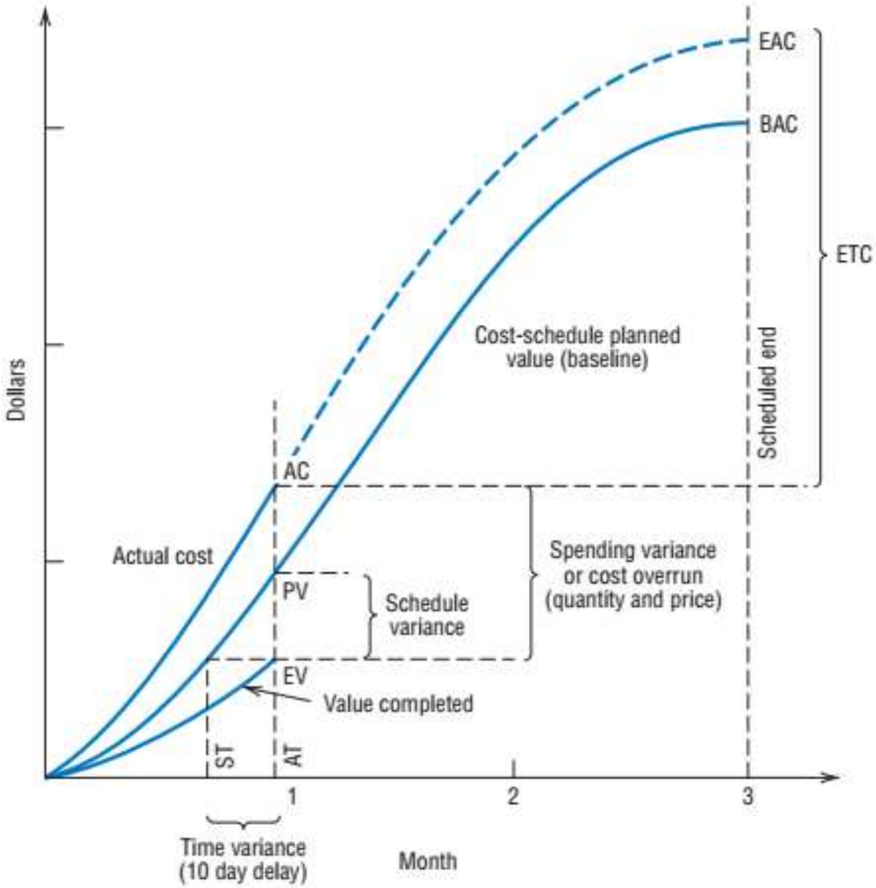
Earned Value Analysis



BAC – Budget At Completion
EAC – Estimated cost At Completion
ETC – Estimated cost To Complete
AC – Actual Cost now (on time of measure)
PV – Planned Value for now
EV – Earned Value now
AT – Actual Time now
ST – Scheduled Time for the work completed

Cost Variance	CV = EV – AC
Schedule Variance	SV = EV – PV
Time Variance	TV = ST – AT

Cost Performance Index CPI = EV/AC

Schedule Performance Index SPI = EV/PV

Time Performance Index TPI = ST/AT

Cost Schedule Index CSI = CPI*SPI = EV^2 /AC*PV

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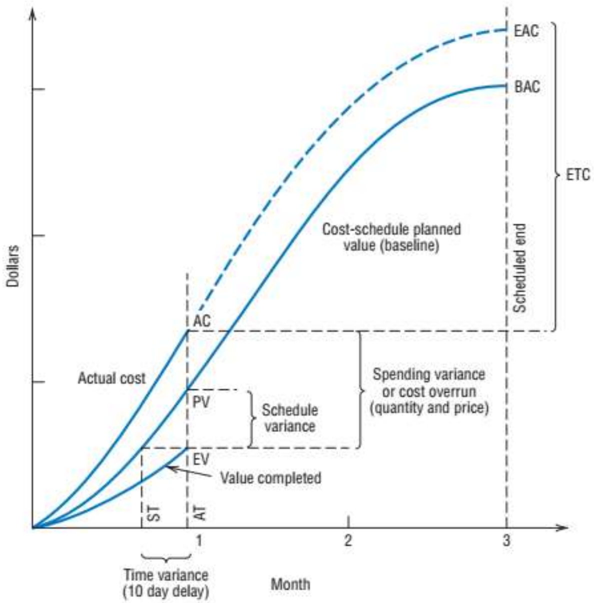
A short example



Assume that operations on a work package were expected to cost $1,500 to complete the package. They were originally scheduled to have been finished today.
At this point, however, we have actually expended $1,350,
and we estimate that we have completed two-thirds of the work.
What are the cost and schedule variances?

CV = EV – AC = 1500*(2/3) – 1350 = -$350

SV = EV – PV = 1500*(2/3) – 1500 = -$500

CPI = EV/AC = 1500*(2/3)/1350 = 74%

SPI = EV/PV = 1500*(2/3)/1500 = 67%

CSI = $(1500*2/3)^2$ / (1350*1500) = 49% < 100% Problem

Easy to see a problem

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Possible Examples for EVA

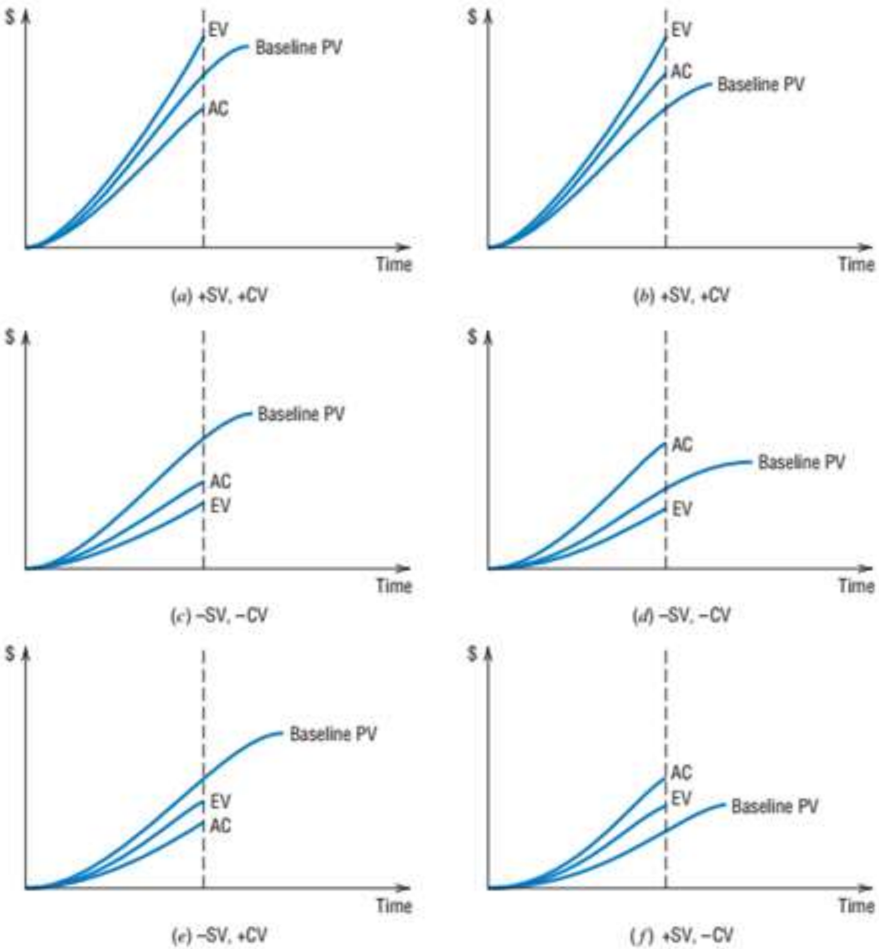
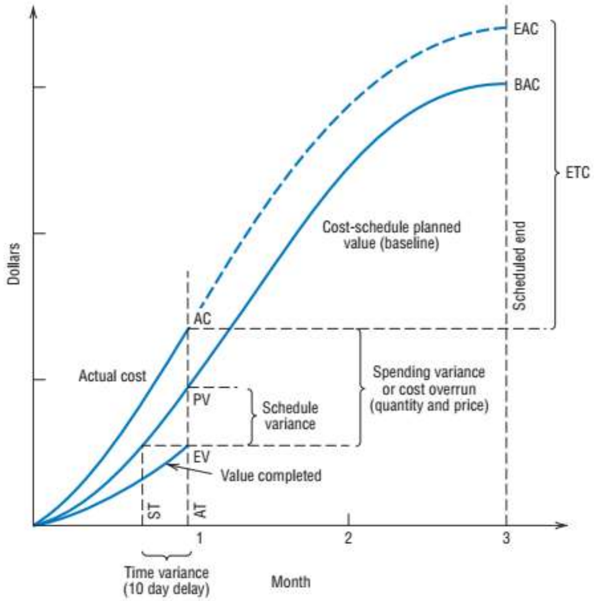


Figure 10-6 Six possible arrangements of AC, EV, and baseline PV resulting in four combinations of positive and negative schedule variance (SV) and cost variance (CV). (Figure 10-5 is arrangement *d*.)

Continue short example



ETC = (BAC – EV) / CPI
= (1500 – 1000) /0.74
= $676

EAC = ETC + AC = 676 + 1350 = $2026

Crashing is done – A rough estimate
for estimated cost to complete

ETC = (BAC – EV) / CPI * SPI = 676 / .67 = ~1000

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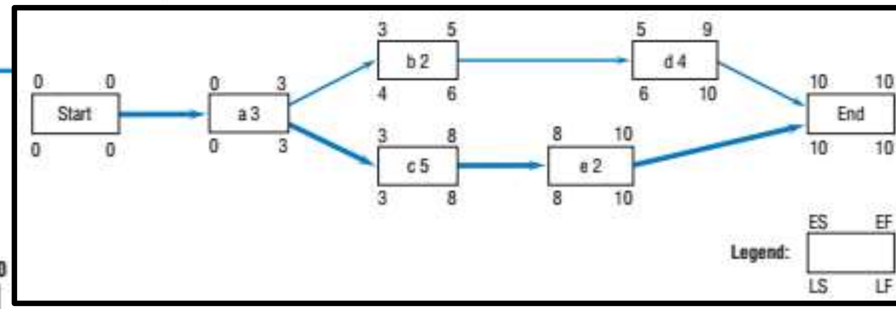
Example

Table 10-1 Earned Value Example (today is day 7)

Activity	*Predecessors*	*Days Duration*	*Budget, $*	*Actual Cost, $*
a	—	3	600	680
b	a	2	300	270
c	a	5	800	
d	b	4	400	
e	c	2	400	



Day

Activity	0	1	2	3	4	5	6	7	8	9	10
a	300		300								
b				150	150						
c				400				400			
d						200			200		
e									200	200	
Total	300		300	550	150	200		400	400	200	
Cum. Total	300	300	600	1150	1300	1500	1500	1900	2300	2500	

Figure 10-8 Example baseline (PV) budget using the 50–50 rule.

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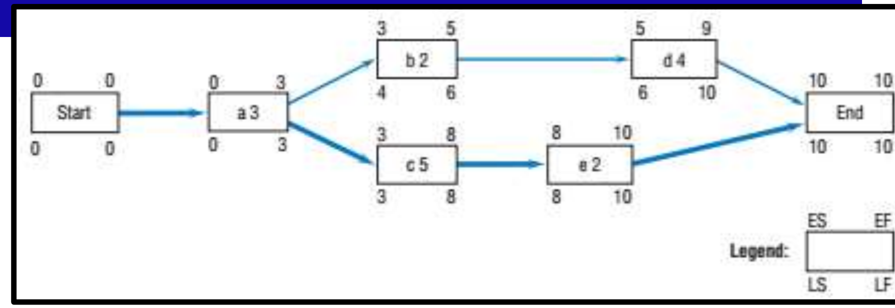
Status at day 7

Day

Activity	0	1	2	3	4	5	6	7	8	9	10
a	300			300							
b					150	150					
c					400						
d							200				
e											
EV	300			300	550	150	200				
Cum. EV	300	300	300	600	1150	1300	1500				
Actual Cost				680		270					
Cum. AC	0	0	0	680	680	950	950				



Day

Activity	0	1	2	3	4	5	6	7	8	9	10
a	300		300								
b				150	150						
c				400				400			
d						200			200		
e									200	200	
Total	300		300	550	150	200		400	400	200	
Cum. Total	300	300	600	1150	1300	1500	1500	1900	2300	2500	

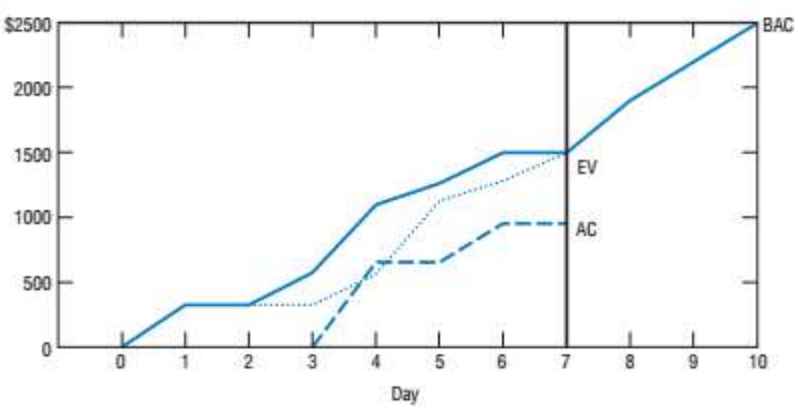


Figure 10-10 Example earned value chart at day 7.

CV = $550 Good

50-50 rule makes estimates rough

Earned value report

Name	PV	EV	AC	Sch. Variance	Cost Variance	BAC	FAC	Variance	QTR 1 Jan	QTR 1 Feb	QTR 1 Mar	QTR 2 Jan	QTR 2 Feb	QTR 2 Mar
Contact Organizations	$3,797.00	$3,980.00	$3,920.00	$183.00	$60.00	$3,980.00	$3,920.00	$60.00						
Print forms	$645.00	$645.00	$645.00	$0.00	$0.00	$645.00	$645.00	$0.00						
Contact organizations	$840.00	$840.00	$728.00	$0.00	$112.00	$840.00	$728.00	$112.00						
Collect display information	$660.00	$660.00	$660.00	$0.00	$0.00	$660.00	$660.00	$0.00						
Gather college particulars	$520.00	$520.00	$520.00	$0.00	$0.00	$520.00	$520.00	$0.00						
Print programs	$687.00	$870.00	$922.00	$183.00	($52.00)	$870.00	$922.00	($52.00)						
Print participants' certificates	$445.00	$445.00	$445.00	$0.00	$0.00	$445.00	$445.00	$0.00						
Banquet and Refreshments	$1,220.00	$1,220.00	$1,200.00	$0.00	$20.00	$1,220.00	$1,200.00	$20.00						
Select guest speaker	$500.00	$500.00	$500.00	$0.00	$0.00	$500.00	$500.00	$0.00						
Organize food	$325.00	$325.00	$325.00	$0.00	$0.00	$325.00	$325.00	$0.00						
Organize liquor	$100.00	$100.00	$100.00	$0.00	$0.00	$100.00	$100.00	$0.00						
Organize refreshments	$295.00	$295.00	$275.00	$0.00	$20.00	$295.00	$275.00	$20.00						
Publicity and Promotion	$2,732.00	$2,297.75	$2,039.00	($434.25)	$258.75	$3,010.00	$2,870.00	$140.00						
Send invitations	$700.00	$700.00	$560.00	$0.00	$140.00	$700.00	$560.00	$140.00						
Organize gift certificates	$330.00	$330.00	$330.00	$0.00	$0.00	$330.00	$330.00	$0.00						
Arrange banner	$570.00	$570.00	$570.00	$0.00	$0.00	$570.00	$570.00	$0.00						
Contact faculty	$280.00	$280.00	$280.00	$0.00	$0.00	$280.00	$280.00	$0.00						
Advertise in college paper	$165.00	$82.50	$65.00	($82.50)	$17.50	$165.00	$165.00	$0.00						
Class announcements	$99.00	$0.00	$0.00	($99.00)	$0.00	$220.00	$220.00	$0.00						
Organize posters	$588.00	$335.25	$234.00	($252.75)	$101.25	$745.00	$745.00	$0.00						
Facilities	$200.00	$0.00	$0.00	($200.00)	$0.00	$200.00	$200.00	$0.00						
Arrange facility for event	$52.00	$0.00	$0.00	($52.00)	$0.00	$52.00	$52.00	$0.00						
Transport materials	$148.00	$0.00	$0.00	($148.00)	$0.00	$148.00	$148.00	$0.00						

Project: Career Day
Date: 3/24

Critical · Progress · Milestone
Noncritical · Summary · Rolled up

Figure 10-11 MSP budget sheet for Career Day project (cf. Chapter 6).

Other control charts

Milestone monitoring

NAME					PROJECT PLAN	ENGR. REVIEW	DESIGN REVIEW	QUOTE QUES.	PAT SCULP COMPL.	PAT SCULP COMPL.	QUOTES DUE	MAKE BUY
PROJECT NO.	PRODUCT NO.	MFG SOURCE	TURNOVER	ORIGINAL								
A = PRICE	QUOTA	POTENTIAL		CURRENT								
				ACTUAL								

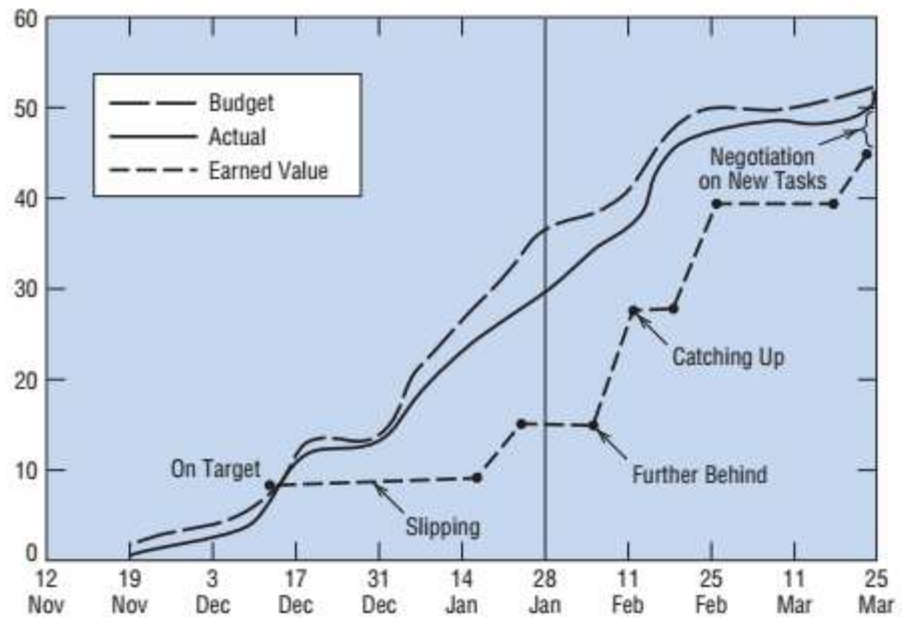
ENGR. RELEASE	PROJECT REVIEW	RELEASE DWGS.	TOOL START	PHOTO SAMPLES	INSIDE SAMPLES	PKG. FILM	INSTR. LAYOUT	INSTR. FILM ART	FINAL PARTS	FIRST EP	FINAL EP	EP SIGN-OFF	ORIENT PS	OBS	PROD. PILOT	PT SIGN-OFF	PROD. START	ATS

Figure 10-13 Milestone monitoring chart for Figure 10-11.

Other Control Charts

Burnup and burndown charts

Scope



time

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PMIS – PM Information System

Software for Project Management

- Establish criteria
  - Easy to use, friendly, keep schedules, communicate team for meetings and more
- Conduct with vendors
- Create shortlist
- Evaluate and negotiate on prices

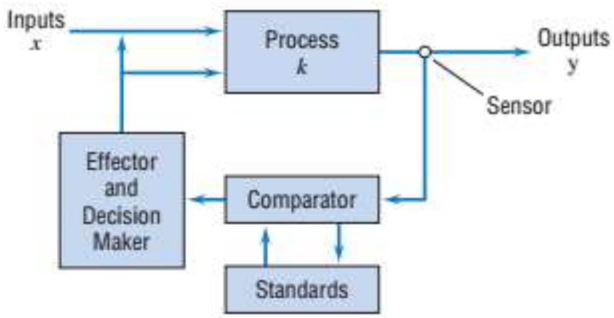
Project Control

What to control

- Physical Assets and Inventory
  - Spreadsheets or SW
- Human Resource control
  - Use sheets or electronic tools and other methods (preferably analytic) of your own.
  - Create chances to improve your team but do not hesitate fire cheaters that harm financially and emotionally your team.
- Financial resource control
  - Keep control of your accounts besides accounting department if necessary (it is most of the time)

Control Processes

Cybernetic



- Investment cost should be justified.
- Corrective action should be immediate

Figure 11-1 A cybernetic control system.

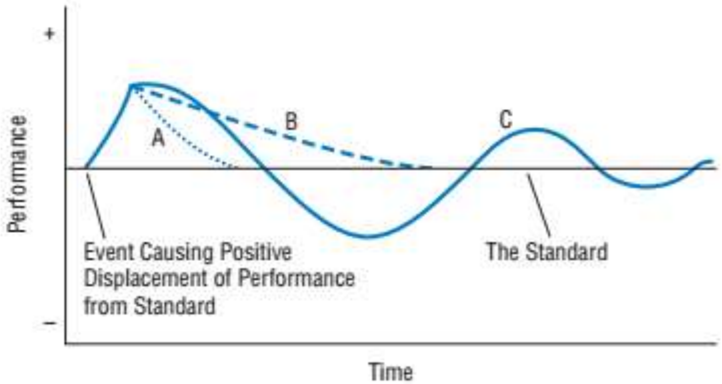


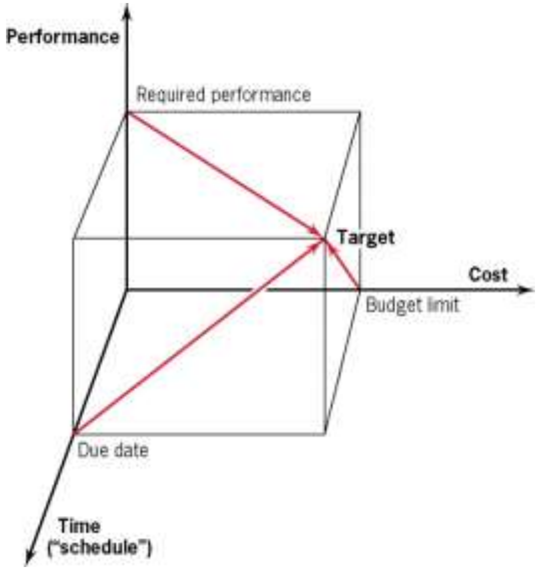
Figure 11-2 Typical paths for correction of deviation of performance from standard.

Control Processes

Go – No-Go controls

Team is in Muddy Water – False scope
Customers not happy
Competitors do better

- Against Predetermined Specifications
- But bosses decides about No-Go



Cost overrun
Can be negotiated with stakeholders

Time overruns
Can be negotiated with stakeholders

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Control Processes

Phase gate process

- Against Predetermined Specifications
- Done at each task and/or milestone
- It is a Go No-Go decision for the next step

Milestone Tracking

CRS-J3

Quality Gate Milestone Tracking		Q9	Q8	Q7	Q6	Q5	Q4	Q3	Q2	Q1
		Business Review	Req'ts	HLD	Release Commit	Iteration Planning	Handoff to Test	Test Complete	Perf Results	GA
Products/Programs										
CRS-J3	*Std Interval*		*5/14*	*7/9*	*8/6*		*11/5*	*12/31*	*12/31*	*11/14*
	Commit		5/14	6/4	7/9					
	Revised			6/8	7/22					
	Actual		5/14	6/8						
% Over (Under) Plan			0.0%	13.3%	0.0%		0.0%	0.0%	0.0%	0.0%
	Developers:	3	Testers:	0	Architects:	2	July Dev, Test, Arch	3	8	2

- **Quality Gate 8 approved on 05/14**
- **Successfully completed the Design Documents and Annotated MRD**
- **Quality Gate 7 approved on 06/08**
- **Quality Gate 6 is targeted for 07/22 (original 07/09 – Delay is due to the COMMCO work planning)**
- **Revised Targets:**
  - Gate 4 – 08/25
  - Gate 1 – 10/13
  - Customer Commit – 10/14

Operations Update – Engineering
6/15
Page 16

Figure 11-3 A quality-gate application.

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Control Processes

Discovery Driven

- How valid initial assumptions appear now.

- If no plan satisfies revised assumptions one option is to kill the project.

Task	Project		
	#1	#2	#3
Priorities set	C	C	C
PM selected	C	C	C
Key members briefed on RFP	C	C	C
Proposal sent	C	C	C
Proposal accepted as negotiated	C	C	C
Preliminary design developed	C	W/10	C
Design accepted	C	W/12	C
Software developed	C	NS/NR	N/A
Product test design	C	W/30	W/15
Manufacturing scheduled	C	NS/HR	W/8
Tools, jigs, fixtures designed	W/1	NS/HR	W/2
Tools, jigs, fixtures delivered	W/2	NS/HR	W/8
Production complete	NS/HR	NS/HR	NS/HR
Product test complete	NS/HR	NS/HR	NS/HR
Marketing sign-off on product	NS/HR	NS/HR	NS/HR

Notes:

N/A—Not applicable
C—Completed

W—Work in progress (number refers to month required)

NS—Not started
NR—Need resources
HR—Have resources

Figure 11-4 Sample project status report.

Post Controls – Lessons learned

Includes

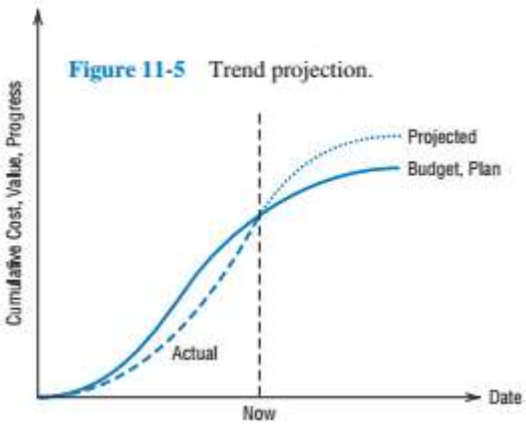
- Project objectives
- Milestones gates and budgets
- The final report on Project Results
- Recommendations

Design of Controls

Back to your project charter

- Flexible
- Cost effective
- Useful
- Ethical
- Timely
- Accurate
- Simple
- Maintainable
- Documented

Figure 11-5 Trend projection.



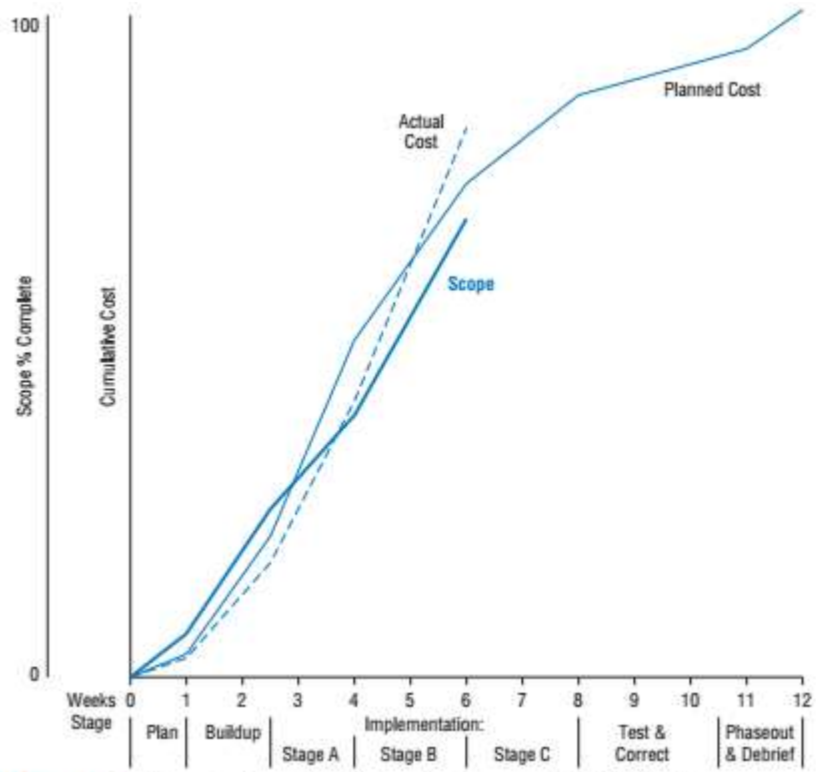


Figure 11-6 Integrated scope/cost/time chart. *Source*: Murdick (1984).

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Critical ratio Control Charts

Back to your project charter

Table 11-1 (Actual Progress/Scheduled Progress) × (Budgeted Cost/Actual Cost)

Task Number	*Actual Progress*		*Scheduled Progress*		*Budgeted Cost*		*Actual Cost*		*Critical Ratio*
1	(2	/	3)	×	(3	/	2)	=	1.00
2	(2	/	3)	×	(6	/	6)	=	0.67
3	(3	/	3)	×	(4	/	6)	=	0.67
4	(3	/	2)	×	(6	/	6)	=	1.50
5	(3	/	3)	×	(6	/	4)	=	1.50

Critical ratio Control Charts

Back to your project charter

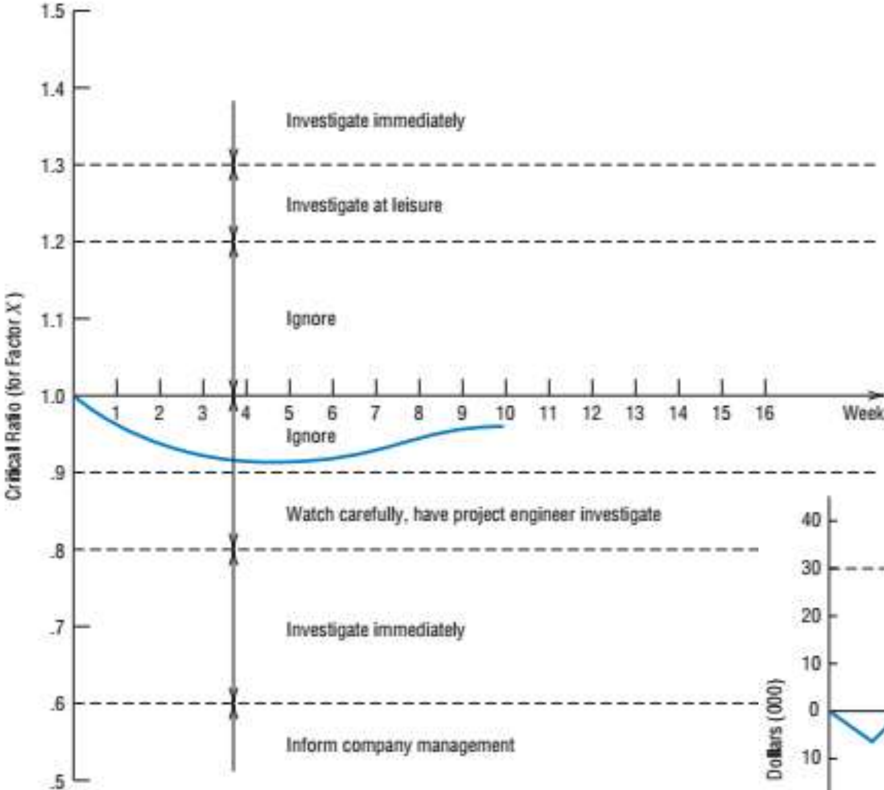

Figure 11-7 Critical ratio control limits.

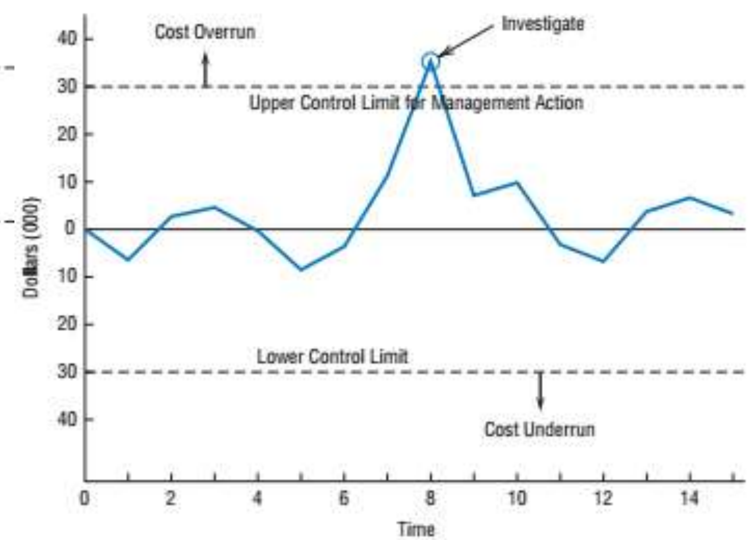

Figure 11-8 Cost control chart.

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Go back to your project charter

- Make the scope clear if it is not
  - In purpose, objectives and schedules
    (Not to drop your team to muddy water)

- Re-observe your resources
  - In timely manner to design control structures

- Re-write Evaluation Methods
  - Considering what you have learned in this lecture

- Observe your risk management plans
  - To prevent your project to be killed
    during execution

Problems – Ch 10

1. Find the schedule and cost variances for a project that has an actual cost at month 22 of $540,000, a scheduled cost of $523,000, and an earned value of $535,000.
2. A sales project at month 5 had an actual cost of $34,000, a planned cost of $42,000, and a value completed of $39,000. Find the cost and schedule variances and the CPI and SPI.
3. A software development project at day 70 exhibits an actual cost of $78,000 and a scheduled cost of $84,000. The software manager estimates a value completed of $81,000. What are the cost and schedule variances and CSI? Estimate the time variance.
4. A project to develop a county park has an actual cost in month 17 of $350,000, a planned cost of $475,000, and a value completed of $300,000. Find the cost and schedule variances and the three indexes.
5. A consulting project has an actual cost in month 10 of $23,000, a scheduled cost of $17,000, and a value completed of $20,000. Find the schedule and cost variances and the three indexes.
6. A project to develop technology training seminars is 5 days behind schedule at day 65. It had a planned cost of $735,000 for this point in time, but the actual cost is only $550,000. Estimate the schedule and cost variances. Re-estimate the variances if the actual cost had been $750,000.
7. Given an activity in an advertising project whose planned cost was $12,000 but actual cost to date is $10,000 so far and the value completed is only 70 percent, calculate the cost and schedule variances. Will the client be pleased or angry?
8. For the following test marketing project at week 6:
   (a) Ignore the far right "% Complete" column and using the 50–50 percent completion rule for PV and EV, calculate the cost, schedule, and time variances. Also calculate the CPI, SPI, CSI, and the ETC and EAC.
   (b) Repeat the calculations in a, but now using the "% Complete" column. Assume that the PV values are based on time proportionality but the "% Complete" values for EV are from the workers actually doing the tasks.

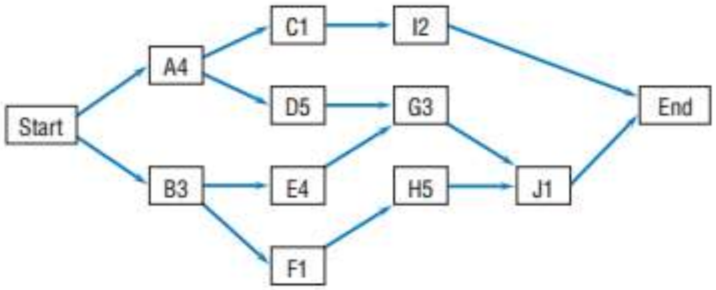
Activity	Predecessors	Duration (weeks)	Budget, $	Actual Cost, $	% Complete
a: Build items	—	2	300	400	100
b: Supply stores	—	3	200	180	100
c: Create ad program	a	2	250	300	100
d: Schedule ads	a	5	600	400	20
e: Check sale results	b, c	4	400	200	20

Problems – Ch 10

9. At week 24 of a project to shoot a television commercial, what should the expenditures be? If the earned value is right on schedule but the actual expenses are $9,000, what are the cost and schedule variances? What are the three indexes, the ETC, and the EAC? Use the proportionality rule.

Activity	*Pre-decessors*	*Duration (weeks)*	*Budget, $*
a: Write script	—	6	900
b: Screen actors	—	6	1200
c: Select actors	a	6	1200
d: Contract studio	a	12	1800
e: Obtain props	b, c	14	1400
f: Schedule date	b, c, d	10	1500
g: Shoot commercial	d, e	16	800

13. Draw an earned value chart for the end of the first week (5 days) assuming the time proportionality rule for the project illustrated in the following network diagram given the following costs and percentage completions:



Activity	*Budget, $*	*Actual, $*	*% Complete*
A	600	400	100
B	300	450	100
C	150	100	100
D	750	60	10
E	400	150	30
F	100	50	100
G	200	0	0
H	400	0	0
I	100	0	0
J	100	0	0

Problems – Ch 10

14. The following project is at the end of its sixth week. Find the cost and schedule variances. Also find the CPI, SPI, ETC, and EAC for the project.

Activity	*Pre-decessors*	*Duration (weeks)*	*Budget, $*	*Actual Cost, $*	*% Complete*
a	—	2	300	400	100
b	—	3	200	180	100
c	a	2	250	300	100
d	a	5	600	400	20
e	b, c	4	400	200	20

Problems – Ch 11

1. Given the following information, calculate the critical ratios, and indicate which activities are on target and which need to be investigated. Comment on the situation for each of the activities.

Activity	Actual Progress	Scheduled Progress	Budgeted Cost	Actual Cost
A	2 days	2 days	$40	$35
B	4 days	6 days	$30	$40
C	1 day	3 days	$50	$70
D	3 days	2 days	$25	$25

2. Calculate the critical ratios for the following activities and indicate which activities are probably on target and which need to be investigated. Comment on each activity.

Activity	Actual Progress	Scheduled Progress	Budgeted Cost	Actual Cost
A	4 days	4 days	$60	$40
B	3 days	2 days	$50	$50
C	2 days	3 days	$30	$20
D	1 day	1 day	$20	$30
E	2 days	4 days	$25	$25

3. Given the following information about a showroom renovation, which activities are on time, which are early, and which are behind schedule?

Activity	Budgeted Cost	Actual Cost	Critical Ratio
A: Plan changes	$60	$40	1.0
B: Solicit bids	$25	$50	0.5
C: Select contractor	$45	$30	1.5
D: Schedule date	$20	$20	1.5
E: Start renovation	$50	$50	0.67

4. Design and plot a critical ratio for a computer installation project that had planned constant, linear progress from 0 to an earned value of 200 over a 100-day duration. In fact, progress for the first 20 days has been: 2, 3, 4, 6, 7, 9, 12, 14, 15, 17, 20, 21, 21, 22, 24, 26, 27, 29, 31, 33. What can you conclude about this project?
5. Design and plot a critical ratio for a Web site project that has planned constant, linear spending from 0 to a total of 1000 over a 100-day duration. In fact, daily spending for the first 15 days has been: 11, 10, 9, 10, 11, 12, 11, 9, 8, 9, 10, 12, 14, 11, 7. What can you conclude about this project?

Problems – Ch 11

6. Industrial Building, Inc., has two project teams installing virtually identical, four-story commercial buildings for a customer in two separate cities. Both projects have a planned daily cost of 100 and a planned daily earned value of 100. The first 6 days for each team have progressed as follows:

Day	Team A: Earned Value	Team B: Earned Value	A: Cost	B: Cost
1	90	90	95	95
2	92	88	98	94
3	94	95	101	102
4	98	101	106	109
5	104	89	116	99
6	112	105	126	118

Compare the two projects in terms of general progress and according to critical ratios.

8. The following information (in AOA format) concerns progress at day 40 of an Internet marketing project. Determine if the project is in control based on time and cost to date. If not, what is the cost overage or underage?

Activity	Days Duration	Budget	Actual Cost	% Completed
1-2: Contact sites	10	300	250	100
2-3: Solicit costs	8	400	450	100
2-4: Design ads	12	350	380	100
4-3: Evaluate budget	0	0	0	—
3-5: Shoot ads	18	405	400	70
5-6: Place ads	16	450	—	0

Problems – Ch 11

9. Determine if the following test marketing project at week 6 is in control. If not, what is out of control? If it is in control, are both budget and schedule in control?

Activity	Predecessors	Duration (weeks)	Budget, $	Actual Cost, $	% Completed
a: Build items	—	2	300	400	100
b: Supply stores	—	3	200	180	100
c: Create ad program	a	2	250	300	100
d: Schedule ads	a	5	600	400	20
e: Check sale results	b, c	4	400	200	20

10. At week 24 of a project to shoot a television commercial, the project manager is worried about her budget since costs have risen to $7,500. Is there a cost overage? If so, how much is it? Is the schedule ahead or behind? Overall, does the project appear to be in control?

Activity	Predecessors	Duration (weeks)	Budget, $	% Completed
a: Write script	—	6	900	100
b: Screen actors	—	6	1200	100
c: Select actors	a	6	1200	100
d: Contract studio	a	12	1800	100
e: Obtain props	b, c	14	1400	100
f: Schedule date	b, c, d	10	1500	40
g: Shoot commercial	d,e	16	800	0

Resources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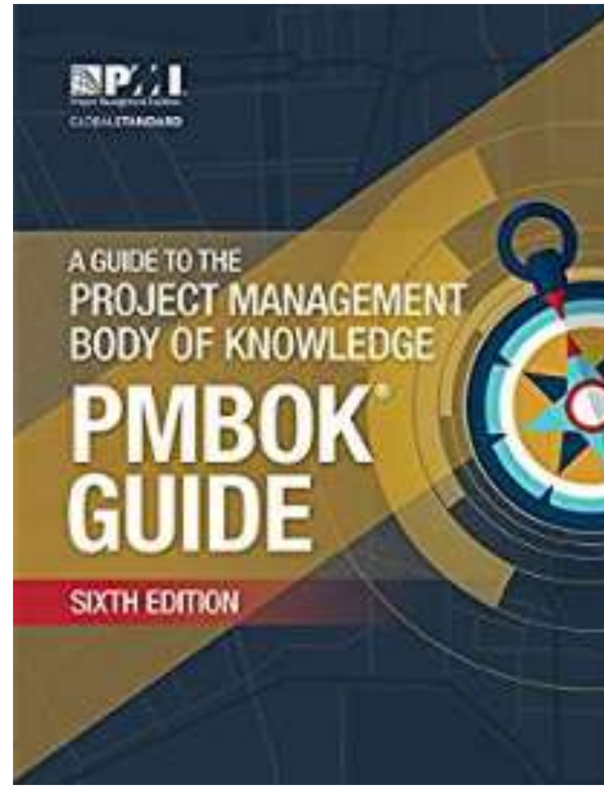
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Questions

- Questions

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NEXT WEEK: Project Execution – Auditing

ENGR3450 – Project Management

Week 10

The Project Execution

Auditing – Official Inspections

Halil POSACI – Dr. Esra Ekinci

2018, İzmir

YAŞAR ÜNİVERSİTESİ
Mühendislik Fakültesi

Agenda today

- Types and Purposes of Auditing
- The Project Audit – Points of Auditing
- Audit Life Cycle

  – Problems from Ch 9 – 10 – 11

Types of Auditing
Can be Internal or External

- Quality audits

  Independent and structured activities to check if

  project activities comply with

  organizational and project

  policies, processes and procedures
- Risk audits

  Effectiveness of risk management activities
- Procurement audits

  Reviews of contracting activities, processes and effectiveness (In TR Sayıştay and governmental inspectors are highly interested)
- Others whenever boss believes

Purpose of Auditing

- Identify problems early
- Clarify   Scope – Time – Cost
  Correctness, relationships, suitability with of organizations(purposes)
- Improve performance as monitoring
- Supply information to stakeholders
- Report to embed new technologies if available

The project audit

- Current status of the project
  - CPI, SPI, TPI, CSI (Look at week 9) and others.
- Future status
  - Against scope, budget and deadlines
- Risk assessment
- Assumptions of the audit process

Comparison with financial audits

Table 12-1 Comparison of Financial Audits with Project Audits

	Financial Audits	*Project Audits*
Status	Confirms status of business in relation to accepted standard	Must create basis for, and confirm, status on each project
Predictions	Company's state of economic well-being	Future status of project
Measurement	Mostly in financial terms	Financial terms plus schedule, progress, resource usage, status of ancillary goals
Record-keeping system	Format dictated by legal regulations and professional standards	No standard system, uses any system desired by individual organization or dictated by contract
Existence of information system	Minimal records needed to start audit	No records exist, data bank must be designed and used to start audit
Recommendations	Usually few or none, often restricted to management of accounting system	Often required, and may cover any aspect of the project or its management
Qualifications to the audit report	Customary to qualify statements if conditions dictate, but strong managerial pressure not to do so	Qualifications focus on shortcomings of audit process (e.g., lack of technical expertise, lack of funds or time)

Value of audits against time

Table 12-2 Timing and Value of Project Audits/Evaluations

Project Stage	*Value*
Initiation	Significant value if audit takes place early—prior to 25 percent completion of initial planning stage
Feasibility study	Very useful, particularly the technical audit
Preliminary plan/schedule budget	Very useful, particularly for setting measurement standards to ensure conformance with standards
Baseline schedule	Less useful, plan frozen, flexibility of team limited
Evaluation of data by project team	Marginally useful, team defensive about findings
Implementation	More or less useful, depending on importance of project methodology to successful implementation
Postproject	More or less useful, depending on applicability of findings to future projects

Unfortunately post project used in TR for governmental. Cost lots of money from external audit companies.

Meredith

Usual format of audit reports

1. Introduction
    - Framework to make reader understand
2. Current status
    - Cost – Schedule – Scope – Quality
3. Future project status
    - Authors ideas for Cost – Schedule – Scope – Quality for future
4. Time – Cost – Scope trade of reviews
5. Review of risk management (not new ideas but caveats)

Audit life cycle

- Assemble a small team of experts and associate (candidate) experts
- Make team familiarize about scope – schedule – budget
  - Do meetings, collect data
- Brief Project Management
- Collect Data – Work in coordination with Project team and PM
- Create report
- Re-brief Project Management including tips of the report
- Recreate final report to submit both Management and team.
- Follow up conclusions of recommendations of the report
  - (if you have given authority)

Audit life cycle

Auditors can be a good bridge
formally in their reports
informally in meetings
between top management
and project team (including PM)
if there exists hierarchical
communication problems
in company organization chart
and organizational culture.

They create good results easily
in TR simply by that ability.

Final Report, Agency Evaluation, Sub-Committee II
Physical Plant, Management of Office, Personnel Practices

Summary of Recommendations

Recommendations which require Board action.

1. The Board of _______ should continue its efforts to obtain additional funds for our salary item.
2. The cost of Blue Cross and Blue Shield insurance coverage on individual employees should be borne by _______.

Recommendations which can be put into effect by *Presidential Order* to committees, staff, or others.

3. The House Committee should activate, with first priority, the replacement of the heating/air conditioning system. Further, this committee should give assistance and support to the Secretary to the Executive Director in maintenance and repair procedures.
4. A professional library should be established even if part time workers must share space to accomplish this.
5. Our insurance needs should be re-evaluated.
6. All activities related to food at meetings should be delegated to someone other than the Secretary to the Executive Director.
7. Majority opinion—positions of Administrative Assistant and Bookkeeper will need more time in the future. Minority opinion—positions of Administrative Assistant, Bookkeeper, and Statistical Assistant should be combined.
8. The Personnel Practices Committee should review job descriptions of Bookkeeper and Statistical Assistant and establish salary ranges for those two positions and that of the Administrative Assistant.
9. Dialogue between the Executive Director, his secretary, and the Administrative Assistant should continue in an effort to streamline office procedures and expedite handling of paperwork.
10. The written description of the Personnel Practices Committee should include

Problem solutions of Ch 9 – 10 – 11

Remember your workshop

Revise your project charters
observing lectures
of weeks 8 – 9 – 10

Resources


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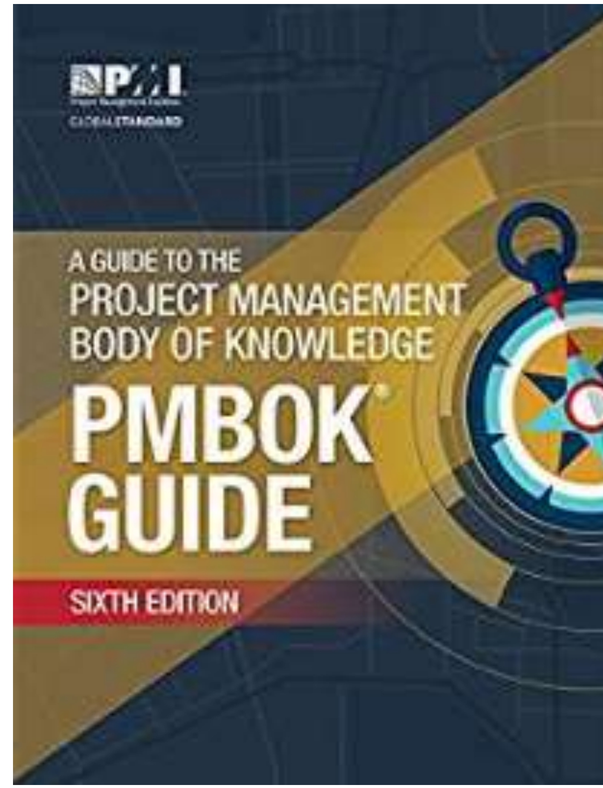
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NEXT WEEK: Project Execution – Project Termination

Problem solutions Ch 9,10,11

ENGR3450 – Project Management

Week 11

The Project Execution

Termination – End of the project

Halil POSACI – Dr. Esra Ekinci

2018, İzmir

YAŞAR ÜNİVERSİTESİ
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Agenda today

- The end of the project
  - Types of ending
  - Ending procedure
  - Final report

  - Problems from Ch 9 – 10 – 11

End of the Project

Projects are temporary endeavors

- The project objectives achieved
- Objective will not or cannot be met
- Funding is exhausted
  Or no longer available for allocation to the project
- The need for the project no longer exist
  The customer no longer want the project completed,
  A change in priority or strategy ends the project
  (the organizational management decides about it)
- The human or physical resources are no longer available
- Termination by a legal cause or convenience

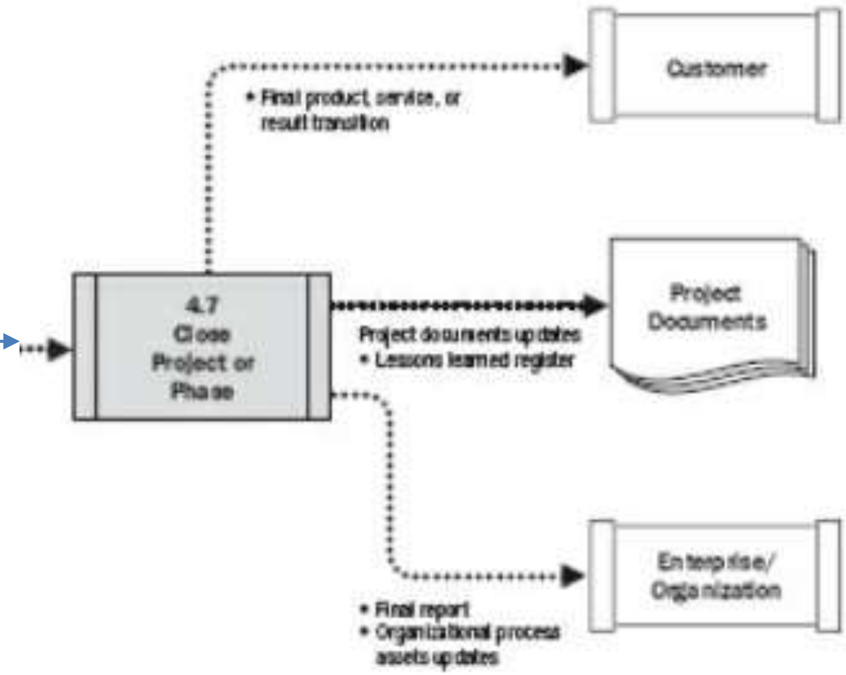
End of the Project

Projects are temporary endeavors

Project Charter

Project Management Plan

Change requests



End of the Project

Projects are temporary endeavors

Close Project or Phase

Inputs

.1 Project charter
.2 Project management plan
- All components

.3 Project documents
- Assumption log
- Basis of estimates
- Change log
- Issue log
- Lessons learned register
- Milestone list
- Project communications
- Quality control measurements
- Quality reports
- Requirements documentation
- Risk register
- Risk report

.4 Accepted deliverables
.5 Business documents
- Business case
- Benefits management plan

.6 Agreements
.7 Procurement documentation
.8 Organizational process assets

Tools & Techniques

.1 Expert judgment
.2 Data analysis
- Document analysis
- Regression analysis
- Trend analysis
- Variance analysis

.3 Meetings

Outputs

.1 Project documents updates
- Lessons learned register

.2 Final product, service, or result transition
.3 Final report
.4 Organizational process assets updates

Figure 4-14. Close Project or Phase: Inputs, Tools & Techniques, and Outputs

End of the Project
Final Report & Lessons Learned

- Summary level description of the project or phase.
- Scope objectives, the criteria used to evaluate the scope, and evidence that the completion criteria were met.
- Quality objectives, the criteria used to evaluate the project and product quality, the verification and actual milestone delivery dates, and reasons for variances.
- Cost objectives, including the acceptable cost range, actual costs, and reasons for any variances.
- Summary of the validation information for the final product, service, or result.
- Schedule objectives including whether results achieved the benefits that the project was undertaken to address. If the benefits are not met at the close of the project, indicate the degree to which they were achieved and estimate for future benefits realization.
- Summary of how the final product, service, or result achieved the business needs identified

End of the Project

Design of Termination

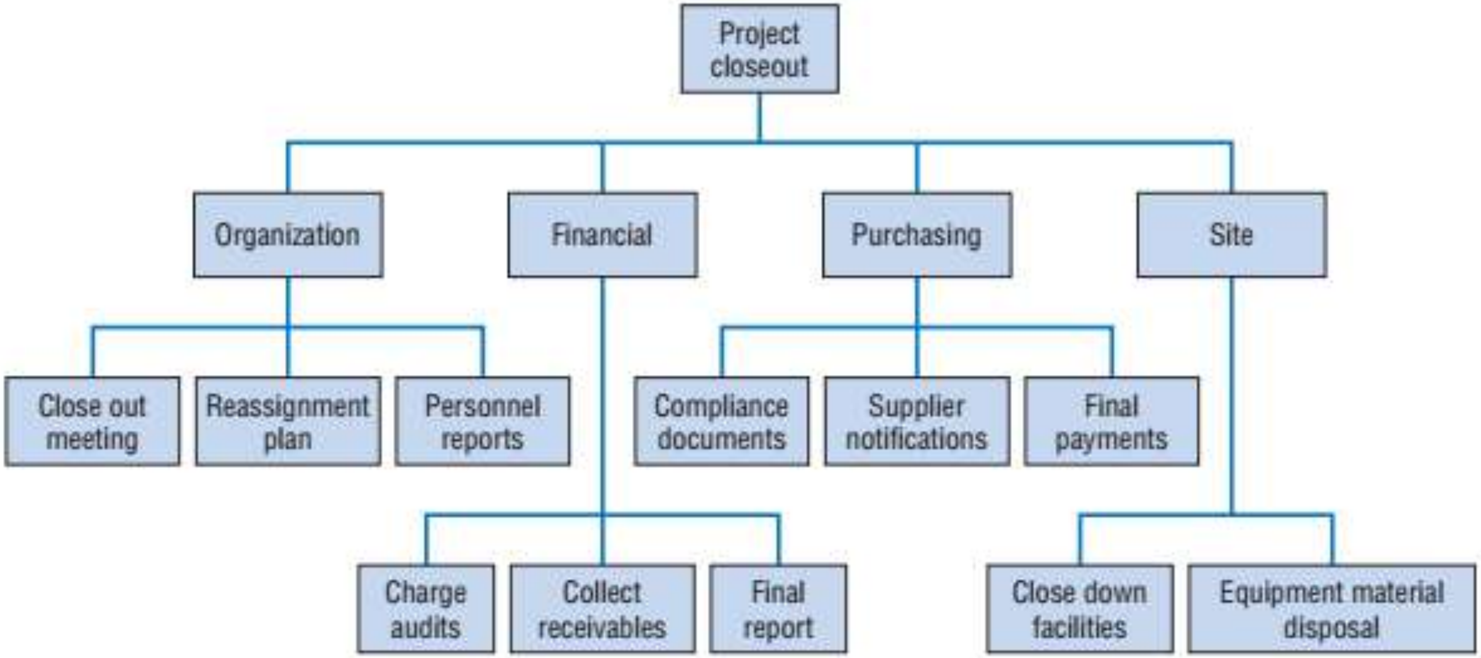


Figure 13-2 Design for project termination.

End of the Project

Use Lean Rules for resources

- Store shortly in a storage
- Use red tag rule for predetermined periods

  Meaning use of deadlines to keep in locations
- Try to send material to locations that can be used

  (follow in those locations by red tag too)
- Sell - transfer or discard if not reusable

End of the Project

Use Checklists

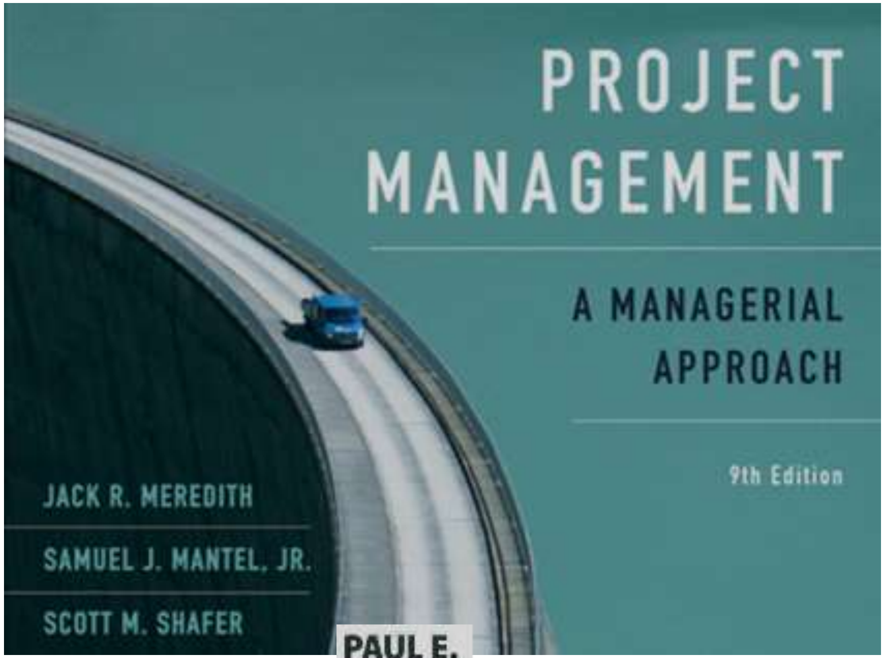
Item No.	Task Description	Required Yes	Required No	Required Date	Assigned Responsibility	PR.	Notes Reference
A.	***Project office (PO) and Project Team (PT) Organization***						
1.	Conduct project close-out meeting						
2.	Establish PO and PT release and reassignment plan						
3.	Carry out necessary personnel actions						
4.	Prepare personal performance evaluation on each PO and PT member						
B.	***Instructions and Procedures*** ***issue instructions for:***						
1.	Termination of PO and PT						
2.	Close-out of all work orders and contracts						
3.	Termination of reporting procedures						
4.	Preparation of final report(s)						
5.	Completion and disposition of project file						
C.	***Financial***						
1.	Close out financial documents and records						
2.	Audit final charges and costs						
3.	Prepare final project financial report(s)						
4.	Collect receivables						
D.	***Project Definition***						
1.	Document final approved project scope						
2.	Prepare final project breakdown structure and enter into project file						
E.	***Plans, Budgets, and Schedules***						
1.	Document actual delivery dates of all contractual deliverable end items						
2.	Document actual completion dates of all other contractual obligations						
3.	Prepare final project and task status reports						
F.	***Work Authorization and Control***						
1.	Close out all work orders and contracts						
G.	***Project Evaluation and Control***						

Problem solutions of Ch 9 – 10 – 11

Revise your project charters
observing lectures
of weeks 8 – 9 – 10 -11

Get ready for your Project Discussions

Resources


PROJECT
MANAGEMENT
A MANAGERIAL
APPROACH
9th Edition
JACK R. MEREDITH
SAMUEL J. MANTEL, JR.
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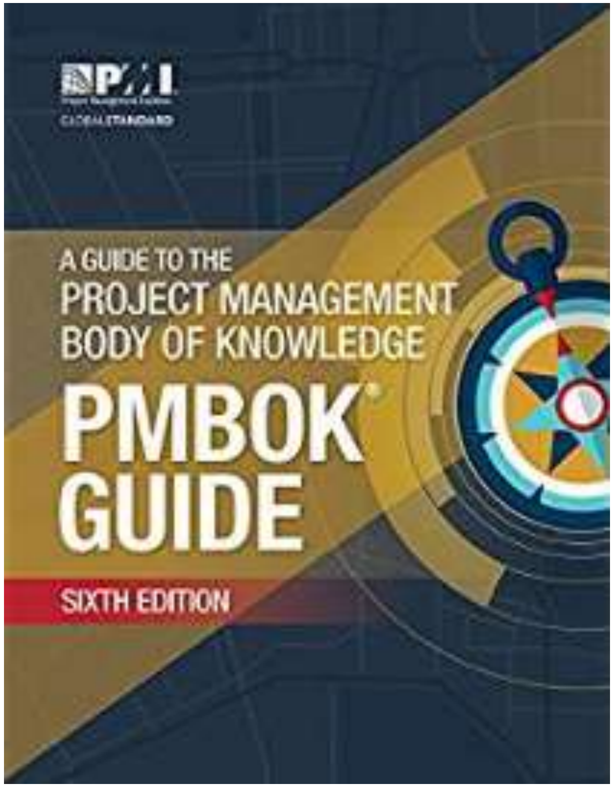
A GUIDE TO THE
PROJECT MANAGEMENT
BODY OF KNOWLEDGE
PMBOK®
GUIDE
SIXTH EDITION


PAUL E.
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PLANNING AND CONTROL USING
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2013 & 2016

Questions

- Questions

hp@quiztechnology.com

NEXT WEEK: Project Discussions of groups A to G
(and volunteer groups too)

THE OTHER WEEK: Remaining Project groups.

Thank you for your success with this course

		Project Management Process Groups				
		Initiating	**Planning**	**Executing**	**Monitoring & Control**	**Closing**
Knowledge Areas	**1. Project Integration Management**	a. Develop Project Charter	b. Develop Project Management Plan	c. Direct and Manage Project Work d. Manage Project Knowledge	e. Monitor and Control Project Work f. Perform Integrated Change Control	g. Close Project or Phase
	2. Project Scope Management		a. Plan Scope Management b. Collect Requirements c.Define Scope d. Create WBS		e. Validate Scope f. Control Scope	
	3. Project Schedule Management		a. Plan Schedule Management b. Define Activities c. Sequence Activities d. Estimate Activity Durations e. Develop Schedule		f. Control Schedule	
	4. Project Cost Management		a. Plan Cost Management b. Estimate Costs c. Determine Budget		d. Control Costs	
	5. Project Quality Management		a. Plan Quality Management	b. Manage Quality	c. Control Quality	
	6. Project Resource Management		a. Plan Resource Management b. Estimate Activity Resources	c. Acquire Resources d. Develop Team e. Manage Team	f. Control Resources	
	7. Project Communcations Management		a. Plan Communcations Management	b. Manage Communications	c. Monitor Communications	
	8. Project Risk Management		a. Plan Resource Management b. Identify Risks c. Perform Qualitative Risk Analysis d. Perform Quantitative Risk Analysis e. Plan Risk Responses	f. Implement Risk Responses	g. Monitor Risks	
	9. Project Procurement Management		a. Plan Procurement Management Plan	b. Conduct Procurements	c. Control Procurements	
	10. Stakeholder Management	a. Identify Stakeholders	b. Plan Stakeholder Engagement	c. Manage Stakeholder Engagement	d. Monitor Stakeholder Engagement	