Seven Quality Tools

Why Do This?

The Deming Chain

Improve Quality
Decrease Costs
Improve Productivity
Decrease Price
Increase Market
Stay in Business
Provide More Jobs
Return on Investment

Six Problem Solving Steps

- **Identify**
  - recognize the symptoms
- **Define**
  - Agree on the problem and set boundaries
- **Investigate**
  - Collect data
- **Analyze**
  - Use quality tools to aid
- **Solve**
  - Develop the solution and implement
- **Confirm**
  - Follow up to ensure that the solution is effective

Seven Quality Tools

- Cause and Effect Diagrams
- Flow Charts
- Checksheets
- Histograms
- Pareto Charts
- Control Charts
- Scatter Diagrams

Quality Tool

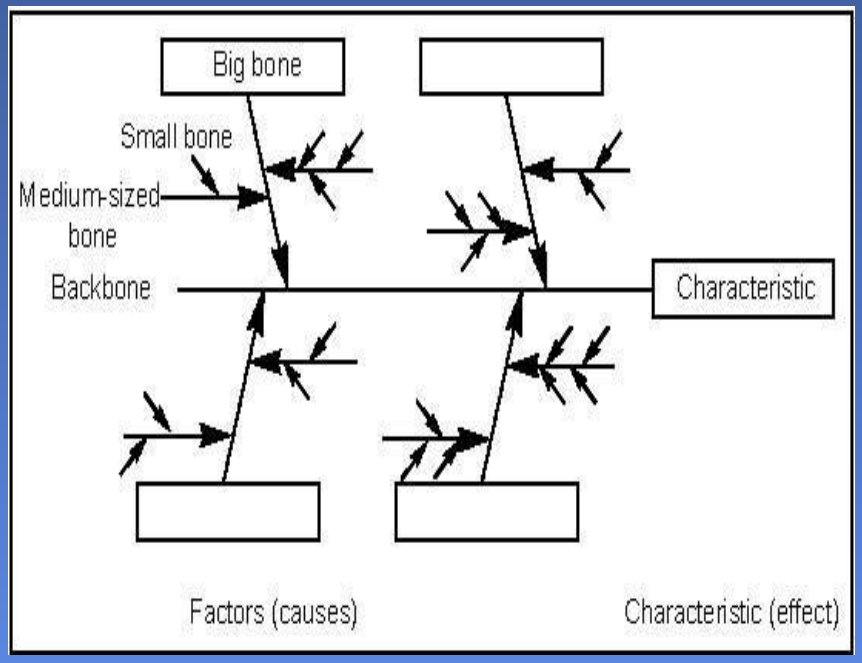
Cause and Effect Diagrams

Fishbone Diagram

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 (may use Pareto chart)
- Backbone –draw straight line
- Ribs – categories
- Medium size bones –secondary causes
- Small bones – root causes



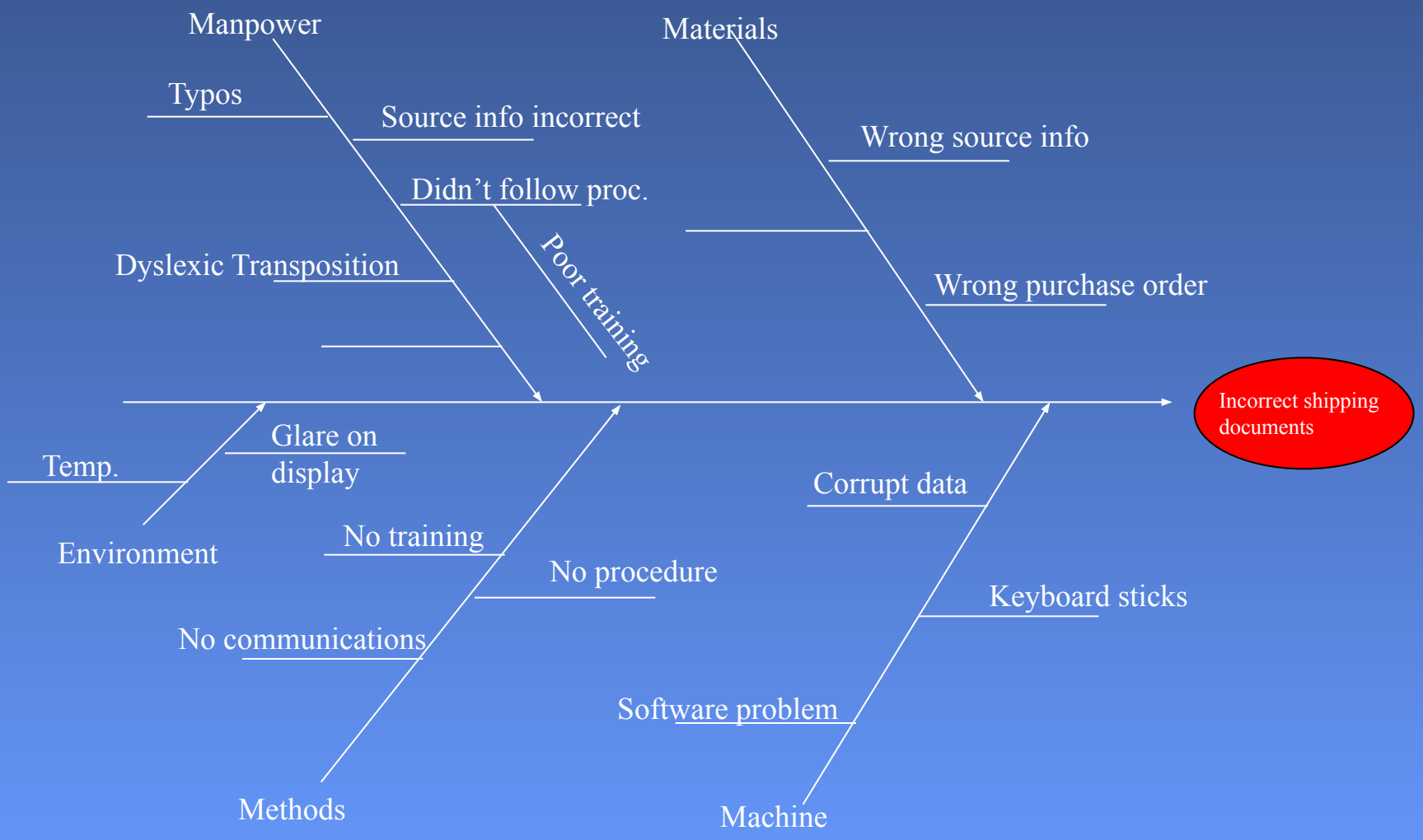
Cause & Effect Diagrams

Benefits:

- Breaks problems down into bite-size pieces to find root cause
- Fosters team work
- Common understanding of factors causing the problem
- Road map to verify picture of the process
- Follows brainstorming relationship

Cause & Effect Diagrams

Sample



Quality Tool

Flow Charts

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.

Benefits:

- ✔ Identify process improvements
- ✔ Understand the process
- ✔ Shows duplicated effort and other non-value-added steps
- ✔ Clarify working relationships between people and organizations
- ✔ Target specific steps in the process for improvement.

Flow Charts

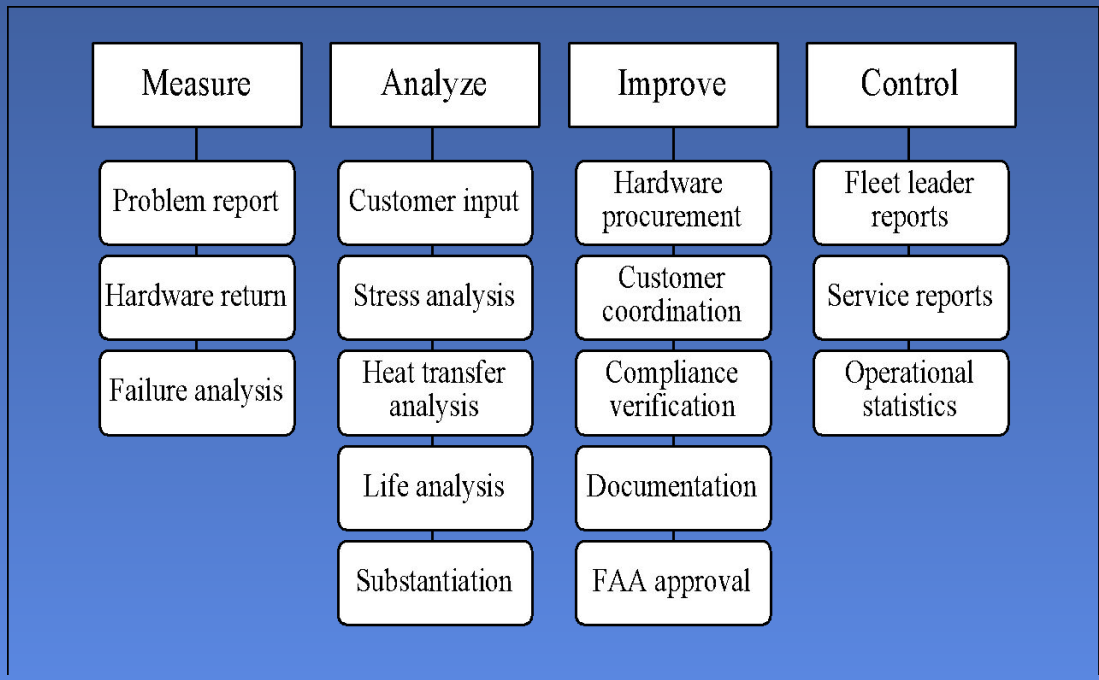
Top Down

Benefits

- Simplest of all flowcharts
- Used for planning new processes or examining existing one
- Keep people focused on the whole process

How is it done?

- List major steps
- Write them across top of the chart
- List sub-steps under each in order they occur



Flow charts

Linear

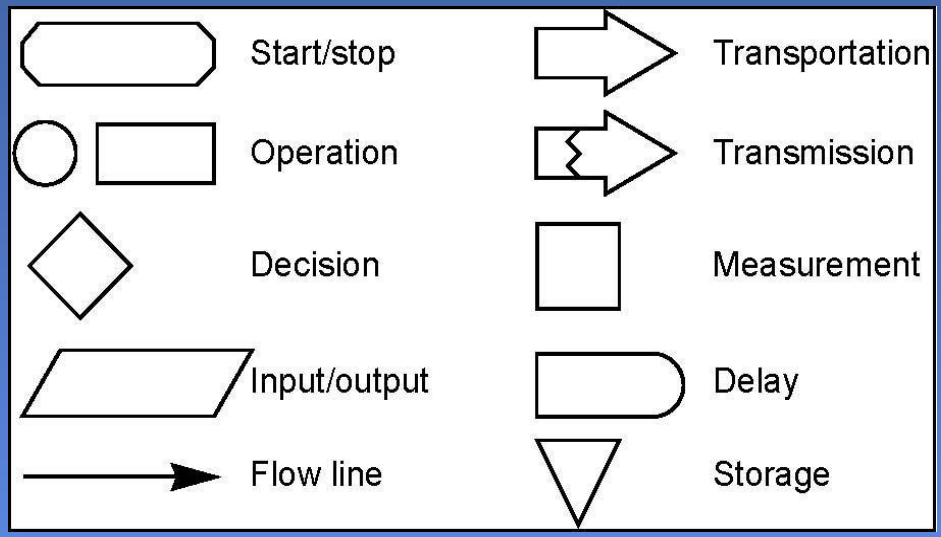
Benefits

- Show what actually happens at each step in the process
- Show what happens when non-standard events occur
- Graphically display processes to identify redundancies and other wasted effort

How is it done?

- Write the process step inside each symbol
- Connect the Symbols with arrows showing the direction of flow

Toolbox



Quality Tool

Checksheets

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)

		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.

Defect Type	Insufficient Solder	Cold Solder	Solder Bridge	Blow Holes	Excessive Solder
Frequency	xxxxxxx	xx	xxx	xxxxxxxxxxxxx	xx
Total	7	2	3	14	2

Quality Control Tool

Histograms

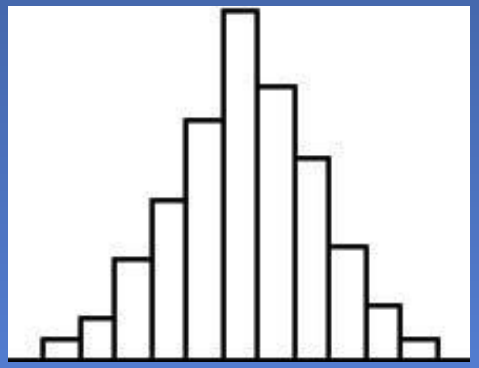
Histograms

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

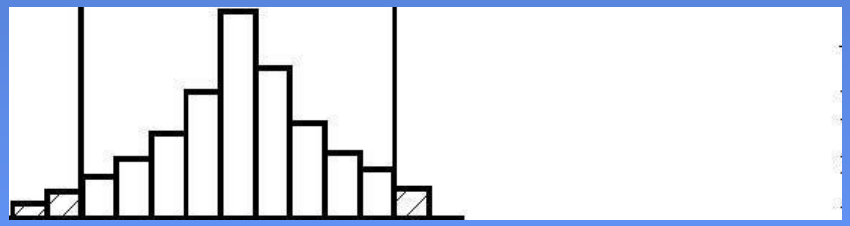


Stable process, exhibiting bell shape

Histograms

Benefits:

- Allows you to understand at a glance the variation that exists in a process
- The shape of the histogram will show process behavior
- Often, it will tell you to dig deeper for otherwise unseen causes of variation.
- The shape and size of the dispersion will help identify otherwise hidden sources of variation
- Used to determine the capability of a process
- Starting point for the improvement process



Quality Control Tool

Pareto Charts

Pareto Charts

Purpose:

Prioritize problems.

How is it done?

- Create a preliminary list of problem classifications.
- Tally the occurrences in each problem classification.
- Arrange each classification in order from highest to lowest
- Construct the bar chart

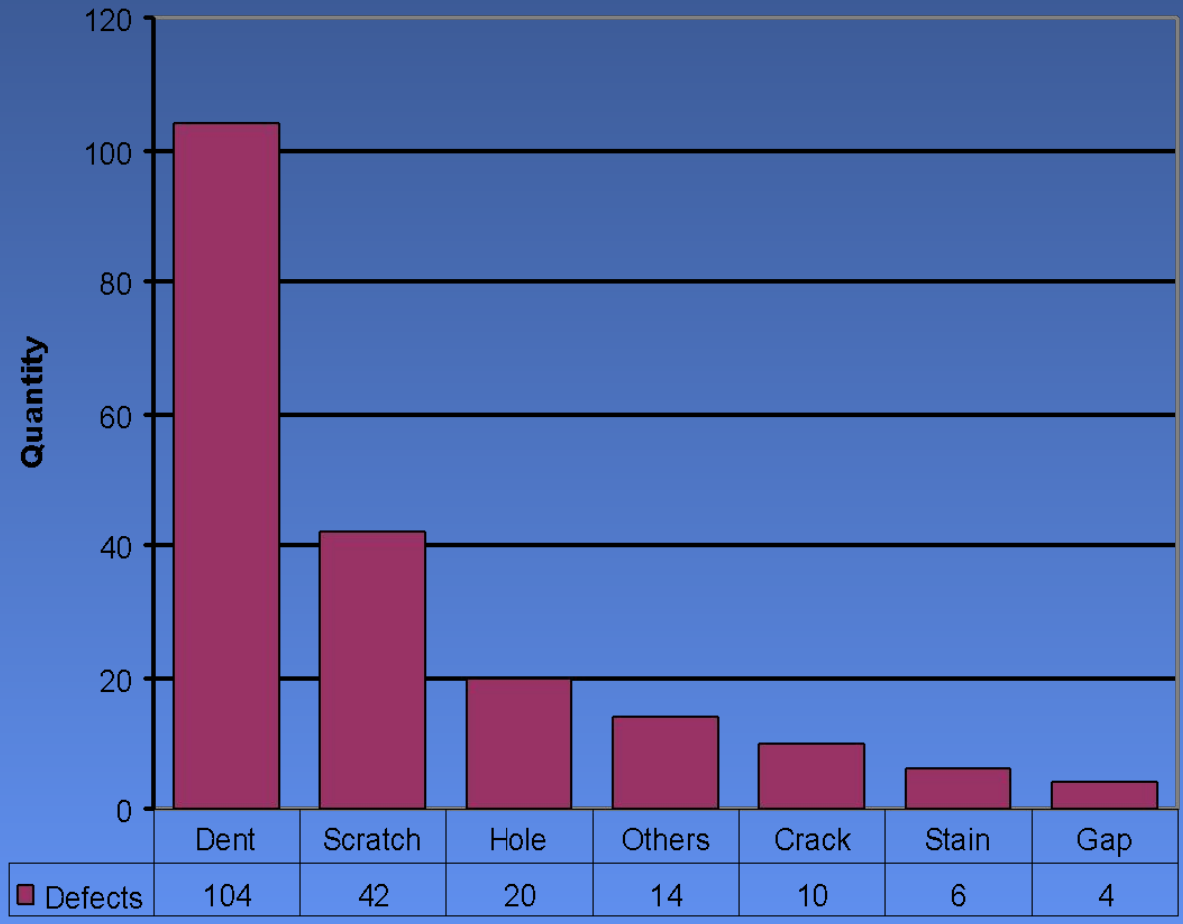
Type of Defect	Tally	Total
Crack	𝍸 𝍸	10
Scratch	𝍸 𝍸 𝍸 𝍸 ..... 𝍸 II	42
Stain	𝍸 I	6
Dent	𝍸 𝍸 𝍸 𝍸 ..... 𝍸 IIII	104
Gap	IIII	4
Hole	𝍸 𝍸 𝍸 𝍸	20
Others	𝍸 𝍸 IIII	14
Total		200

Example of a data tally sheet

Pareto Charts

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

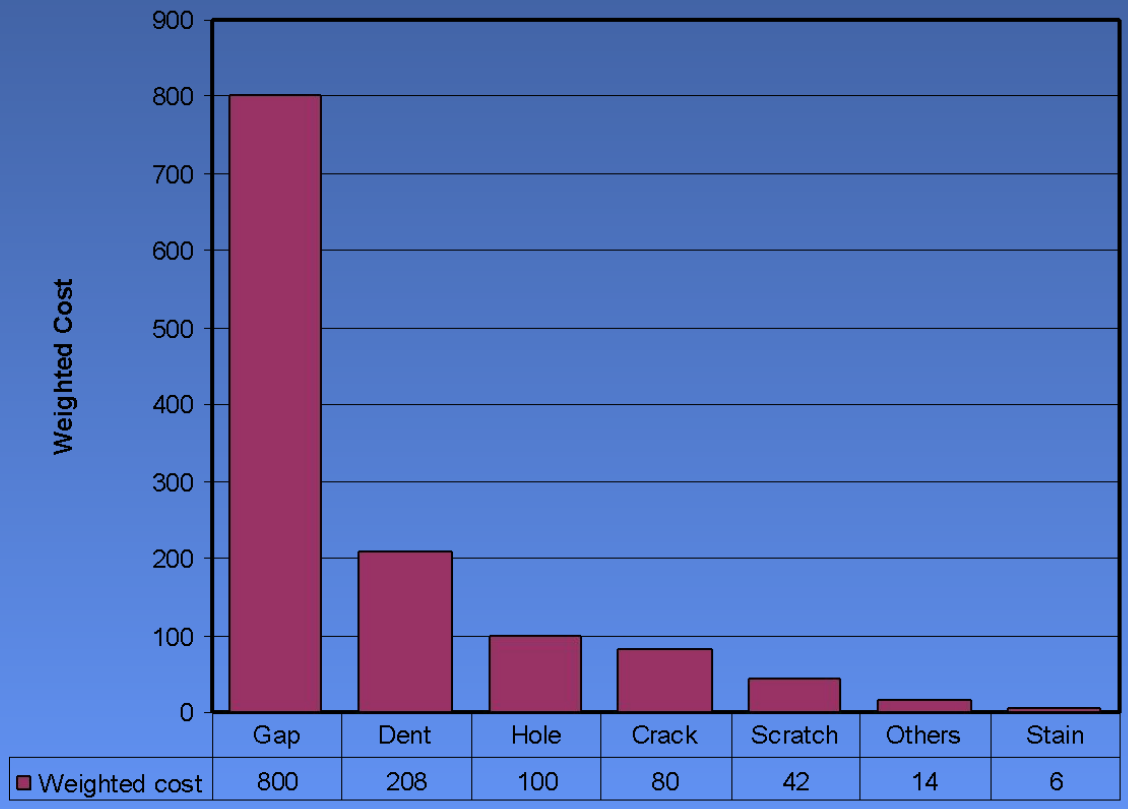


Pareto Charts

Pareto Charts
Weighted Pareto

- 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



Quality Control Tool

Control Charts

Control Charts

Purpose:

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

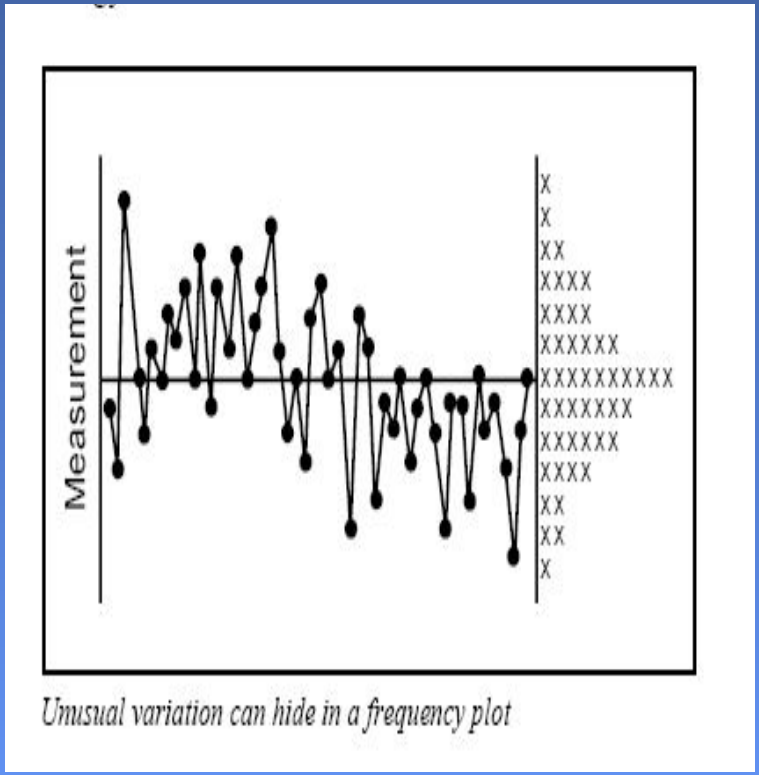
Benefits:

- 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

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

Quality Control Tool

Scatter Diagrams

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.
  - These variables could be a Critical To Quality (CTQ) characteristic and a factor affecting it two factors affecting a CTQ or two related quality characteristics.
- 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.