EC 0416- Module 6
ENGINEERING MANAGEMENT

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Unit – 6: Project management:

basic concepts of project management such as scope, time, cost and quality, network diagrams and critical path, 7 QC tools.8 Hrs.

SLE: Subcontract management.

PROJECT

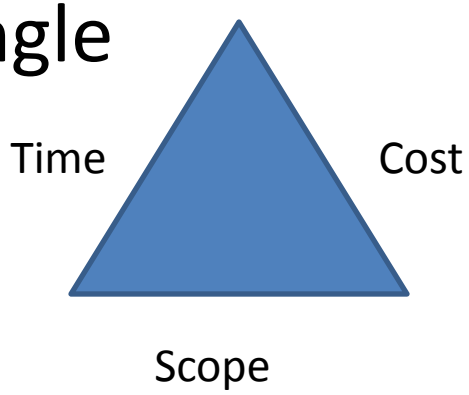
- Project is a unique process
- consist of a set of coordinated and controlled activities with start and finish dates
- undertaken to achieve an objective confirming to specific requirements,
- including the constraints of time, cost and resource.

Project Characteristics

- Unique in nature
- Have definite objectives (goals) to achieve
- Requires set of resources
- Have a specific time frame for completion with a definite start and finish
- Involves risk and uncertainty
- Requires cross-functional teams and interdisciplinary approach

Project dimensions: Quality triangle

- Three major dimensions that define the project performance are:
- scope, time, and cost.
- These parameters are interrelated and interactive
- equilateral triangle



Project dimensions

- It is evident that any change in any one of dimensions would affect the other.
- For example, if the scope is enlarged, project would require more time for completion and the cost would also go up.
- If time is reduced the scope and cost would also be required to be reduced.
- Similarly any change in cost would be reflected in scope and time.

Project dimensions

- Successful completion of the project would require accomplishment of specified goals within scheduled time and budget.
- Mathematically Performance = f(Scope, Cost, Time)

Project management

- Project management is a distinct area of management that helps in handling projects
- It has three key features: a project manager, the project team and the project management system
- The project management system comprises organization structure, information processing and decision making
- The project management system focuses on integrated planning and control

Benefits of Project Management Approach

The rationale for following project management approach is as follows.

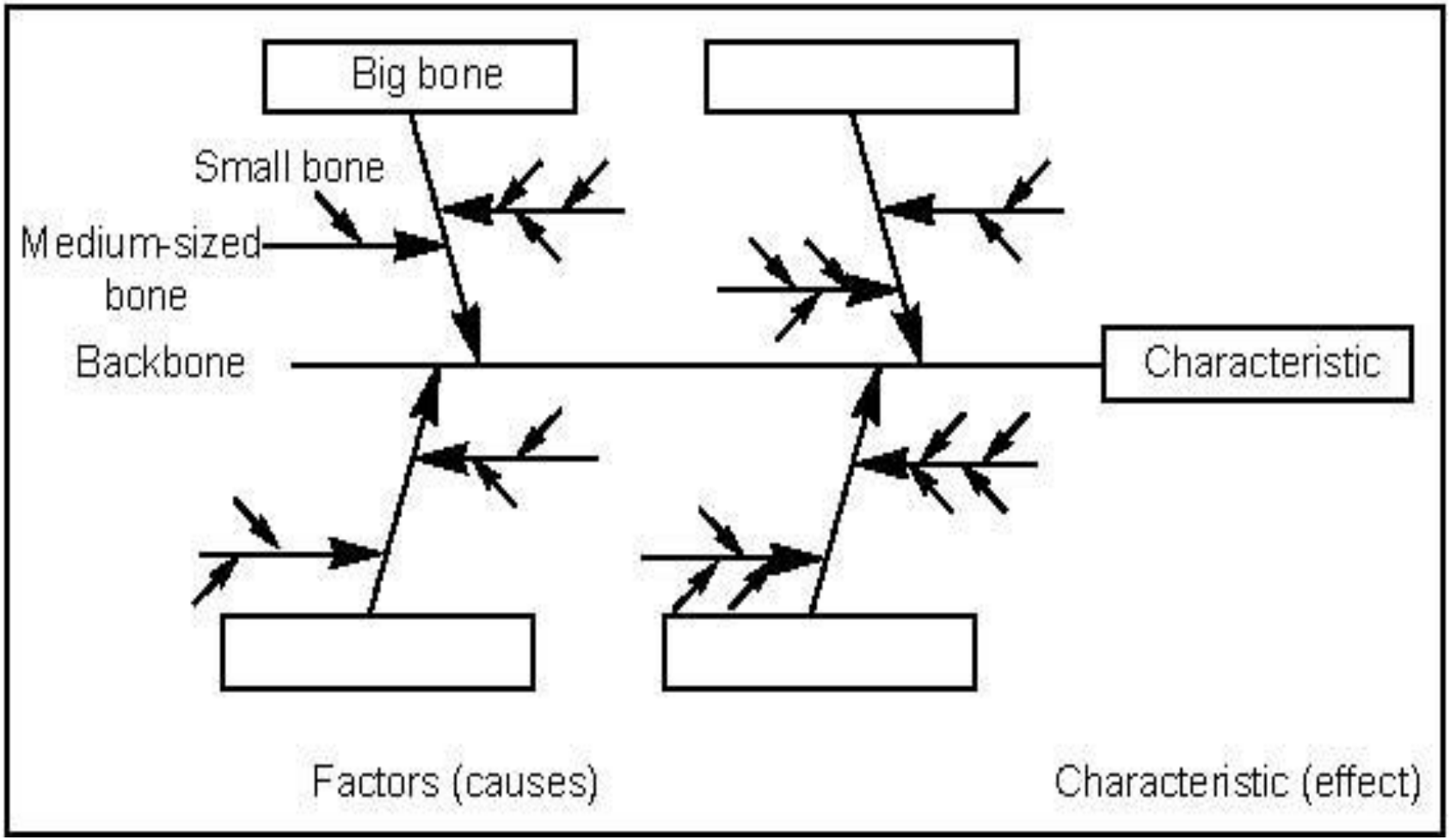
- Project management approach will help in handling complex, costly and risky assignments by providing interdisciplinary approach in handling the assignments. Example: R&D organizations.
- Project management approaches help in handling assignments in a specified time frame with definite start and completion points. Example handling customer orders by Industries involved in production of capital goods.
- Project management approaches provide task orientation to personnel in an Organization in handling assignments. Example: Organizations in IT sector handling software development assignments for clients.

Basic Quality tools

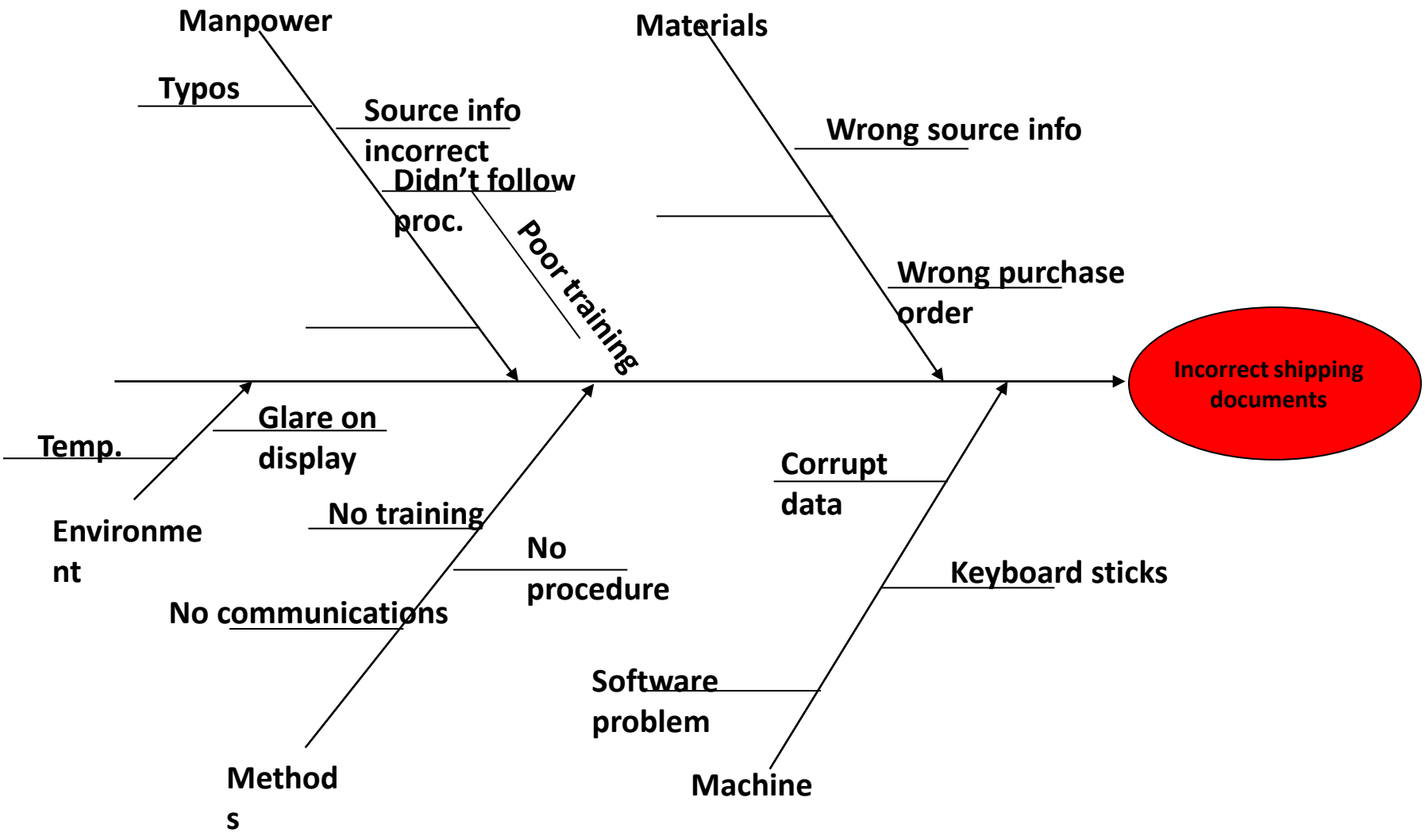
- Cause and Effect Diagrams
- Flow Charts/ Stratification
- Check sheets
- Histograms
- Pareto Charts
- Control Charts
- Scatter Diagrams

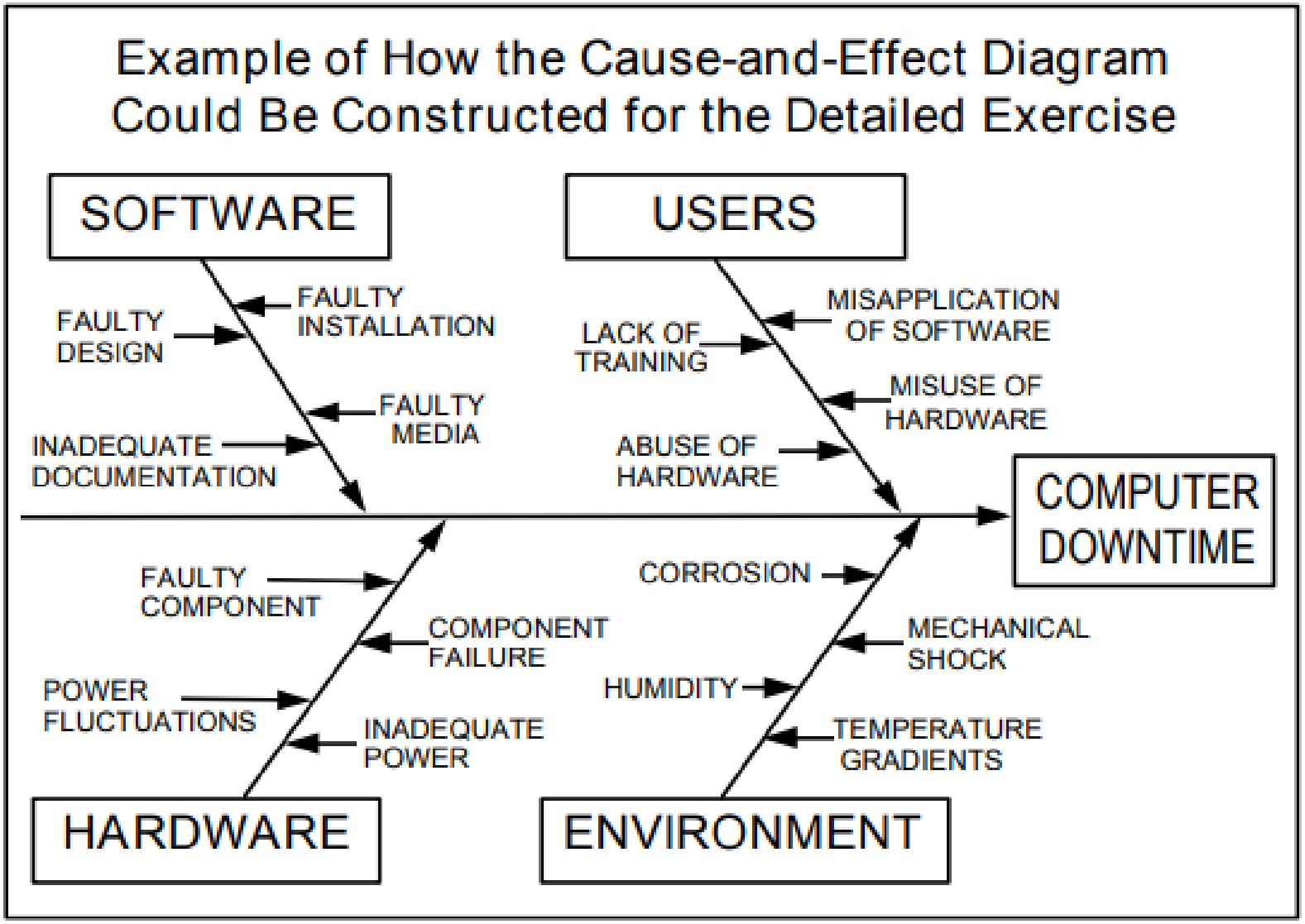
Cause and Effect Diagrams

- **Purpose:** Graphical representation of the trail leading to the root cause of a problem
- **How is it done?**
  - Decide which quality characteristic, outcome or effect you want to examine
  - Backbone –draw straight line
  - Ribs – categories
  - Medium size bones –secondary causes
  - Small bones – root causes


Big bone
Small bone
Medium-sized bone
Backbone
Characteristic
Factors (causes)
Characteristic (effect)

Cause & Effect Diagram: Sample




Example of How the Cause-and-Effect Diagram Could Be Constructed for the Detailed Exercise
SOFTWARE
USERS
FAULTY INSTALLATION
FAULTY DESIGN
FAULTY MEDIA
INADEQUATE DOCUMENTATION
MISAPPLICATION OF SOFTWARE
LACK OF TRAINING
MISUSE OF HARDWARE
ABUSE OF HARDWARE
COMPUTER DOWNTIME
FAULTY COMPONENT
COMPONENT FAILURE
POWER FLUCTUATIONS
INADEQUATE POWER
CORROSION
MECHANICAL SHOCK
HUMIDITY
TEMPERATURE GRADIENTS
HARDWARE
ENVIRONMENT

Flow Charts

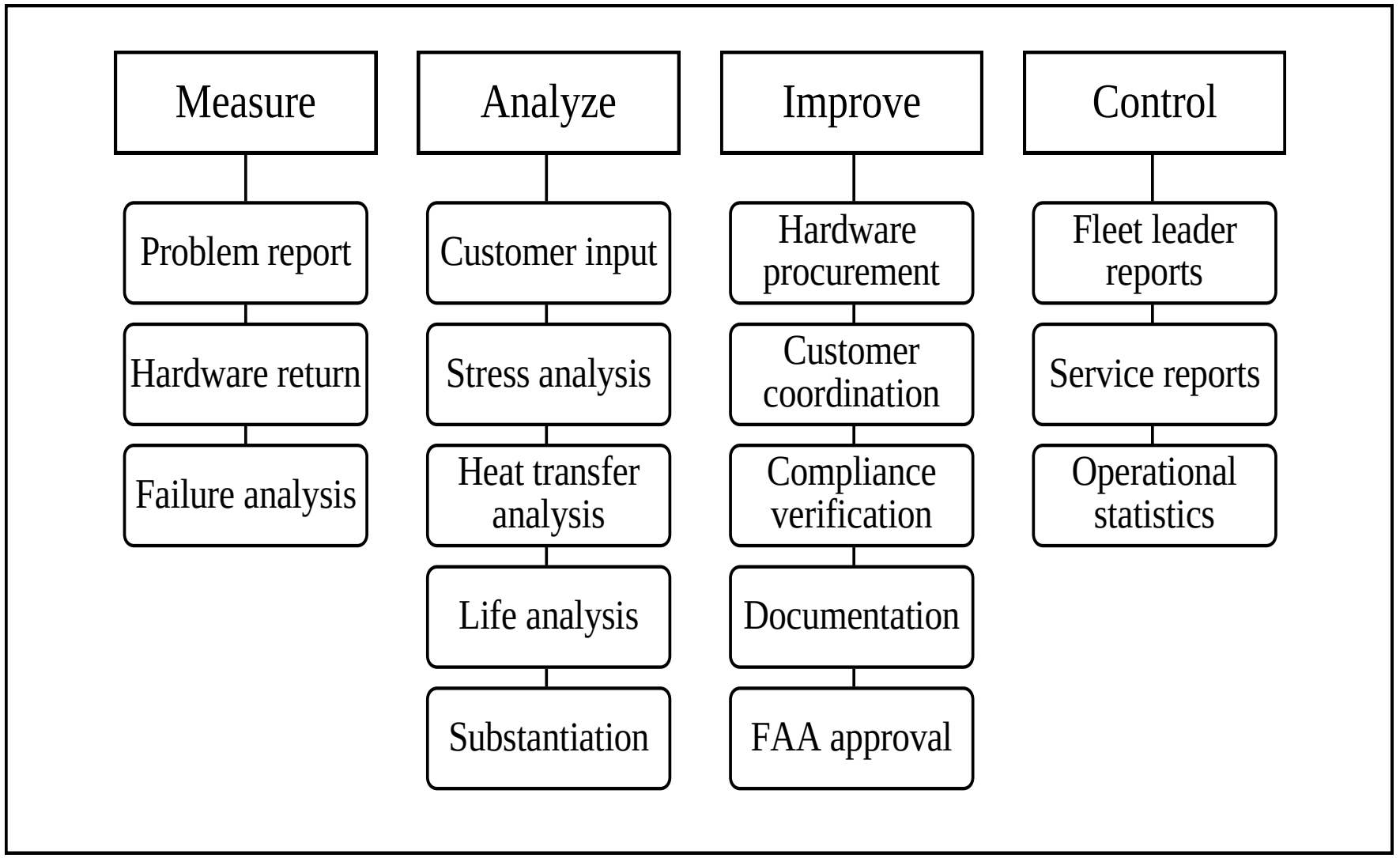
Purpose:

Visual illustration of the sequence of operations required to complete a task

- ✓Schematic drawing of the process to measure or improve.
- ✓Starting point for process improvement
- ✓Potential weakness in the process are made visual.
- ✓Picture of process as it *should* be.

Flow Charts

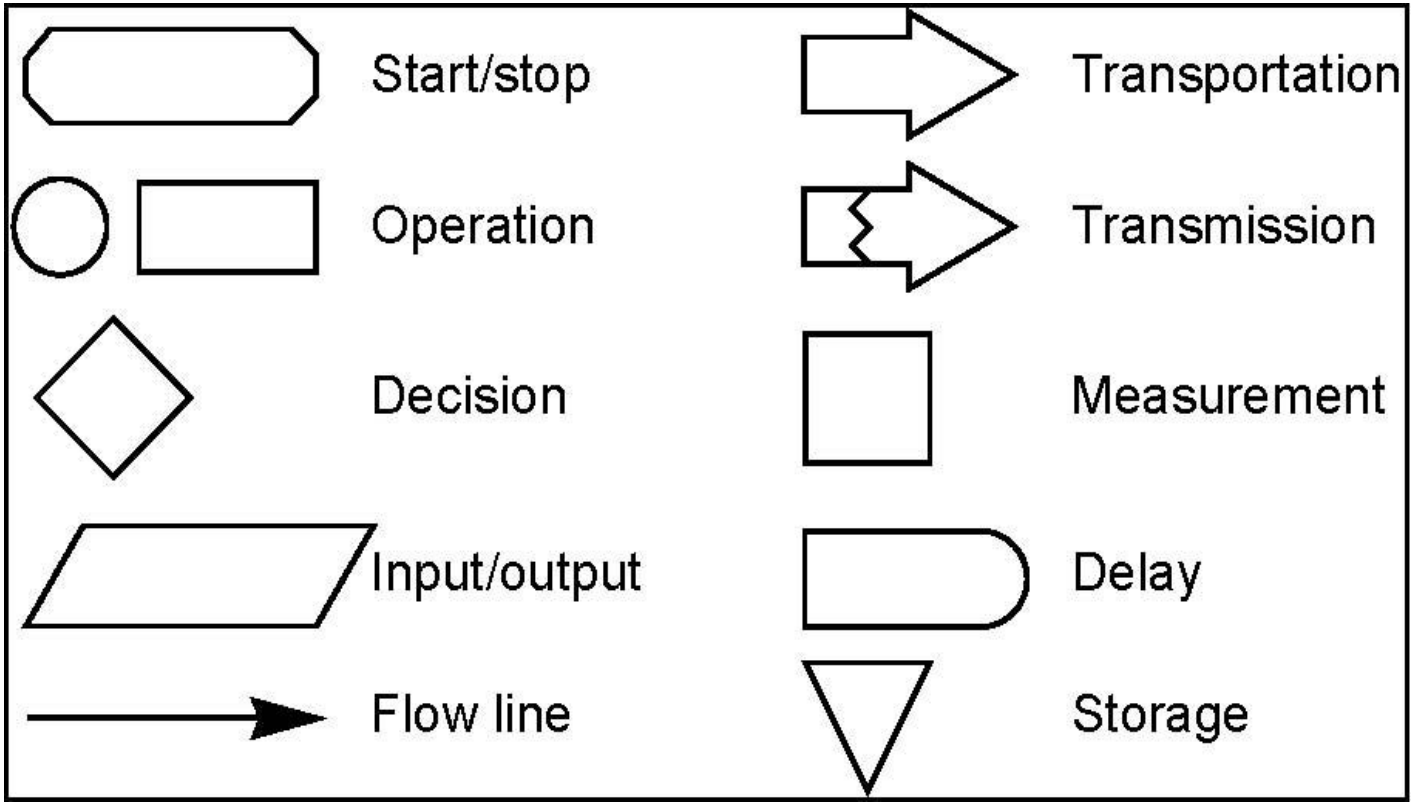
Top Down



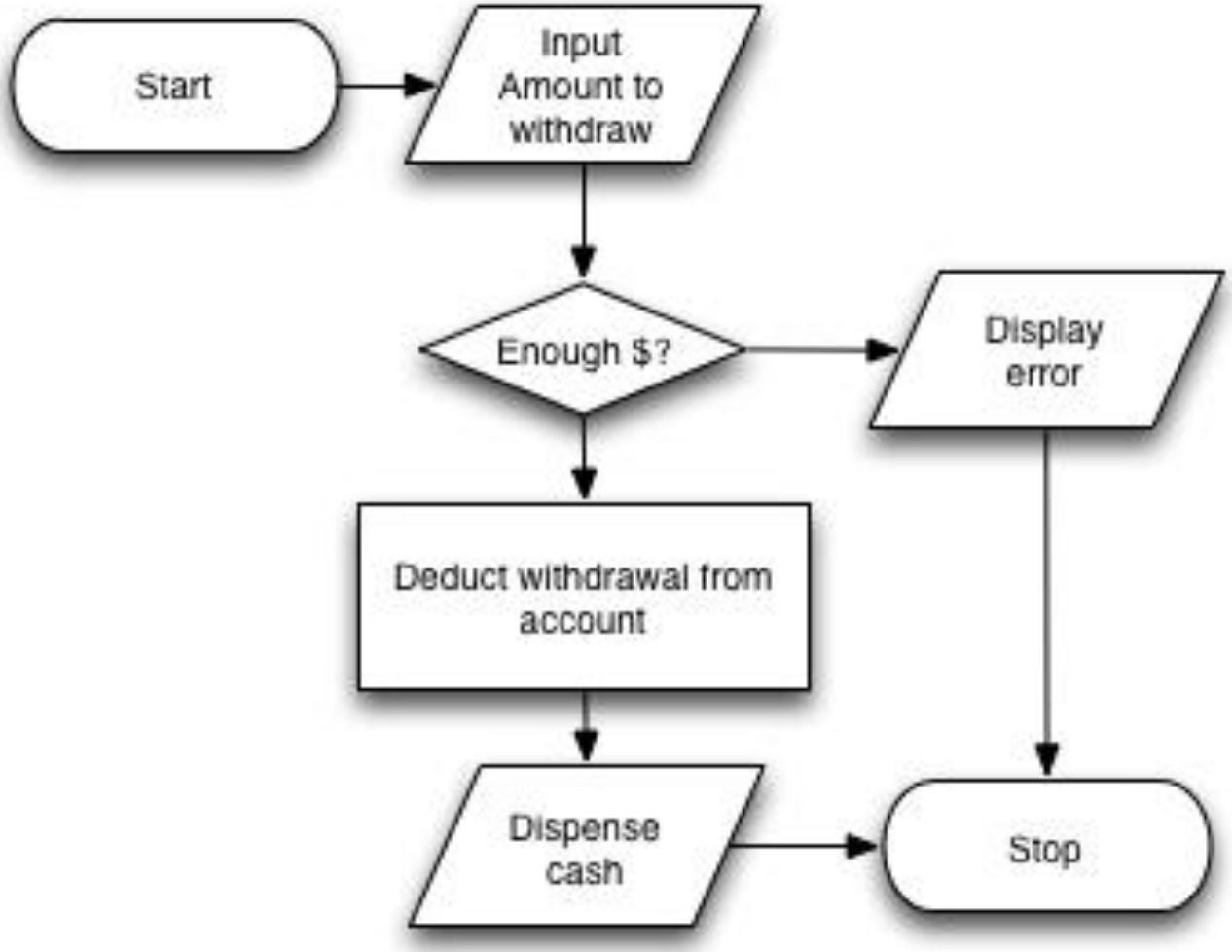
Flow charts

Linear

Toolbox



Flow Chart- Example



Checksheets

Purpose:

- Tool for collecting and organizing measured or counted data
- Data collected can be used as input data for other quality tools

Benefits:

- Collect data in a systematic and organized manner
- To determine source of problem
- To facilitate classification of data (stratification)

Checksheets

		Machine 1	Machine 2
Operator A	Morning	X	X
	Afternoon	XX	XXXXXX
Operator B	Morning	X	XX
	Afternoon	XX	XXXXXXXXX

X= Number of times the supervisor is called per day.

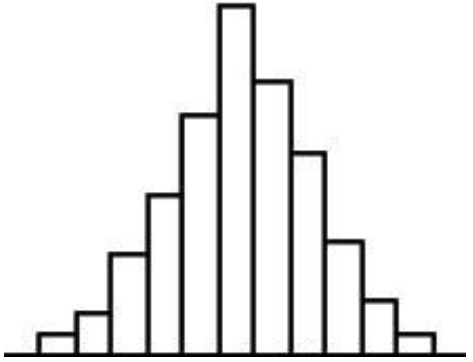
Histograms

Purpose:

To determine the spread or variation of a set of data points in a graphical form

How is it done?:

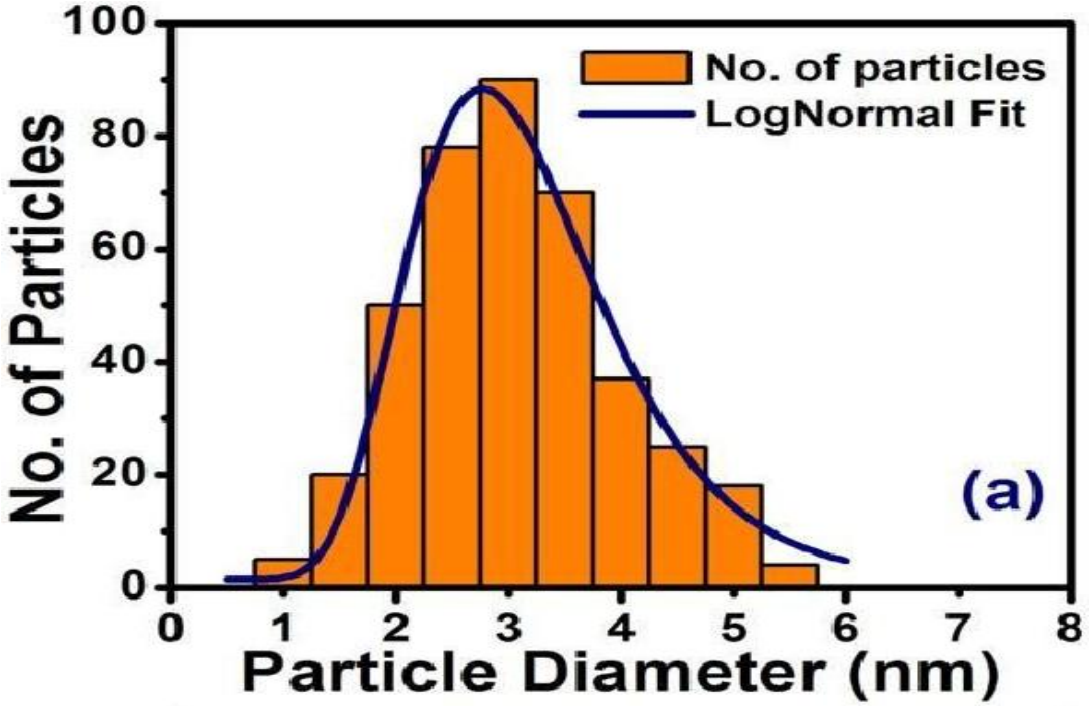
- Collect data, 50-100 data point
- Determine the range of the data
- Calculate the size of the class interval
- Divide data points into classes Determine the class boundary
- Count # of data points in each class
- Draw the histogram

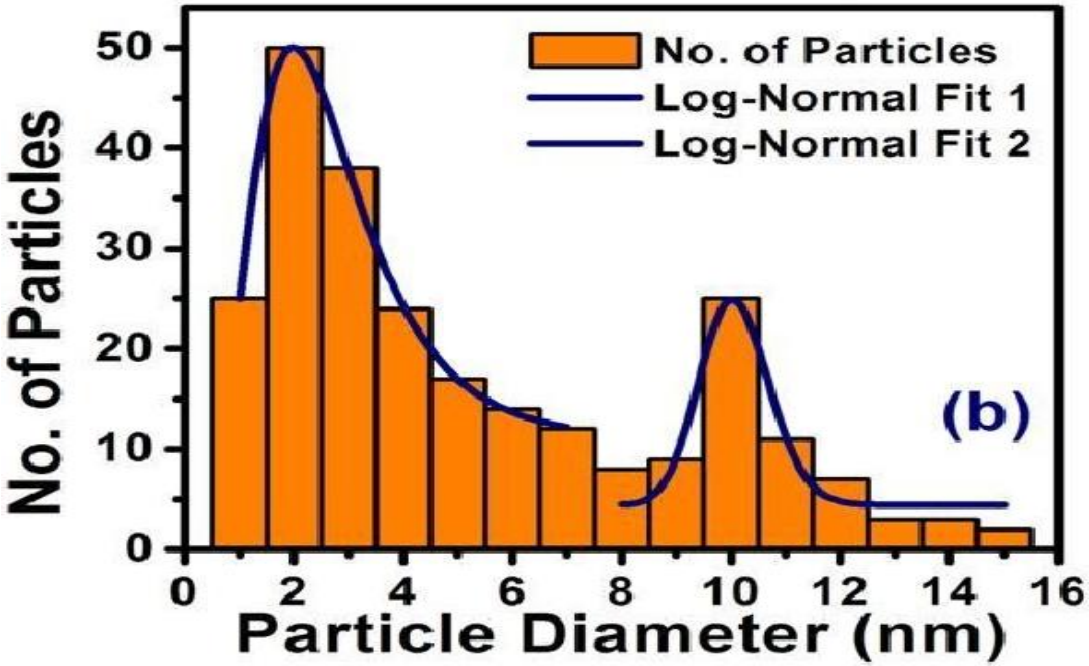


Stable process, exhibiting bell shape

Histogram

- A **histogram** is a bar graph of raw data that creates a picture of the data distribution.
- The bars represent the frequency of occurrence by classes of data.
- A **histogram** shows basic information about the data set, such as central location , width of spread , and shape.


No. of particles
LogNormal Fit
No. of Particles
Particle Diameter (nm)
(a)


No. of Particles
Log-Normal Fit 1
Log-Normal Fit 2
No. of Particles
Particle Diameter (nm)
(b)

Pareto Charts

Benefits:

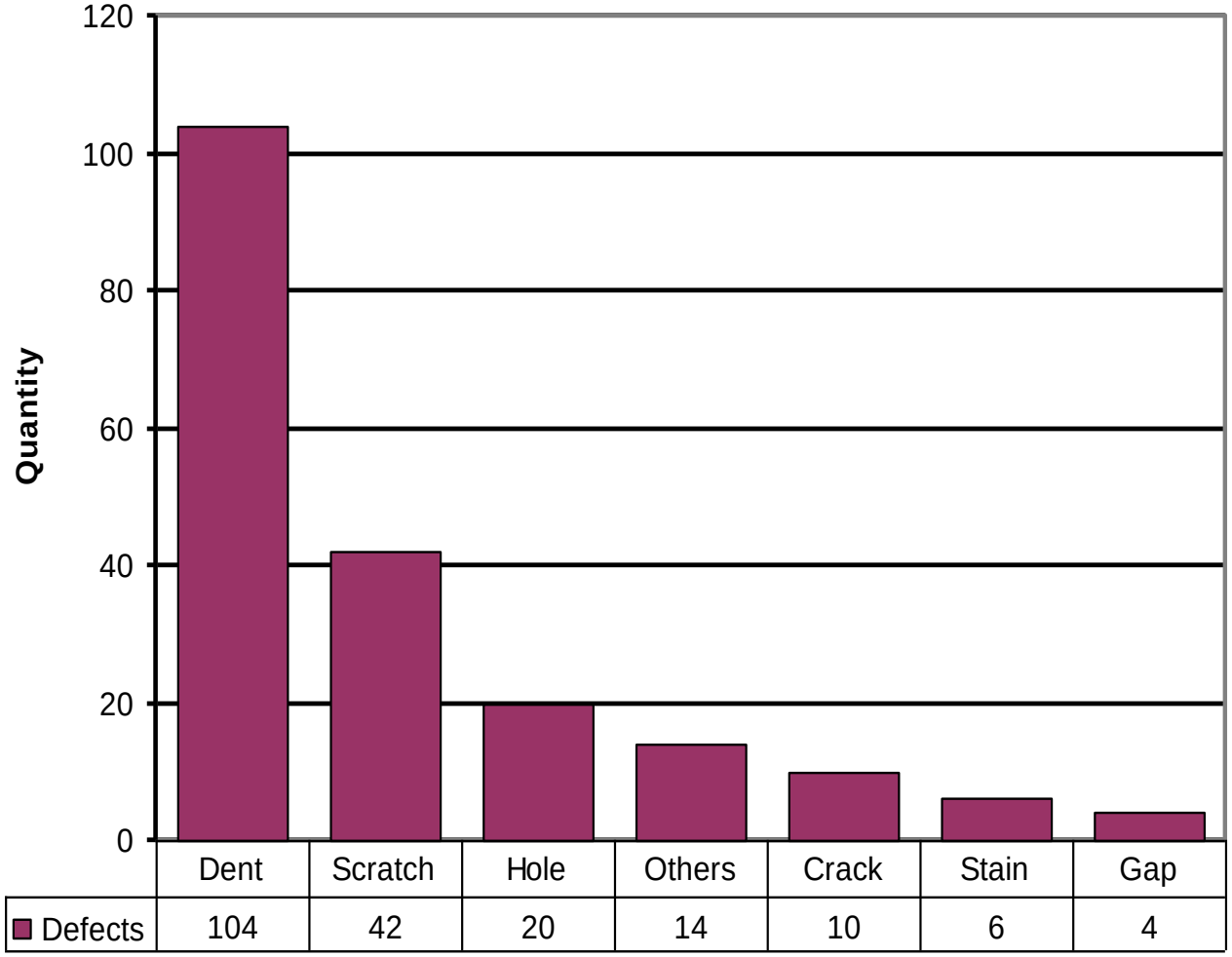
- Pareto analysis helps graphically display results so the significant few problems emerge from the general background
- It tells you what to work on first

Pareto Charts

Type of Defect	Tally	Total
Crack	𝍸 𝍸	10
Scratch	𝍸 𝍸 𝍸 𝍸 ..... 𝍸 II	42
Stain	𝍸 I	6
Dent	𝍸 𝍸 𝍸 𝍸 ..... 𝍸 IIII	104
Gap	IIII	4
Hole	𝍸 𝍸 𝍸 𝍸	20
Others	𝍸 𝍸 IIII	14
Total		200

Example of a data tally sheet

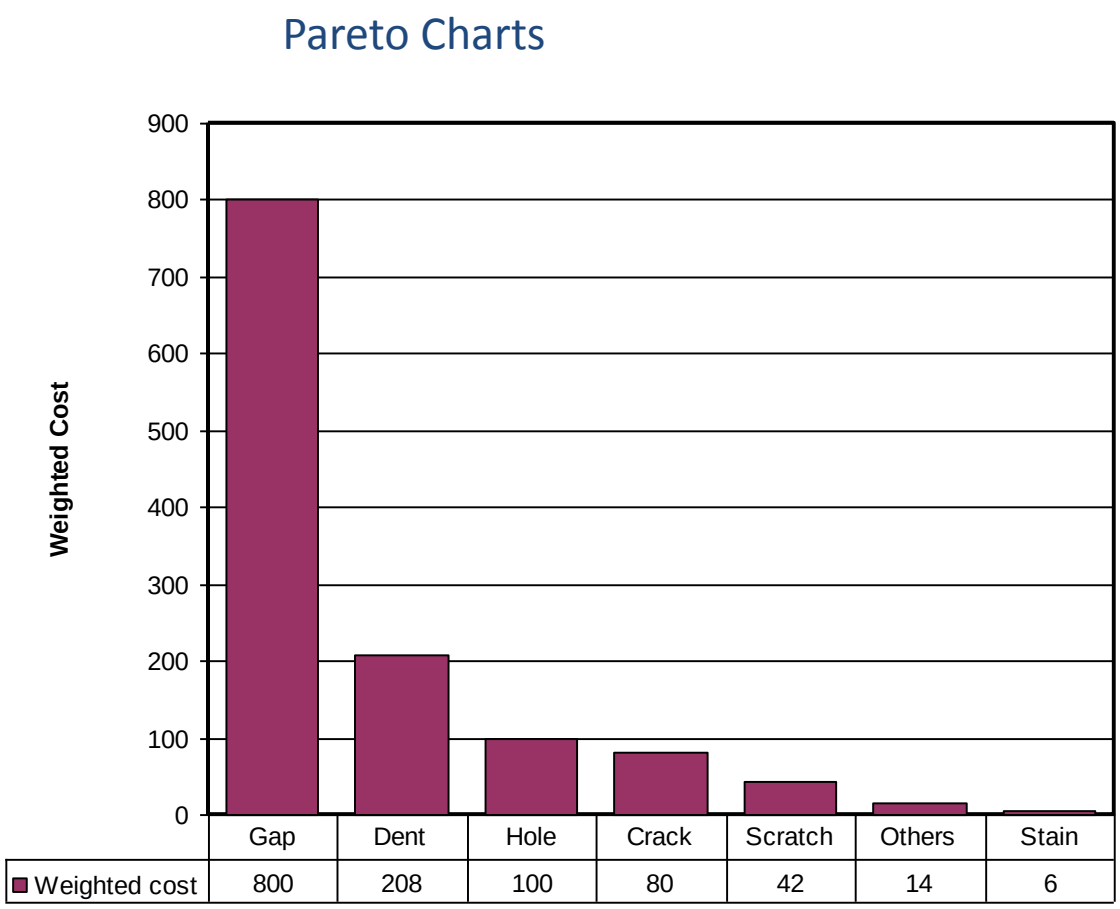
Pareto Charts



Pareto Charts

- Weighted Pareto charts use the quantity of defects multiplied by their cost to determine the order.

Defect	Total	Cost	Weighted cost
Gap	4	200	800
Dent	104	2	208
Hole	20	5	100
Crack	10	8	80
Scratch	42	1	42
Others	14	1	14
Stain	6	1	6



Control Charts

Purpose:

The primary purpose of a control chart is to predict expected product outcome.

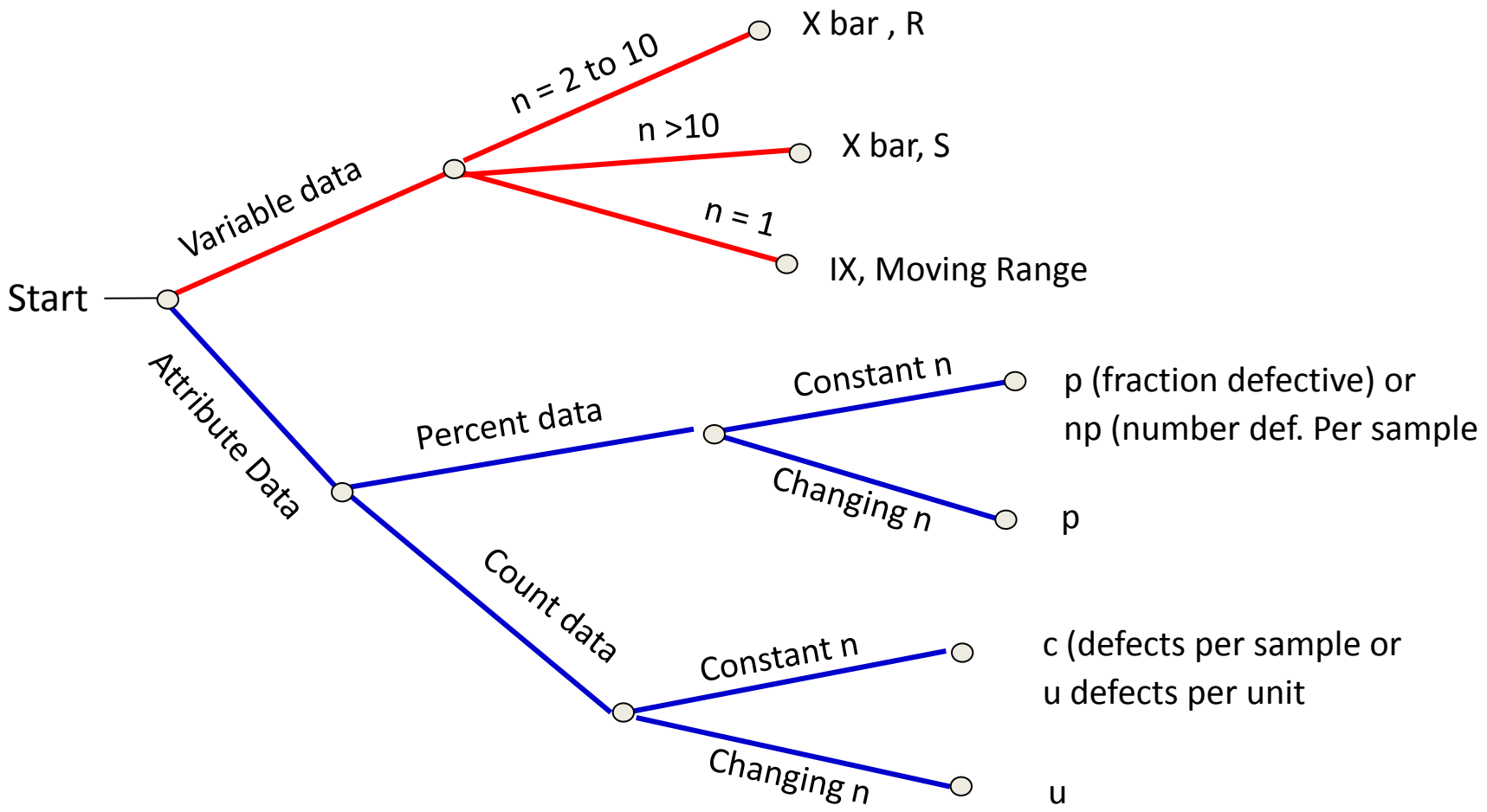
Benefits:

- Predict process out of control and out of specification limits
- Distinguish between specific, identifiable causes of variation
- Can be used for statistical process control

Control Charts

- **Control Chart Decision Tree**
  - Determine Sample size (n)
  - Variable or Attribute Data
    - Variable is measured on a continuous scale
    - Attribute is occurrences in n observations
  - Determine if sample size is constant or changing

Control Charts

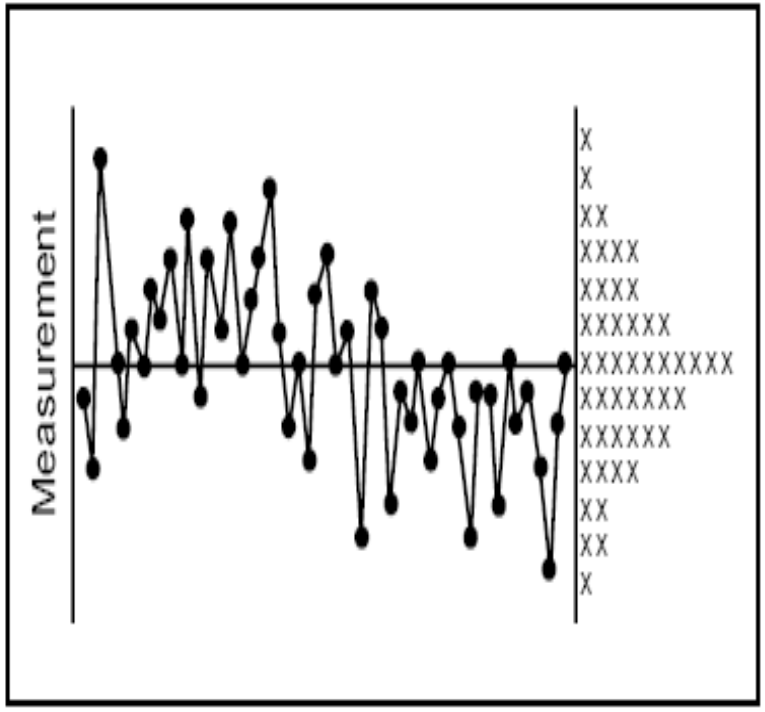


Control Chart Decision Tree

Control Charts

What does it look like?

- Adding the element of time will help clarify your understanding of the causes of variation in the processes.
- A run chart is a line graph of data points organized in time sequence and centered on the median data value.



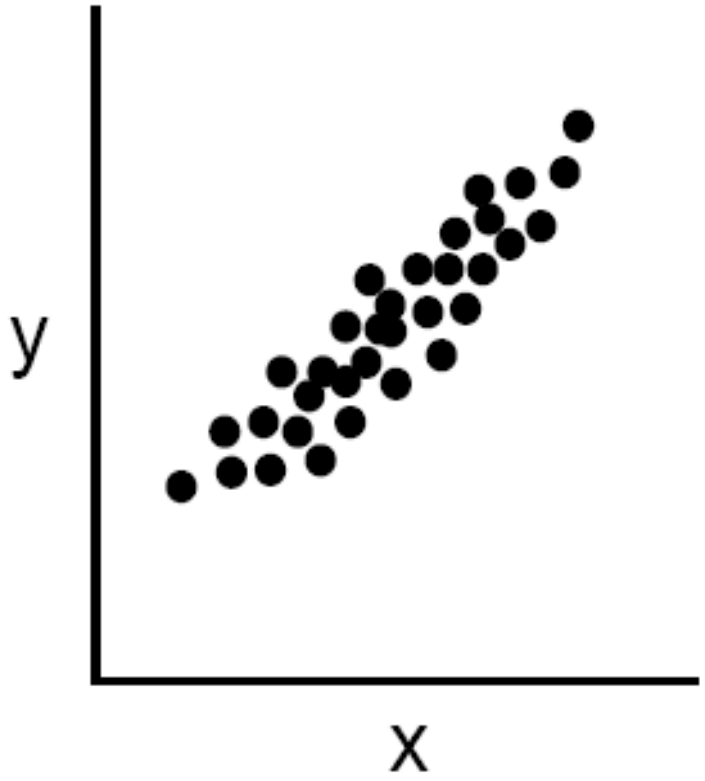
Unusual variation can hide in a frequency plot

Scatter Diagrams

Purpose:

- To identify the correlations that might exist between a quality characteristic and a factor that might be driving it
- A scatter diagram shows the correlation between two variables in a process.
  - Dots representing data points are *scattered* on the diagram.
  - The extent to which the dots cluster together in a line across the diagram shows the strength with which the two factors are related.

Scatter Diagrams

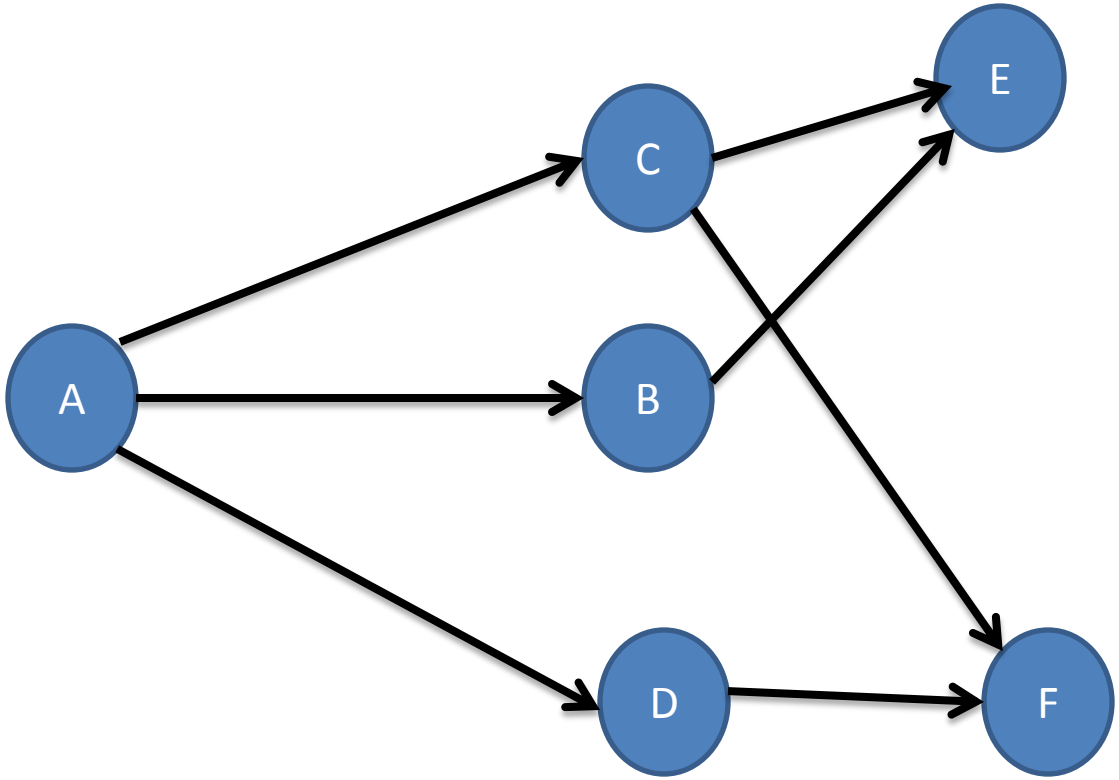


Network Diagram

- Creating relationship between activities
- arrow shows the relationship

Activity A must be finished before B can start

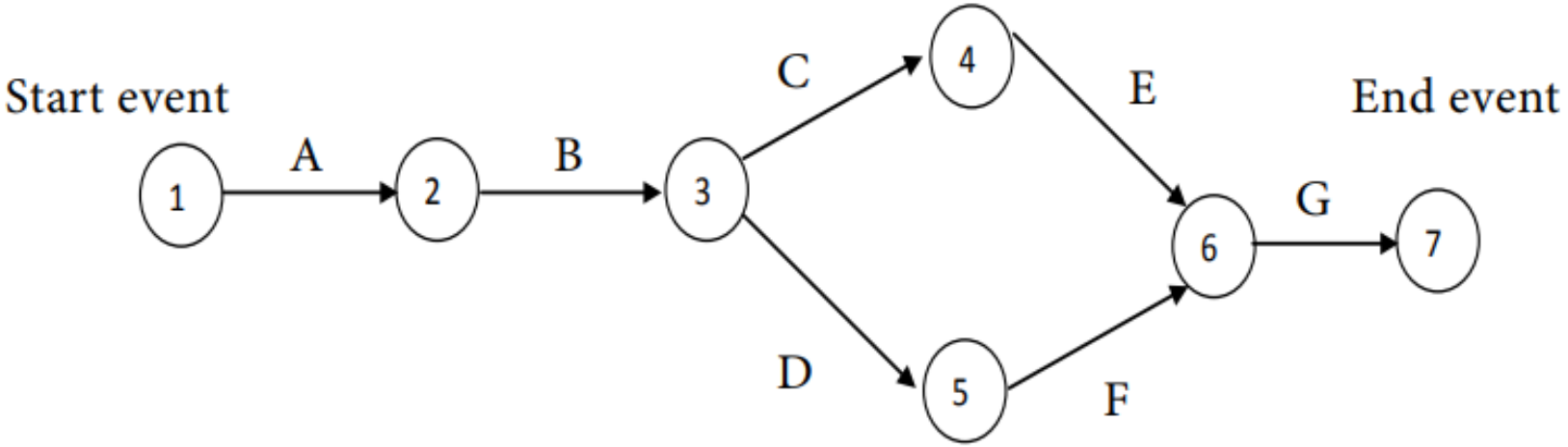
Network Diagram



Network diagram: Problem

Activity	Immediate Predecessor Activity
A	-
B	A
C, D	B
E	C
F	D
G	E, F

Network diagram



Construct the network diagram

Activity	Immediate Predecessor Activity
A	-
B	-
C	A
D	B
E	A
F	C, D
G	E
H	E
I	F, G
J	H, I

Critical Path

- The critical path method (CPM) aims at the determination of the time to complete a project and the important activities on which a manager shall focus attention.
- it is assumed that precise time estimate is available for each activity

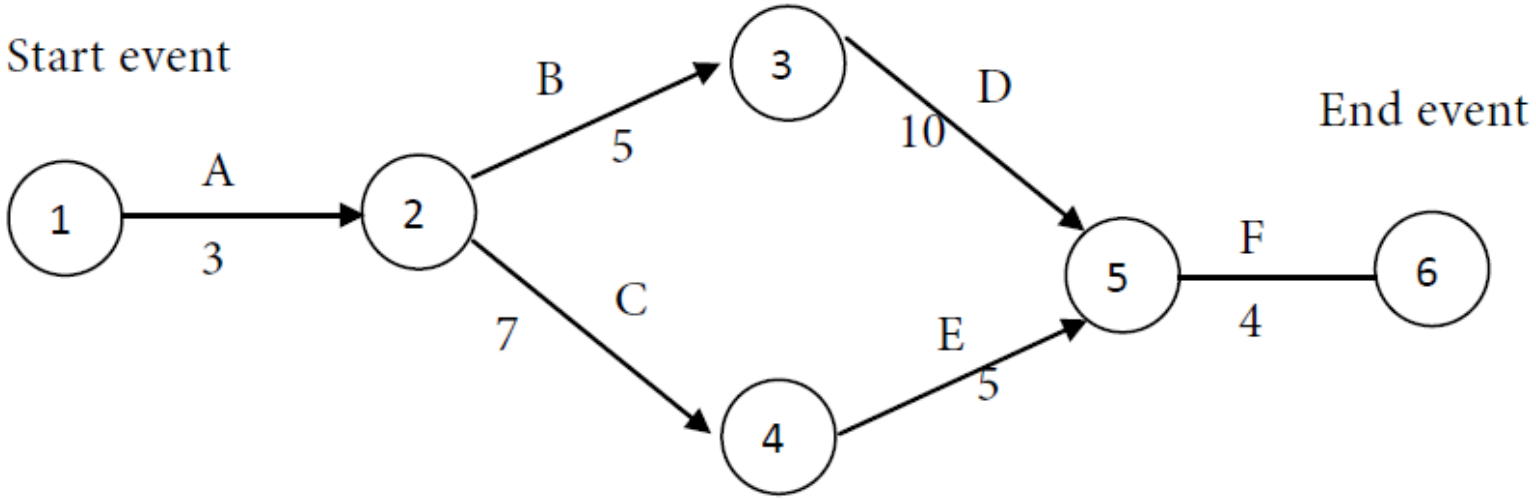
Critical Path

- From the start event to the end event, the time required to complete all the activities of the project in the specified sequence is known as the project completion time.
- A continuous sequence, consisting of nodes and activities alternatively, beginning with the start event and stopping at the end event of a network is called a path in the network.

- Consider all the paths in a project, beginning with the start event and stopping at the end event.
- For each path, calculate the time of execution, by adding the time for the individual activities in that path.
- The path with the largest time is called the critical path and the activities along this path are called the critical activities or bottleneck activities.
- The activities are called critical because they cannot be delayed.

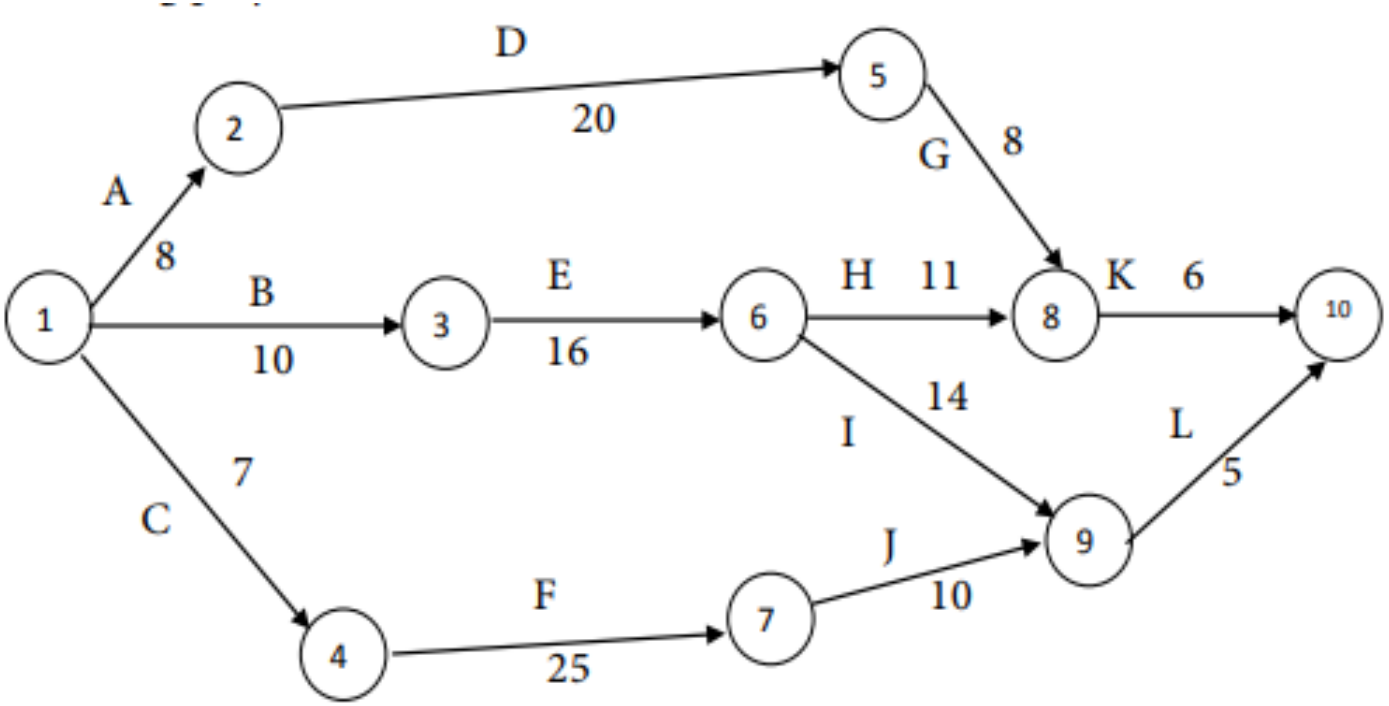
Problem 1

Activity	Predecessor Activity	Duration (Weeks)
A	-	3
B	A	5
C	A	7
D	B	10
E	C	5
F	D,E	4



Critical path = max(3+5+10+4, 3+7+5+4) = 22

Problem 2. Find out the completion time and critical activity



Problem 3. Draw the network diagram and estimate the critical path delay

Activity	Time estimate (Weeks)
1- 2	5
1- 3	6
1- 4	3
2 -5	5
3 -6	7
3 -7	10
4 -7	4
5 -8	2
6 -8	5
7 -9	6
8 -9	4

Problem 4. Draw the network diagram and find out the completion time and critical activity

Activity	IMMEDIATE Predecessor Activity	time estimate (weeks)
A	-	4
B	-	7
C	-	3
D	A	6
E	B	4
F	B	7
G	C	6
H	E	10
I	D	3
J	F, G	4
K	H, I	2