FUNDAMENTALS OF
PROJECT
MANAGEMENT

SIXTH EDITION

REVISED AND UPDATED

JOSEPH HEAGNEY

AN OVERVIEW OF PROJECT MANAGEMENT

[FIGURE 1-1]

TRIANGLES SHOWING THE RELATIONSHIPS AMONG P, C, T, AND S
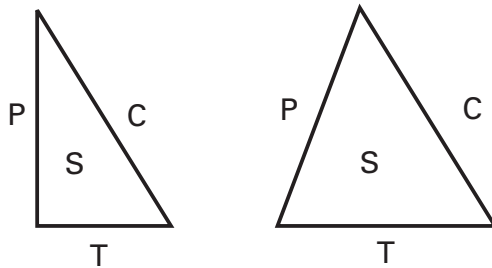
[FIGURE 1-2]

LIFE CYCLE OF A TROUBLED PROJECT
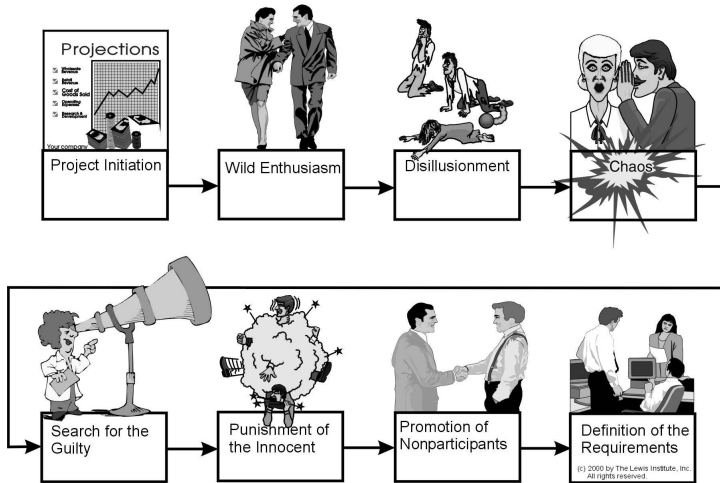
[FIGURE 1-3]

APPROPRIATE PROJECT LIFE CYCLE

CONCEPT	DEFINITION	PLANNING	EXECUTION	CLOSEOUT
Marketing Input Survey of Competition	Define Problem Develop Vision Write Mission Statement	Develop Strategy Implementation Planning Risk Management	Do All Work Monitor Progress Corrective Action	Final Reports Lessons-Learned Review

EFFORT EXPENDED IN PLANNING
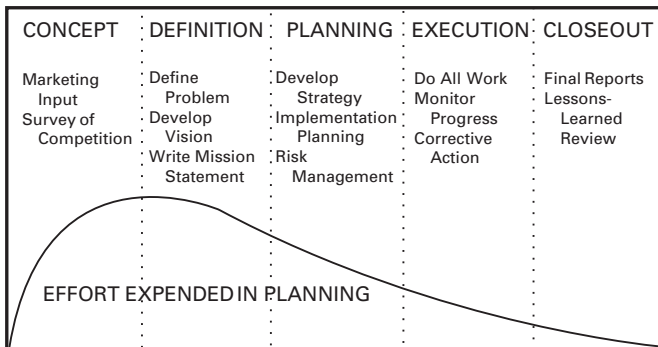
[FIGURE 1-4]

THE STEPS IN MANAGING A PROJECT

Define the Problem

Develop Solution Options

Plan the Project

What must be done?
Who will do it?
How will it be done?
When must it be done?
How much will it cost?
What do we need to do it?

Execute the Plan

Monitor & Control Progress

Are we on target?
If not, what must be done?
Should the plan be changed?

Close the Project

What was done well?
What should be improved?
What else did we learn?

EXERCISES

1. Project management is not just:
    a. Planning.
    b. Rework.
    c. Scheduling.
    d. Controlling.
2. The problem with being a working project manager is that, in a conflict between working and managing:
    a. You don't know what priorities to set.
    b. Your boss will think you're slacking off.
    c. There will never be enough time to do both.
    d. The work will take precedence, and managing will suffer.
3. The *PMBOK® Guide* refers to:
    a. The body of knowledge identified by PMI as needed by project managers to be effective.
    b. A test administered by PMI to certify project managers.
    c. An acronym for a special kind of risk analysis, like FMEA (Failure Mode and Effects Analysis).
    d. None of the above.
4. Project scope defines:
    a. A project manager's line of sight to the end date.
    b. The magnitude or size of the job.
    c. How often a project has been changed.
    d. The limits of a project manager's authority.

PLANNING THE PROJECT

[FIGURE 3-1]

TWO PAIN CURVES IN A PROJECT OVER TIME
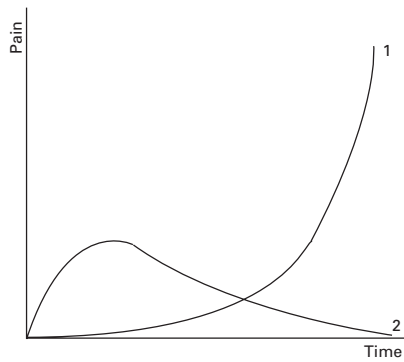
[FIGURE 3-2]

PLANNING IS ANSWERING QUESTIONS

EXERCISE

We have talked about strategy, tactics, and logistics.

Which must be decided first?

a. Strategy
b. Tactics
c. Logistics
d. Does not matter

What is the function of tactics?

When would you plan for logistics?

INCORPORATING STAKEHOLDER MANAGEMENT IN THE PROJECT PLANNING PROCESS

[FIGURE 4-1]

THE STAKEHOLDER GRID
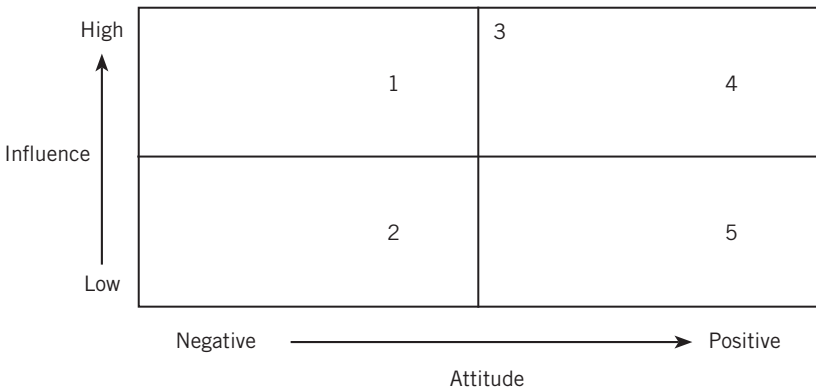
[FIGURE 4-2]

THE STAKEHOLDERS ENGAGEMENT ASSESSMENT MATRIX

Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
Stakeholder 1	C			D	
Stakeholder 2			C	D	
Stakeholder 3				D C	

KEY:

Unaware. Unaware of project and potential impact.

Resistant. Aware of project and potential impacts and resistant to change.

Neutral. Aware of project yet neither supportive nor resistant.

Supportive. Aware of project and potential impacts and supportive to change.

Leading. Aware of project and potential impacts and actively engaged in ensuring the project is a success.

C = Current engagement

D = Desired engagement

[FIGURE 4-3]

AUDIENCE GUIDE TO KNOWLEDGE AND COMMUNICATION

Audience Guides	Knowledge Level	Communication
Project Manager	• Deeply knowledgeable about project/subject—knows technical terms, jargon, and acronyms.	• Acceptable to use jargon and acronyms and not explain terms.
Client SMEs and Client PM	• Fairly knowledgeable about project/subject. Some knowledge about project process but not all technical terms.	• Translate technical language into project language. • Include a glossary of project/technical terms.
Project Sponsors	• Have big picture. • Not focused on details. • Very limited to understanding of technical jargon.	• They are most concerned about hitting project goals and vision. • Less technical jargon and detail required.
Everyone Else (End Users, etc.)	• Know how things currently work. • No real project knowledge.	• Translate terms. • Communicate vision and goals. • Avoid technical terms.

[FIGURE 4-4]

THE FIVE CULTURAL DIMENSIONS

Dimension	Cultures Scoring Low	Cultures Scoring High
1. Power	Rely on consensus to make decisions.	Rely on hierarchical structures to make decisions.
2. Uncertainty Avoidance	Are comfortable with ambiguous or unknown situations.	Feel threatened by ambiguous or unknown situations. Prefer structure and predictability.
3. Individualism	Value the team above the individual.	Value autonomy. Put the individual's needs ahead of the team's.
4. Assertiveness	Tend to be more modest.	Tend to self-promote.
5. Time Perspective	Look to what provides immediate benefits.	Look to what will benefit the organization in the long run.

DEVELOPING A MISSION, VISION, GOALS, AND OBJECTIVES FOR THE PROJECT

[**FIGURE 5-1**]

CHEVRON SHOWING MISSION, VISION, AND PROBLEM STATEMENT

Problem: I have no place to live.		
MUSTS	WANTS	NICE
3 bedrooms 2,500 sq. ft. 2-car garage 1-acre lot large family room	room for home office basement	fireplace in family room

Mission:
   To find a place that meets all musts and as many of the others as possible.

[FIGURE 5-2]

RISK ANALYSIS EXAMPLE

What could go wrong?	Contingency
1. Exposure wrong	Bracket the exposure
2. Shots unacceptable	Take extra photos
3. Film lost or damaged	Hand-carry to client
4. Weather delays	Allow extra time

EXERCISE

Choose a project that you are going to do or perhaps have just started. Answer the questions that follow to the best of your ability. If you need to confer with others to answer some of them, fine. Remember, the people who have to follow the plan should participate in preparing it.

► What are you trying to achieve with the project? What need does it satisfy for your customer? Who exactly is actually going to use the finished project deliverable(s)? (That is, who is your real customer?) What will distinguish your deliverable from those already available to the customer?
► Write a problem statement on the basis of your answers to the first question. What is the gap between where you are now and where you want to be? What obstacles prevent easy movement to close the gap?
► Write a mission statement, answering the two basic questions:
   1. "What are we going to do?"
   2. "For whom are we going to do it?"

Talk to your customer about these issues. Do not present your written statements to her. Instead, see whether you can get confirmation by asking open-ended questions. If you can't, you may have to revise what you have written.

CREATING THE PROJECT RISK AND COMMUNICATION PLANS

RISK ASSESSMENT TABLE

Risk	Probability	Negative Impact
A	M	L
B	M	M
C	L	L
D	H	H

NUMBER-BASED RISK ASSESSMENT TABLE

Risk	Probability		$ Impact		Total
A	3	×	1K	=	3K
B	7	×	1K	=	7K
C	2	×	14K	=	28K
D	5	×	3K	=	15K

[FIGURE 6-1]
RISK MATRIX
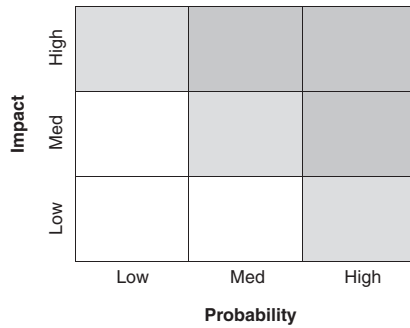
Probability

[FIGURE 6-2]
RISK REGISTER

ID	Risk	Outcome/Response	Owner	P	I	Active

P = Probability **I = Imapct**

Source: The American Management Association seminar, "Improving Your Project Management Skills: The Basics for Success"

[FIGURE 6-3]

COMMUNICATION PLAN

ID	Description	Owner	Medium	Frequency	To Whom
1	Management status report	Nicolle	Meeting	Monthly	Sponsor
2	Team member status collection	Kyle	One-on-one	Bi-weekly	PM
3	Detailed project plan	Sue	Share drive	On-demand	Requester

EXERCISE

Choose one of your current or recent projects, and practice the Six-Step Process. Make a list of potential risks to the project and prioritize each, utilizing H-M-L or a simple metric-based scale. Pick any three risks and establish:

► Preventive measures
► Contingencies
► Trigger points

Two or three bullet points for each should suffice.

USING THE WORK BREAKDOWN STRUCTURE TO PLAN A PROJECT

[FIGURE 7-1]

WBS DIAGRAM TO CLEAN A ROOM

[FIGURE 7-2]
WBS LEVEL NAMES

1. Program
2. Project
3. Task
4. Subtask
5. Work Package
6. Level of Effort

[FIGURE 7-3]
PARTIAL WBS

Design Airplane

Design Wing

Design Engine

Design Avionics
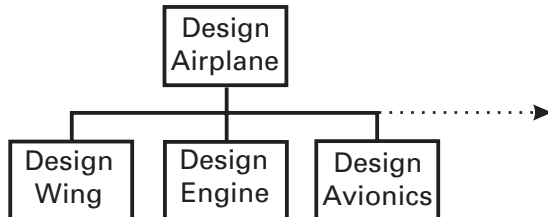
[FIGURE 7-4]

RESPONSIBILITY CHART

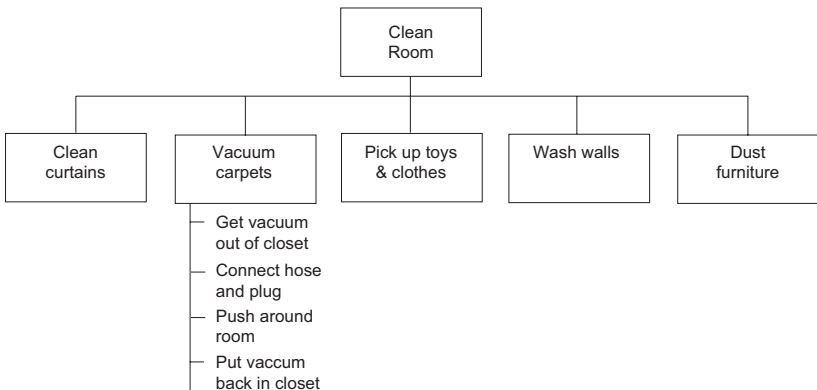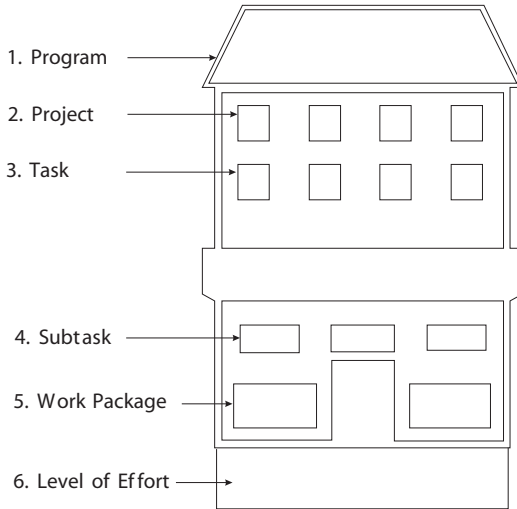| Linear Responsibility Chart															
Project:			Date Issued:					Sheet Number:				of			
Manager:			Date Revised:					Revision No.				File: LRCFORM.61			
			Project Contributors												
Task Descriptions															
CODES: 1 = ACTUAL RESPONSIBILITY; 2 = SUPPORT; 3 = MUST BE NOTIFIED; BLANK = NOT INVOLVED															

[FIGURE 7-5]

HUMAN PRODUCTIVITY

Productivity Factor	Hours	Cost/Hour	Labor Cost	Duration
Base Estimate	40	$75	$3,000	5.00
Project Loss (15%)	6	$75	$450	0.75
Rework/Debug (10%)	4	$75	$300	0.50
Subtotal (Direct Cost)	50	$75	$3,750	6.25
Labor Overhead	6	-	-	0.75
Total For Scheduling	**56**	**-**	**-**	**7.00**

© American Management Association

[FIGURE 7-6]

TIME, COST, RESOURCE TRADE-OFF

Labor Hours Needed

As a person's time is split, time is lost in stopping and restarting.

As the number of people increases, communication and conflict increase.

Number of People Assigned
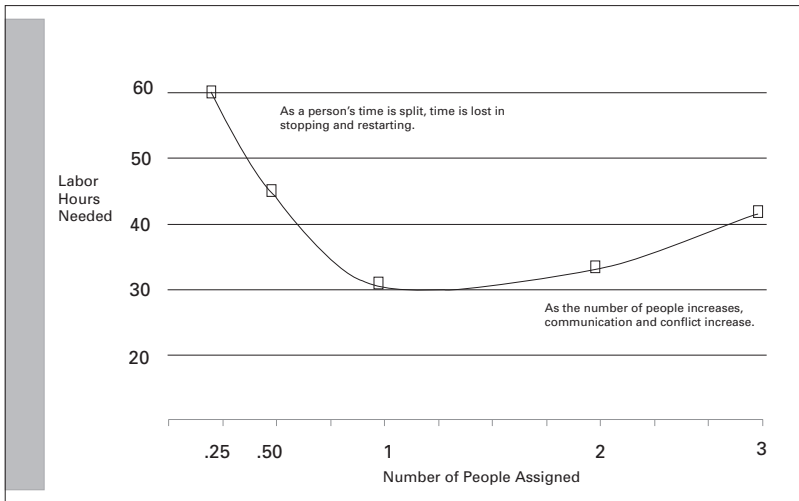
[FIGURE 7-7]

CALCULATING THE STANDARD AVERAGE

Improving Accuracy Using Three-Point Estimates

$$\text{Standard average} = \frac{O + ML + P}{3}$$

Key: O = Optimistic estimate | ML = Most likely estimate | P = Pessimistic estimate

[FIGURE 7-8]

CALCULATING THE PERT WEIGHTED AVERAGE

Improving Accuracy Using Three-Point Estimates

$$(\text{PERT}) \text{ weighted average} = \frac{O + 4ML + P}{6}$$

Key: O = Optimistic estimate | ML = Most likely estimate | P = Pessimistic estimate

EXERCISE

Following is a list of tasks to be performed in preparation for a camping trip. Draw a WBS that places the tasks in their proper relationship to one another. The solution can be found in the Answers section.

- Arrange for supplies and equipment.
- Select campsite.
- Make site preparations.
- Make site reservation.
- Arrange time off from work.
- Select route to site.
- Prepare menu for meals.
- Identify source of supplies and equipment.
- Load car.
- Pack suitcases.
- Purchase supplies.
- Arrange camping trip (project).

SCHEDULING PROJECT WORK

[FIGURE 8-1]

BAR CHART
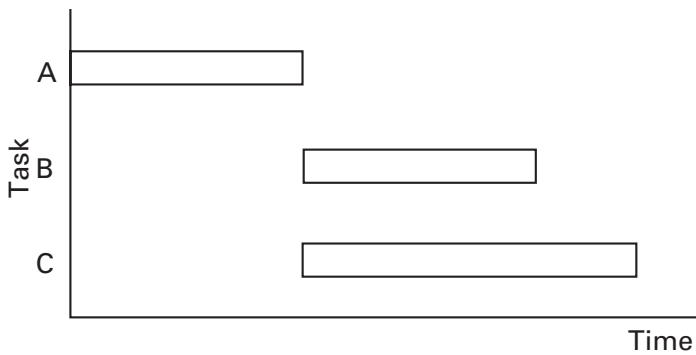
[FIGURE 8-2]
ARROW DIAGRAMS

An activity-on-node network
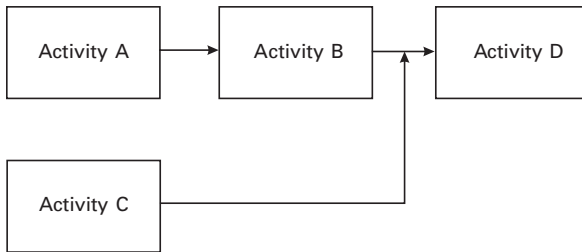
An activity-on-arrow network
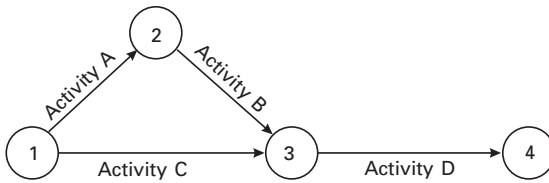
[FIGURE 8-3]
WBS TO DO YARD PROJECT
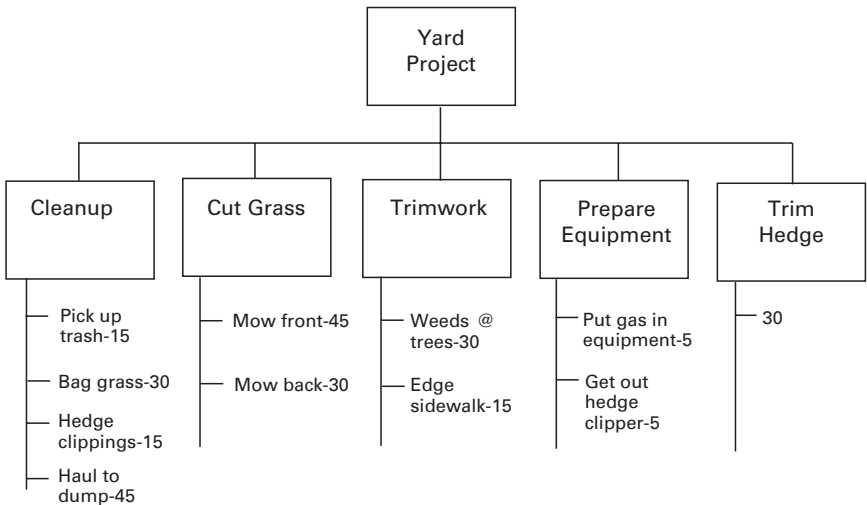
[FIGURE 8-4]

CPM DIAGRAM FOR YARD PROJECT
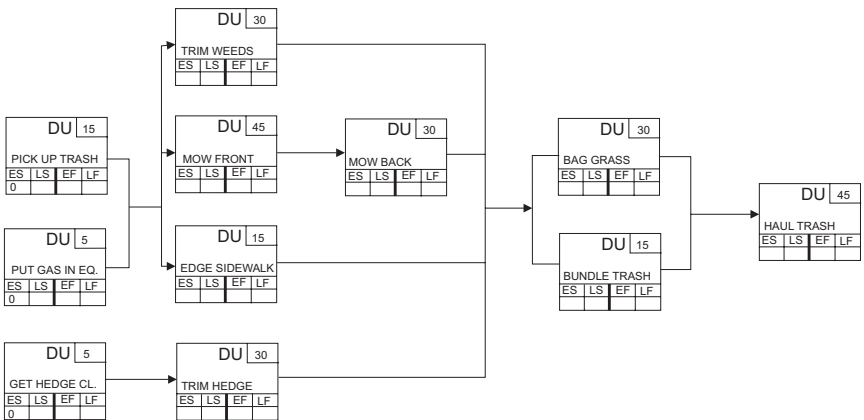
EXERCISE

For the following WBS (figure 8-5), draw an arrow diagram. One solution is shown in the Answers section.

WBS TO CLEAN ROOM

PRODUCING A WORKABLE SCHEDULE

[FIGURE 9-1]

NETWORK TO ILLUSTRATE COMPUTATION METHODS

[FIGURE 9-1]

NETWORK TO ILLUSTRATE COMPUTATION METHODS

TRIM WEEDS — DU 30

ES	LS	EF	LF
15		45	

PICK UP TRASH — DU 15

ES	LS	EF	LF
0		15	

MOW FRONT — DU 45

ES	LS	EF	LF
15		60	

MOW BACK — DU 30

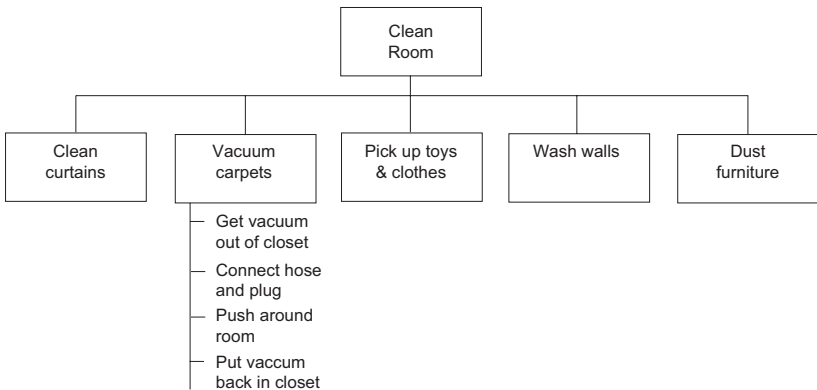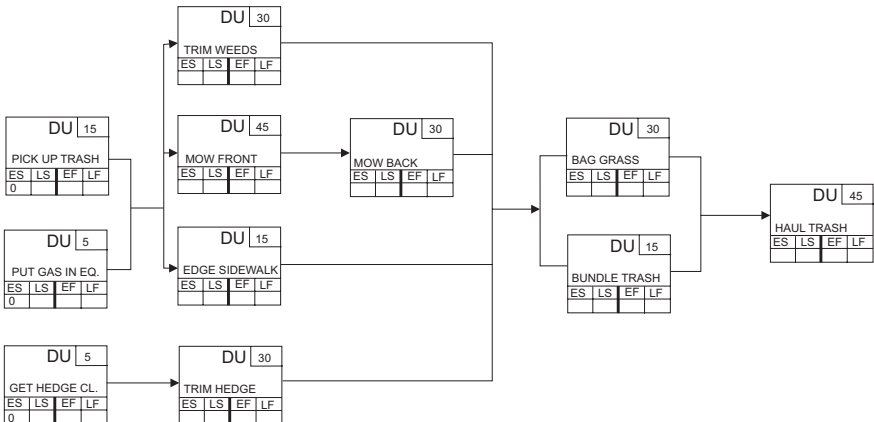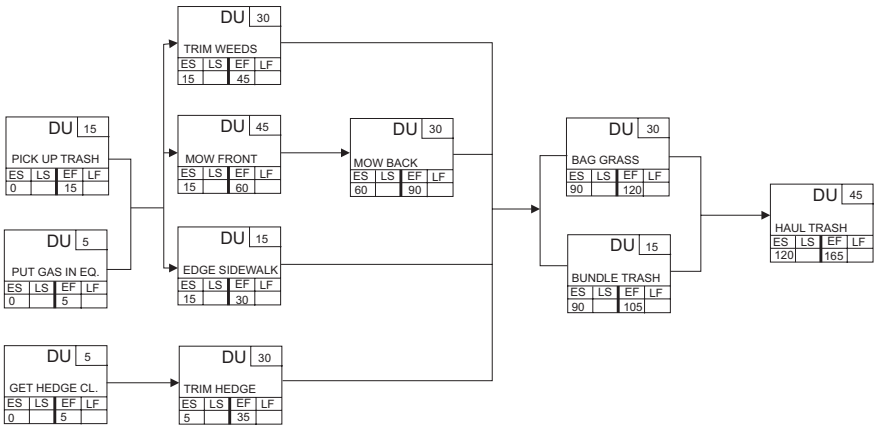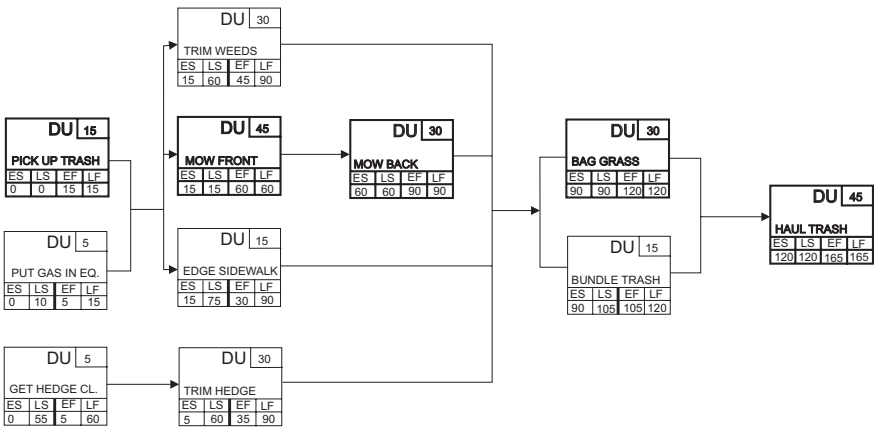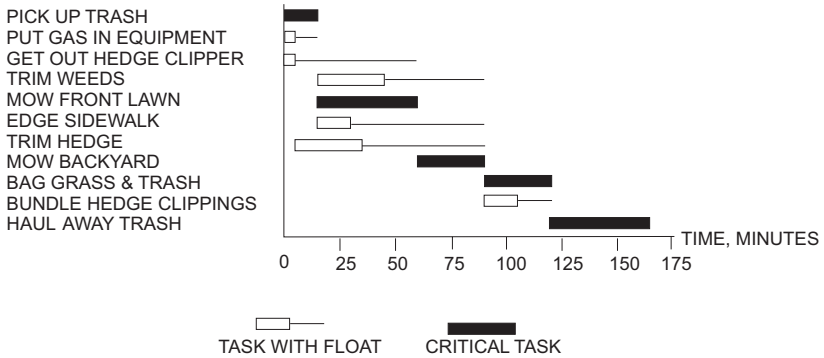| ES	LS	EF	LF
60		90	

BAG GRASS — DU 30

ES	LS	EF	LF
90		120	

HAUL TRASH — DU 45

ES	LS	EF	LF
120		165	

PUT GAS IN EQ. — DU 5

ES	LS	EF	LF
0		5	

EDGE SIDEWALK — DU 15

ES	LS	EF	LF
15		30	

BUNDLE TRASH — DU 15

ES	LS	EF	LF
90		105	

GET HEDGE CL. — DU 5

ES	LS	EF	LF
0		5	

TRIM HEDGE — DU 30

ES	LS	EF	LF
5		35	

[FIGURE 9-3]

DIAGRAM SHOWING CRITICAL PATH

TRIM WEEDS — DU 30

ES	LS	EF	LF
15	60	45	90

PICK UP TRASH — DU 15

ES	LS	EF	LF
0	0	15	15

MOW FRONT — DU 45

ES	LS	EF	LF
15	15	60	60

MOW BACK — DU 30

ES	LS	EF	LF
60	60	90	90

BAG GRASS — DU 30

ES	LS	EF	LF
90	90	120	120

HAUL TRASH — DU 45

ES	LS	EF	LF
120	120	165	165

PUT GAS IN EQ. — DU 5

ES	LS	EF	LF
0	10	5	15

EDGE SIDEWALK — DU 15

ES	LS	EF	LF
15	75	30	90

BUNDLE TRASH — DU 15

ES	LS	EF	LF
90	105	105	120

GET HEDGE CL. — DU 5

ES	LS	EF	LF
0	55	5	60

TRIM HEDGE — DU 30

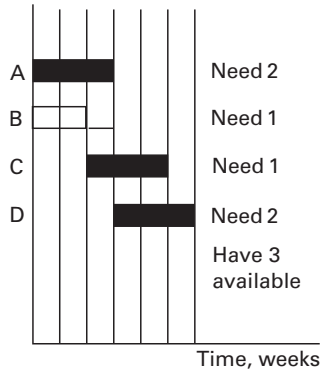| ES	LS	EF	LF
5	60	35	90

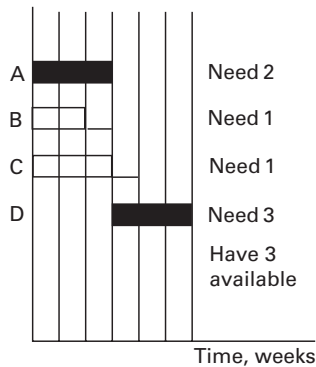[FIGURE 9-4]

BAR CHART SCHEDULE FOR YARD PROJECT

[FIGURE 9-5]

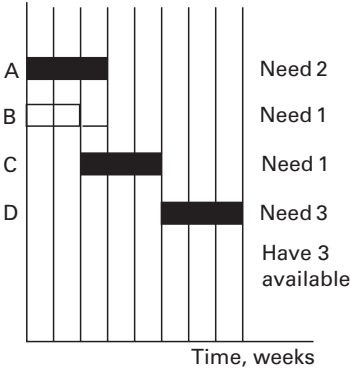SCHEDULE WITH RESOURCES OVERLOADED
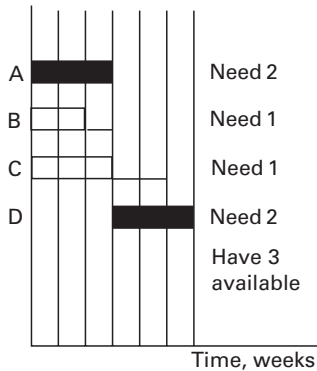
[**FIGURE 9-6**]

SCHEDULE USING FLOAT TO LEVEL RESOURCES

[**FIGURE 9-7**]

SCHEDULE WITH INADEQUATE FLOAT ON C TO PERMIT LEVELING

[**FIGURE 9-8**]

SCHEDULE UNDER RESOURCE-CRITICAL CONDITIONS
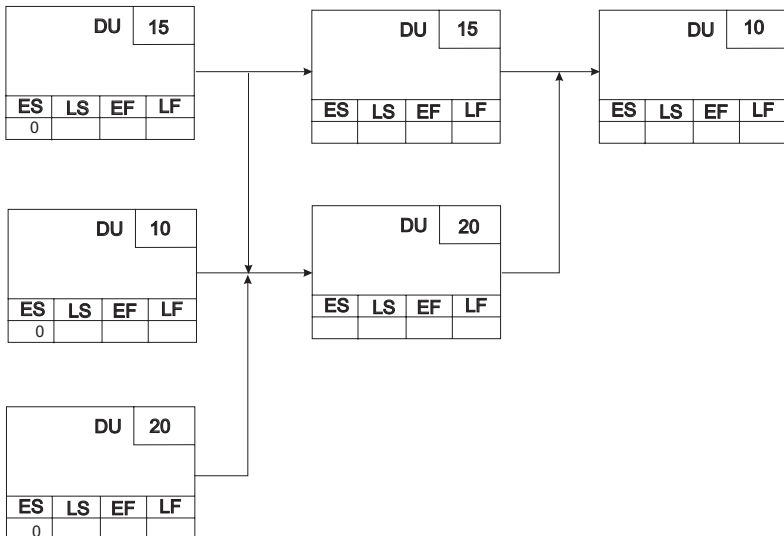

Time, weeks

EXERCISE

For the network in figure 9-9, calculate the early and late times and the float available on noncritical activities. Which activities form the critical path? Answers are in the Answers section.
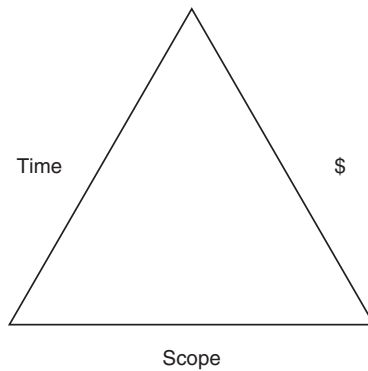
[FIGURE 9-9]

NETWORK FOR EXERCISE

THE CHANGE CONTROL PROCESS

[FIGURE 11-1]
TRIPLE CONSTRAINTS TRIANGLE

Time $

Scope

[FIGURE 11-2]

PROJECT CHANGE CONTROL FORM

Project No.: 710   **Task No.:** 16   **Revision No.:** 1   **Date Revised:** 8/13/2021

Objective Statement:
Relocation of the accounting department to suitable and renovated quarters for 22 persons within the same building no later than December 31, 2021.

Description of Change:
Site #2 will not be available for evaluation until August 21 or 22. This will cause a two-day delay in the evaluation of all sites. This change will probably not cause a delay to the project but may delay the final site decision by one day.

Reason for Change:
The site will not be available for review and evaluation due to major corporate planning sessions that will consume that space for two days.

Schedule Change Information

Task No.	Task	Orig. Start Date	Orig. Comp. Date	New Start Date	New Comp. Date
16	Evaluate Site #2	8/15/21	8/20/21	8/17/21	8/22/21

Estimated Costs:

Approvals

Project Manager: Mr. Bill Boyd	**Date:** 8/11/21
Task Manager: Mr. Dan O'Brien	**Date:** 8/12/21
Functional Manager:	**Date:**
Senior Manager:	**Date:**

[**FIGURE 11-3**]

PROJECT CHANGE CONTROL LOG

Change Number	Date of Change	Description of Change	Requested by	Status O/C	Schedule Impact	Budget Impact	Comments
1	8/12/21	Site #2 not available on 2/21	Jim Morrison		2 days	N/A	

EXERCISE

Identify a recent change to a project of yours that required a response. On the basis of what you've learned in this chapter, answer the following questions:
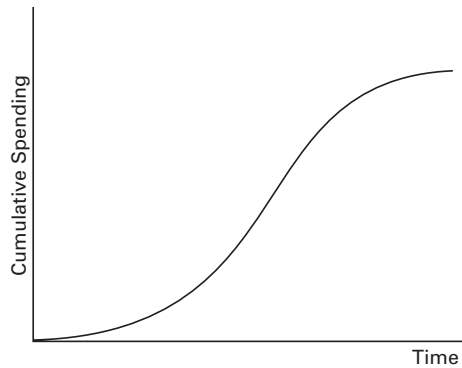
1. Is it appropriate to accept the change?
2. Should a change control document be triggered?
3. How did this change impact the project triangle?
4. To whom should the response be communicated?
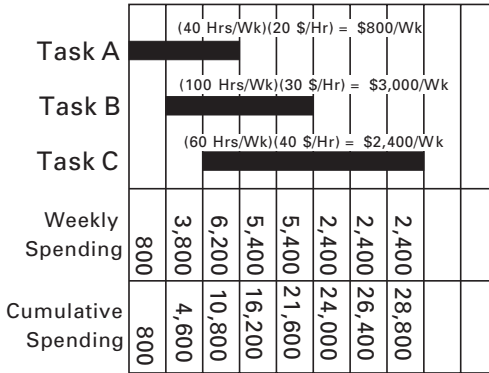5. What change thresholds are appropriate to establish for this project?

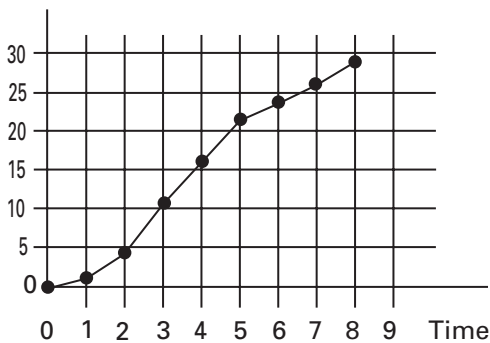# PROJECT CONTROL USING EARNED VALUE ANALYSIS

[FIGURE 12-1]

BCWS CURVE

[FIGURE 12-2]

BAR CHART SCHEDULE ILLUSTRATING CUMULATIVE SPENDING

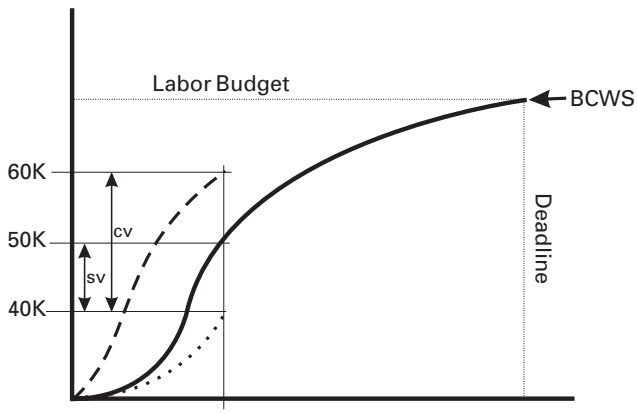|										
Task A	▬▬▬	(40 Hrs/Wk)(20 $/Hr) = $800/Wk								
Task B		▬▬▬▬	(100 Hrs/Wk)(30 $/Hr) = $3,000/Wk							
Task C			▬▬▬▬▬▬	(60 Hrs/Wk)(40 $/Hr) = $2,400/Wk						
Weekly Spending	800	3,800	6,200	5,400	5,400	2,400	2,400	2,400		
Cumulative Spending	800	4,600	10,800	16,200	21,600	24,000	26,400	28,800		

[FIGURE 12-3]

CUMULATIVE SPENDING FOR THE SAMPLE BAR CHART

[FIGURE 12-4]

PLOT SHOWING PROJECT BEHIND SCHEDULE AND OVERSPENT
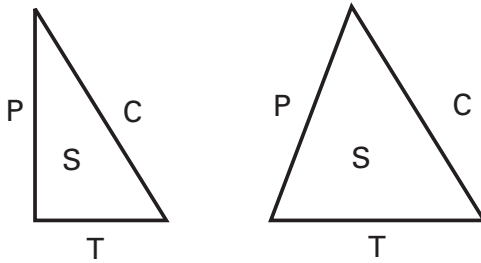

[FIGURE 12-5]

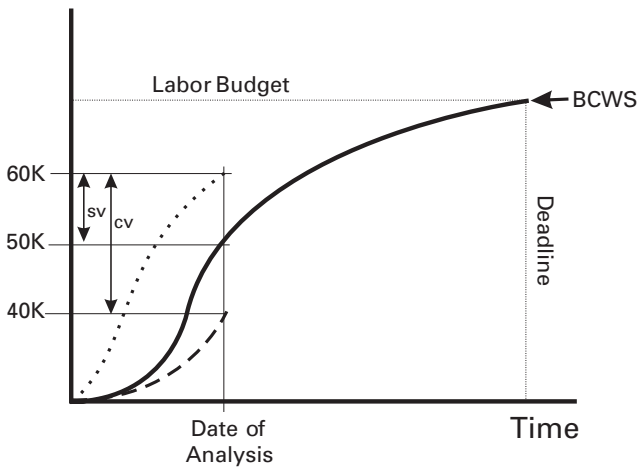PROJECT AHEAD OF SCHEDULE, SPENDING CORRECTLY
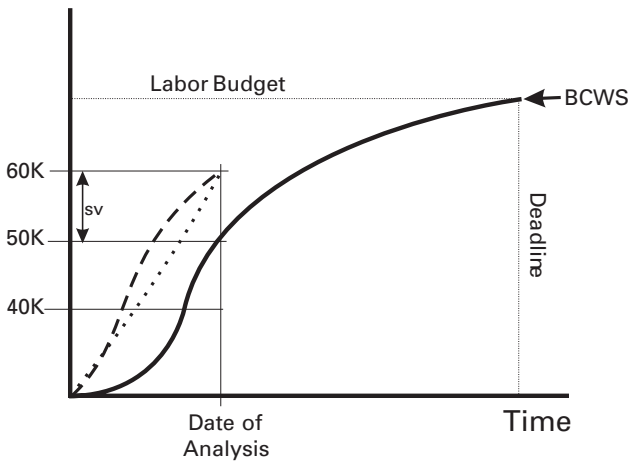
[FIGURE 12-6]

PROJECT IS BEHIND SCHEDULE BUT SPENDING CORRECTLY

The relationships of P, T, C, and S

[FIGURE 12-7]

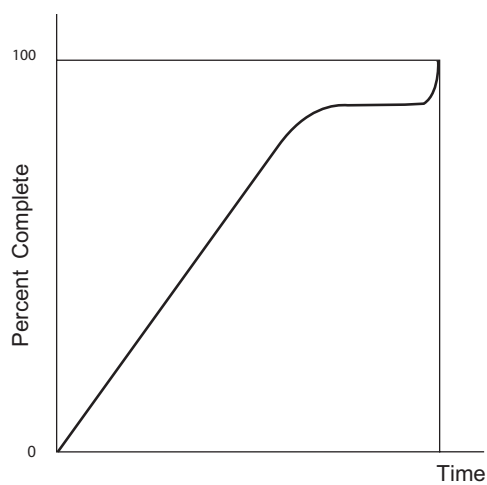**PROJECT IS AHEAD OF SCHEDULE AND UNDERSPENT**

cv = cost variance   – – – – – ACWP
sv = schedule variance   · · · · · · · · · BCWP

[FIGURE 12-8]

PERCENTAGE COMPLETE CURVE

EXERCISE

Consider the report in figure 12-9, showing earned value figures for a project. Answer the questions by analyzing the data. Answers are provided in the Answers section.

1. Is the task ahead or behind schedule? By how much?
2. Is the task overspent or underspent? By how much?
3. When the task is completed, will it be overspent or underspent?

[FIGURE 12-9]

EARNED VALUE REPORT

WBS #	Cumulative-to-date			Variance		At Completion		
	BCWS	BCWP	ACWP	SCHED.	COST	BUDGET	L. EST.	VARIANCE
301	800	640	880	−160	−240	2,400	2,816	−416

CHAPTER 14

....

THE PROJECT MANAGER AS LEADER

[FIGURE 14-1]

LEADERSHIP STYLE AND ALIGNMENT

	Project Scenario 1	
Your	Project Scenario 2	**Stakeholder**
Leadership		**Behavioral**
Style	Project Scenario 3	**Characteristics**
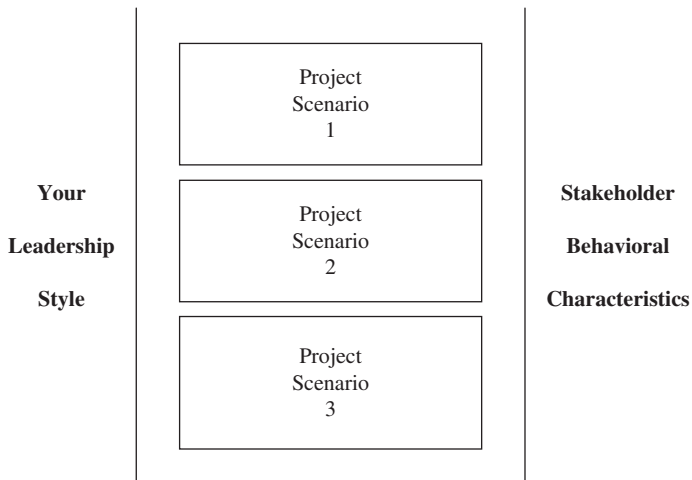
[FIGURE 14-2]

THE GAP ANALYSIS

CURRENT STATE	GAPS	DESIRED STATE
	ACTION PLAN	

[**FIGURE** 14-3]

VIRTUAL DECISION MATRIX

FEATURES	VIRTUAL PLATFORMS				
	A	B	C	D	E
Immersive	X				
Size		X		X	X
Chat		X	X		
Messaging		X	X		
Screen Sharing	X	X	X	X	
Breakout Rooms	X			X	X
Constraints					
Cost	H	M	M	L	L
Training	M	M	H	M	L
Approvals	Y	Y	Y	N	N

X = Satisfies Requirements

H-M-L = High / Med / Low

Y/N = Yes / No

Remember to customize your matrix as appropriate

EXERCISE

Analyze the project environment in your organization.

► Make a list of ten important project leadership characteristics that help ensure success.

► From that list, identify the three most important characteristics.

► Then, contrast the list with your own abilities.

Which characteristics are your strongest?

Which areas may need improvement?

CLOSING THE PROJECT

[FIGURE 15-1]

LESSONS-LEARNED ANALYSIS

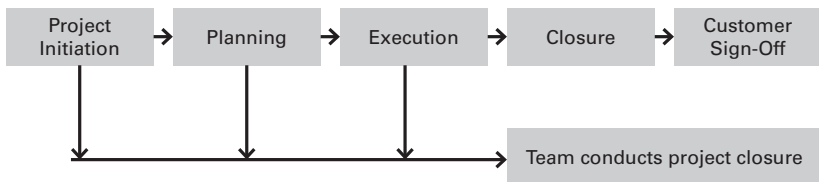| ID	Type	Item	Description	Comments
1	Improve	Communications	More frequent status updates are required; correspondence must be more efficient.	Create common plan.
2	Improve	PERT duration estimates (See chapter 7)	Schedule estimates were overly optimistic.	Adjust PERT duration estimates for better accuracy.
3	Embrace	Risk management	Most risks were captured by the risk management plan; contingency plans were effective and implemented in a timely manner.	N/A
4	Embrace	WBS construction	Project scope was well defined—limited scope creep.	N/A

[FIGURE 15-2]

PROJECT CLOSURE CHECKLIST

Item	Owner	Action	Status
1	Steven	Internal documentation complete/archived	X
2	Laurie	All change requests have been closed/archived	?
3	Rocco	All financials closed out	X
4	Rocco	All project contracts are closed	X
5	Molly	All technical documentation is complete	X
6	Project Manager	Client/customer signs off on project deliverables	X
7	Steven	Project celebration has been scheduled	X

X = Completed

? = Unknown

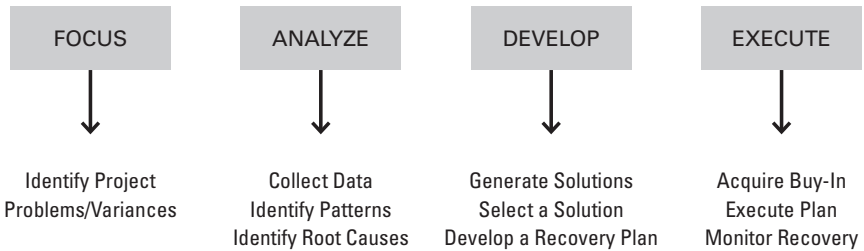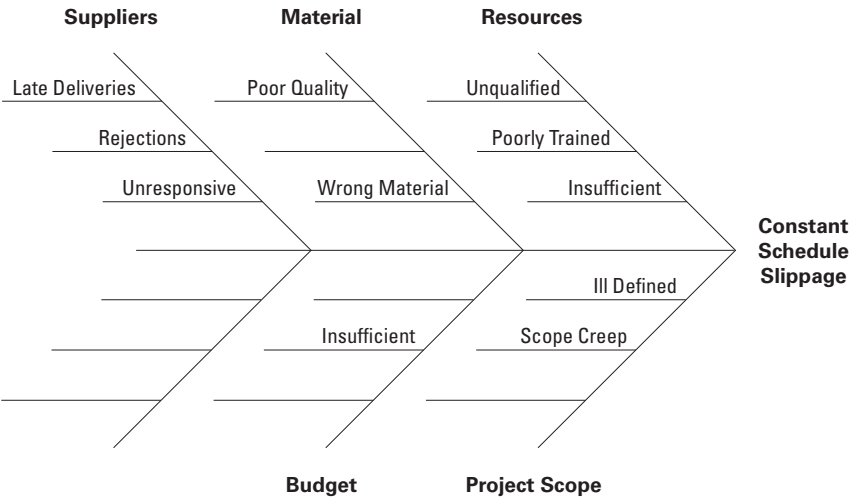**[FIGURE 15-3]**

EARLY TERMINATION/CANCELLATION CHART

PROJECT RECOVERY

[FIGURE 16-1]
THE FADE PROCESS

FOCUS	ANALYZE	DEVELOP	EXECUTE
↓	↓	↓	↓
Identify Project Problems/Variances	Collect Data Identify Patterns Identify Root Causes	Generate Solutions Select a Solution Develop a Recovery Plan	Acquire Buy-In Execute Plan Monitor Recovery

[**FIGURE 16-2**]

THE FISHBONE DIAGRAM

Suppliers

Late Deliveries

Rejections

Unresponsive

Material

Poor Quality

Wrong Material

Insufficient

Resources

Unqualified

Poorly Trained

Insufficient

Ill Defined

Scope Creep

Constant Schedule Slippage

Budget

Project Scope

ANSWERS TO EXERCISES

Chapter 1

1. c
2. d
3. a
4. b

Chapter 3

You should decide on project strategy before you begin implementation planning. At that point, you should develop tactics to execute strategy and plan logistics so that people will have what they need to execute the tactics.

Chapter 5

Check your work for:
　　Prioritization factors: probability and impact.

Remember:
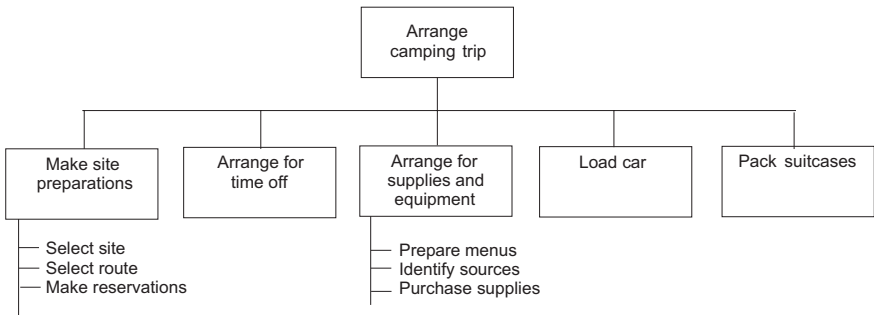　　Some risks cannot be prevented, but they can be mitigated.
　　Your contingencies should represent specific actions if the
　　　　risk occurs.
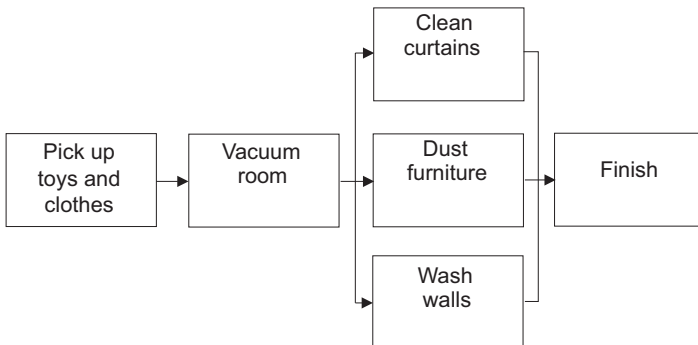　　Your trigger points should relate directly to a contingency.

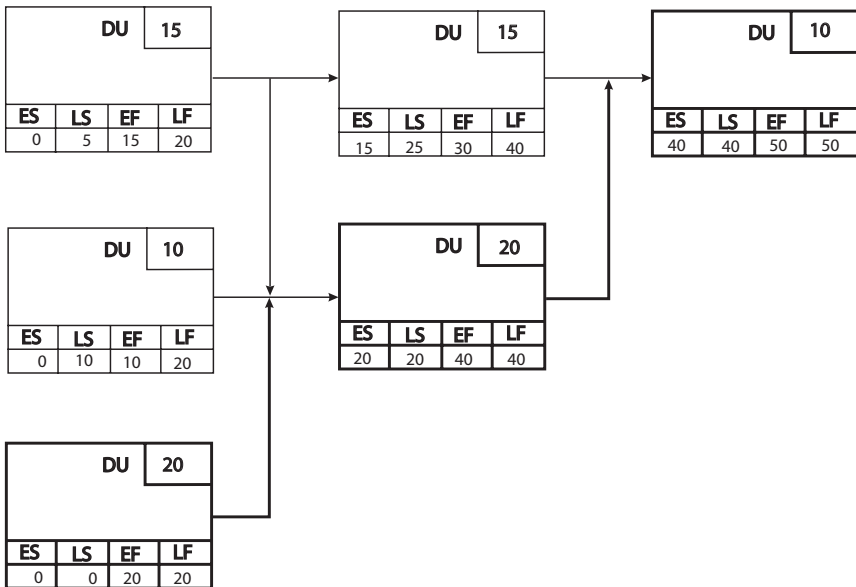WBS for camping trip:

Chapter 8

Solution to the WBS exercise:

[FIGURE A-2]

ARROW DIAGRAM FOR HOUSE CLEANING

Solution to the scheduling exercise:

[FIGURE A-3]
SOLUTION FOR SCHEDULING EXERCISE

Chapter 11

Refer to the chapter to check your responses regarding a change to your project.

Chapter 12

1. It is behind schedule by $160 worth of work.
2. It is overspent by $240.
3. It will be overspent by $416.

You can use this exercise as you would a post-project "lessons-learned analysis." Reinforce your strongest project leadership characteristics—work to improve characteristics where you are deficient.