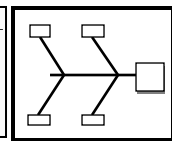
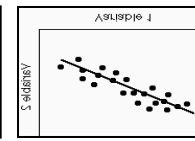


Category	Sub-category	Frequency	Percentage
Defect	Defect 1	10	10%
Defect	Defect 2	20	20%
Defect	Defect 3	30	30%
Defect	Defect 4	40	40%
Defect	Defect 5	50	50%
Defect	Defect 6	60	60%
Defect	Defect 7	70	70%
Defect	Defect 8	80	80%
Defect	Defect 9	90	90%
Defect	Defect 10	100	100%

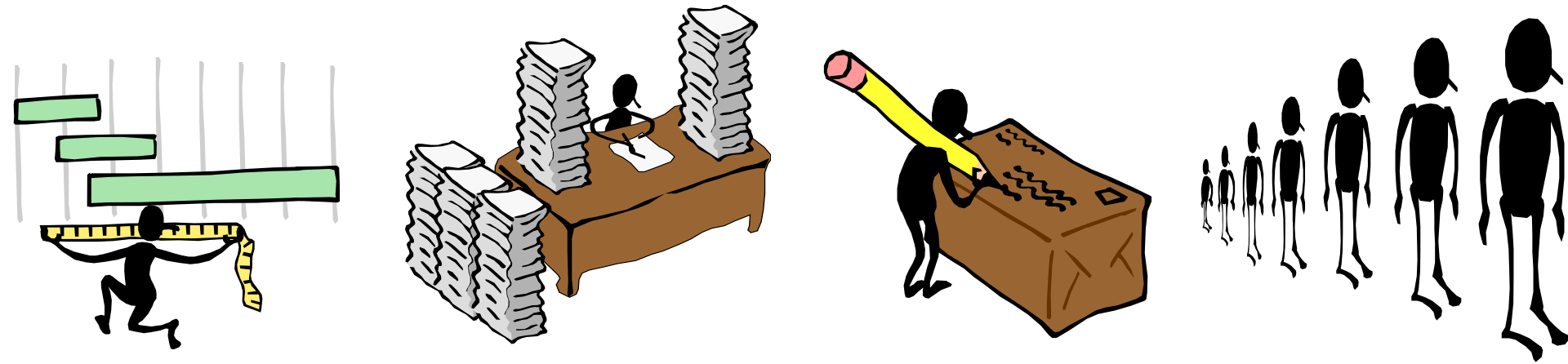


7 TOOLS OF QUALITY & PROBLEM SOLVING

By

MQS Office

"Why do we need Quality ?"



Why do we need 'Quality' ?

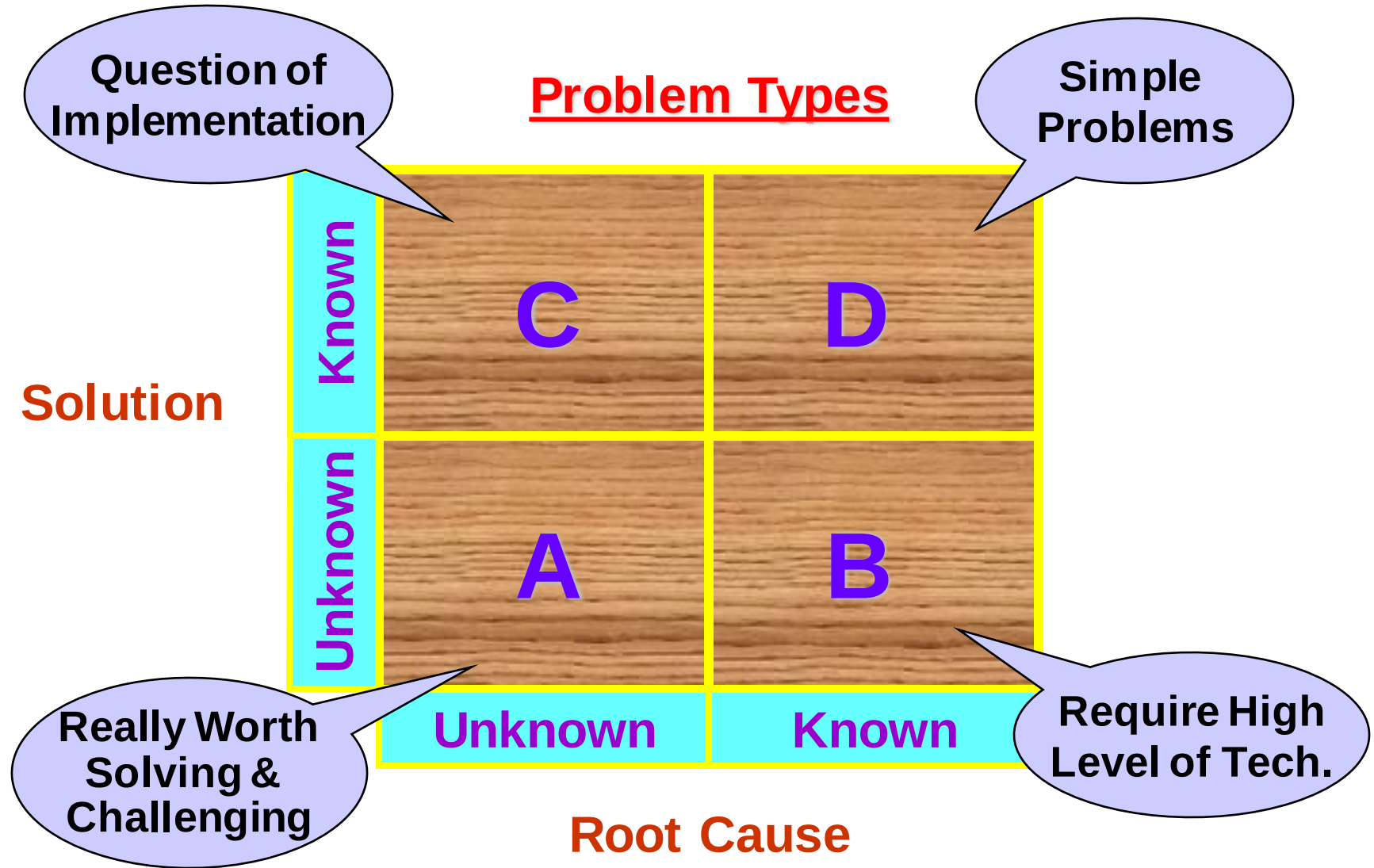
A Quote from Bill Smith ...

In 1985, Bill Smith, an engineer at Motorola (Father of Six Sigma) presented a paper which concluded that ...

"If a product was found defective & corrected during the production process, other defects were bound to be missed and found later by the customer during early use of the product....

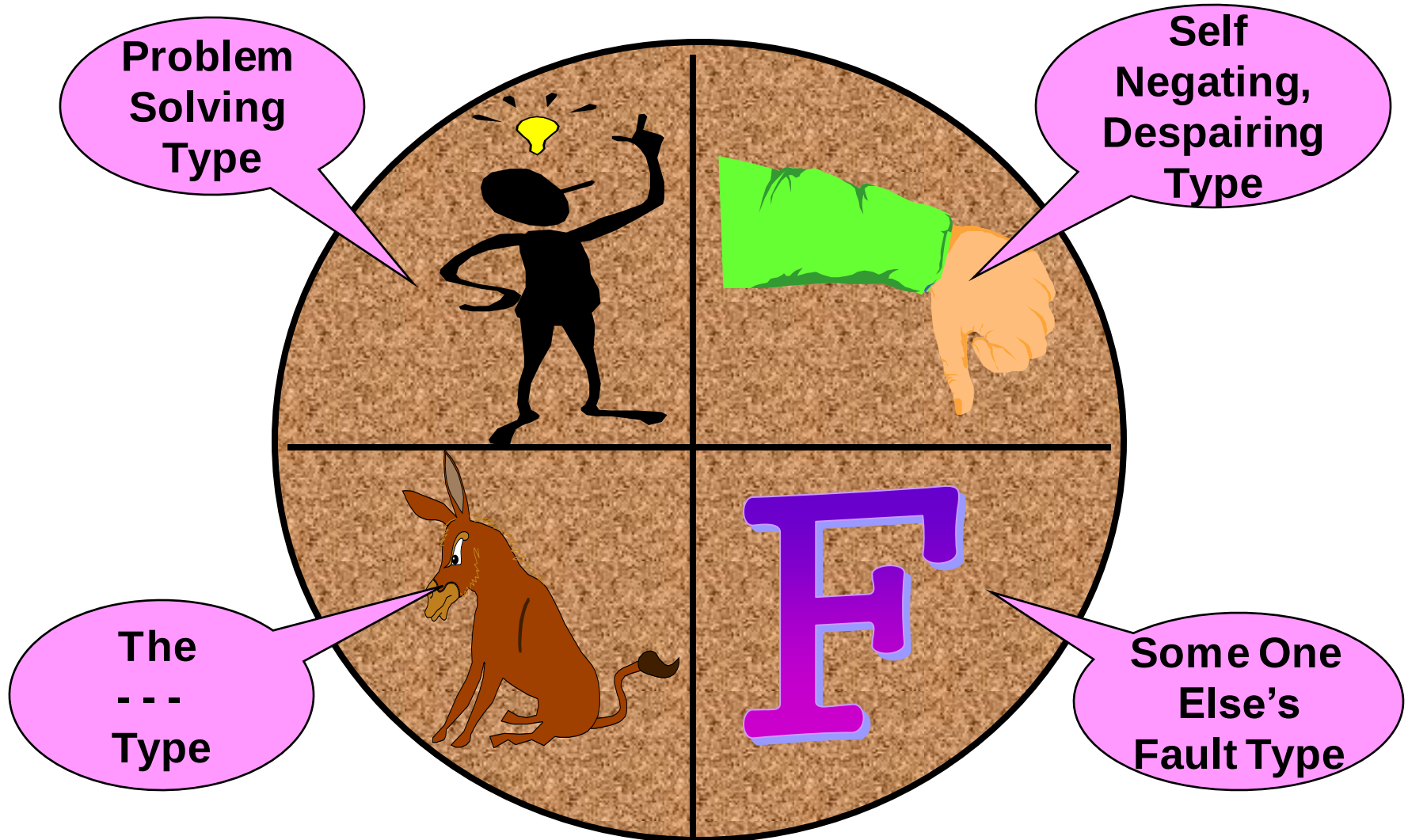
However, when the product is manufactured error free, it rarely fails during early use by the consumer ..."

Problem Solving Technique

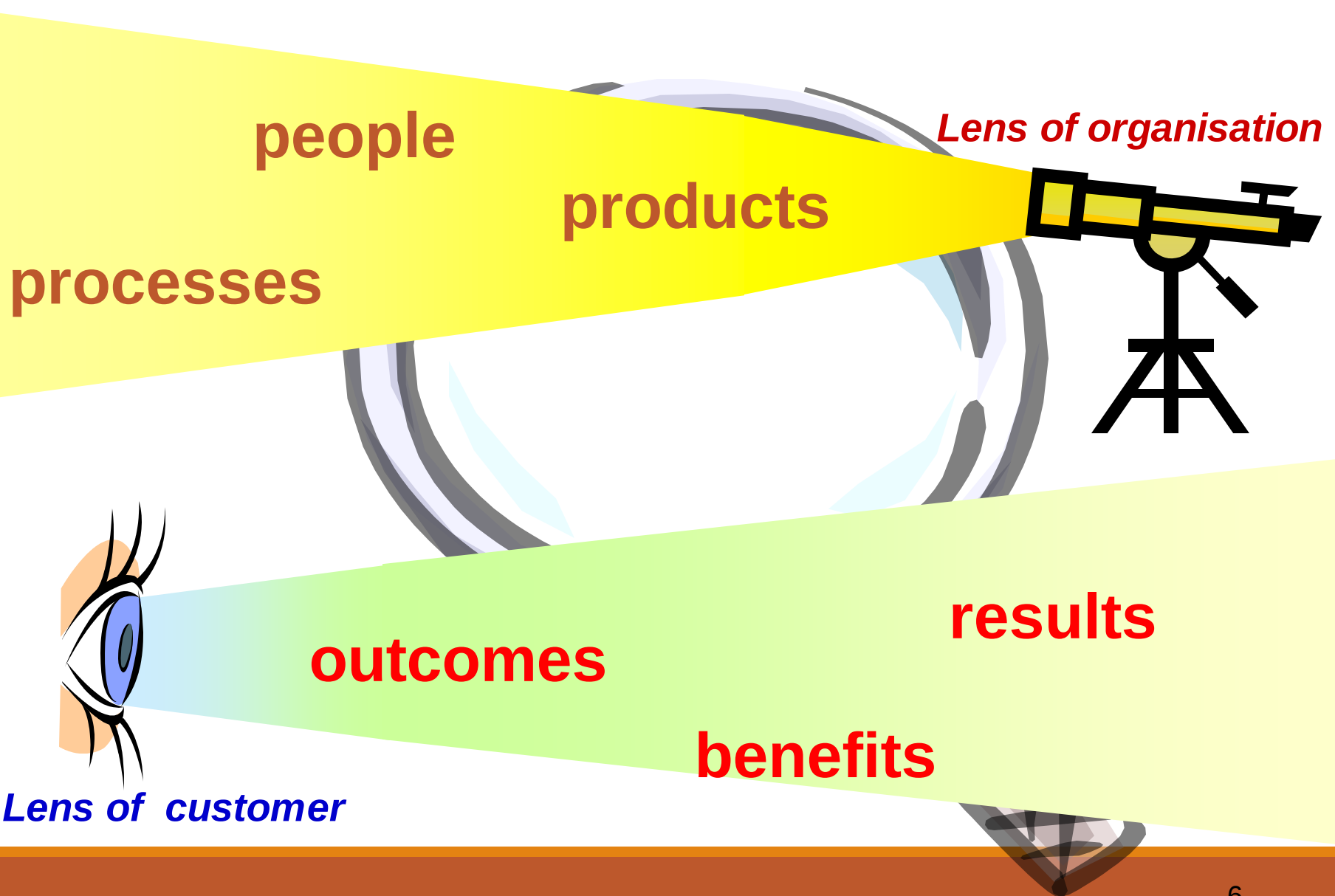


Problem Solving Technique

Types of Problem Solvers



Whose perspective should we look at?



Who are Our Customers?

**Most
useful**



**Least
useful**

1. End Users

E.g. Consumer, User, Service

2. Intermediate customers

E.g. Retailer, Distributor, OEM

3. Internal customers

E.g. Manufacturing, In-plant user

**Least
heard**



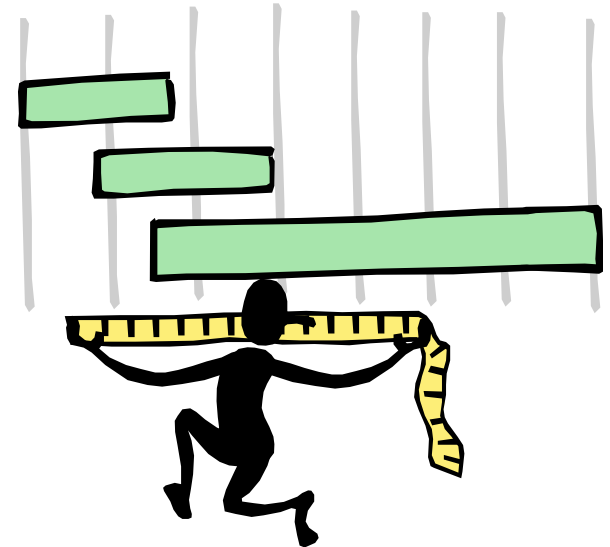
**Most
heard**

Why Do we need Quality Tools?

“95% of the problem is solved when clearly defined”

□ We need Quality Tools for:

1. Problem solving - making judgments & decisions.
2. For continual improvement.
3. For Process measurement.



Problem solving - Methods & Tools



What methods & Tools do we have for Problem Solving?

Problem solving - Methods & Tools

"As much as 95% of Quality related problems in the factory can be solved with Seven fundamental quantitative tools."

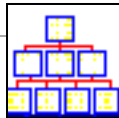
- Kaoru Ishikawa



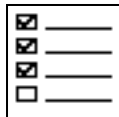
7 QC TOOLS

The 7 QC Tools;

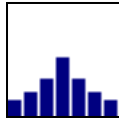
□ Flow chart



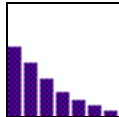
□ Check sheet



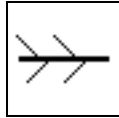
□ Histogram



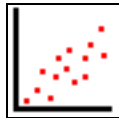
□ Pareto Diagram



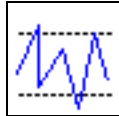
□ Cause & Effect



□ Scatter diagram



□ Control charts

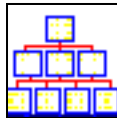


and

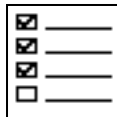
7 QC TOOLS

The 7 QC Tools;

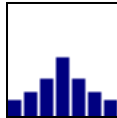
□ **Flow chart**



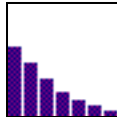
□ Check sheet



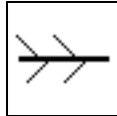
□ Histogram



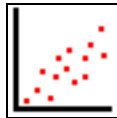
□ Pareto Diagram



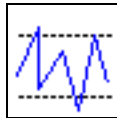
□ Cause & Effect



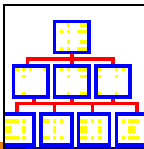
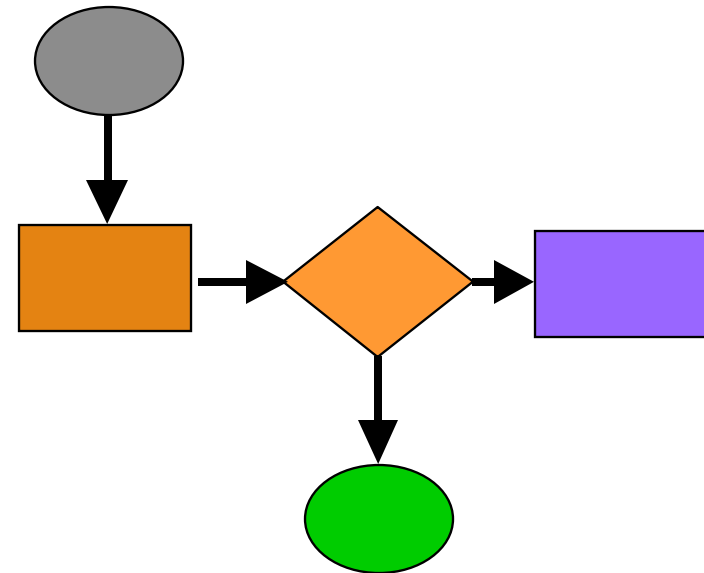
□ Scatter diagram



□ Control charts



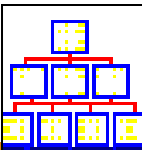
FLOW CHART



FLOW CHARTS

What is a Flow chart ?

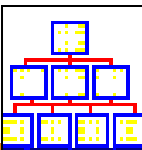
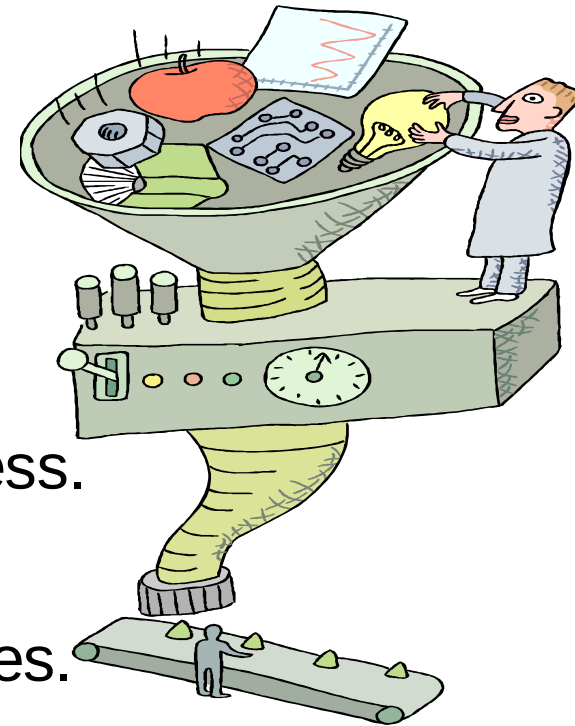
“ A diagram that uses graphic symbols to depict the nature and flow of the steps in a process.”



FLOW CHARTS

What is a Flow chart ?

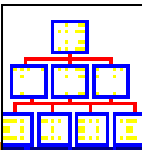
- Graphical representations of a process.
- Sequential flow of processes & sub-process.
- Process steps shown with symbolic shapes.
- Process flow indicated by arrows & symbols.



FLOW CHARTS

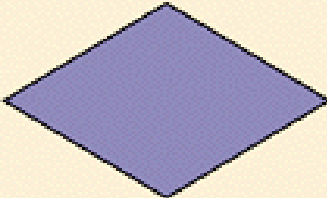
When to use Flow Charts ?

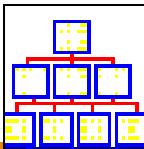
- To determine how a process currently functions.
- To determine how a process could ideally function.



FLOW CHARTS

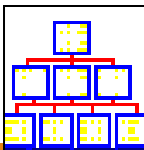
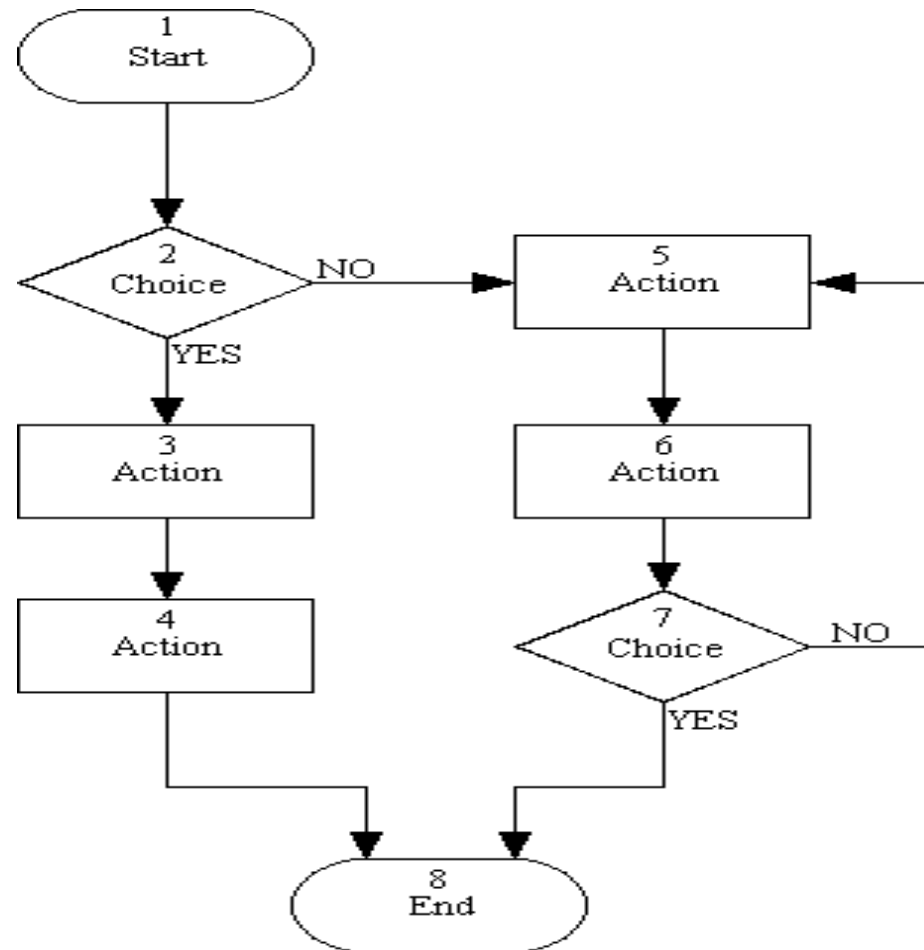
FLOW CHART SYMBOLS

Name	Symbol	Use in flowchart
Oval		Denotes the beginning or end of a program.
Flow line		Denotes the direction of logic flow in a program.
Parallelogram		Denotes either an input operation (e.g., INPUT) or an output operation (e.g., PRINT).
Rectangle		Denotes a process to be carried out (e.g., an addition).
Diamond		Denotes a decision (or branch) to be made. The program should continue along one of two routes (e.g., IF/THEN/ELSE).



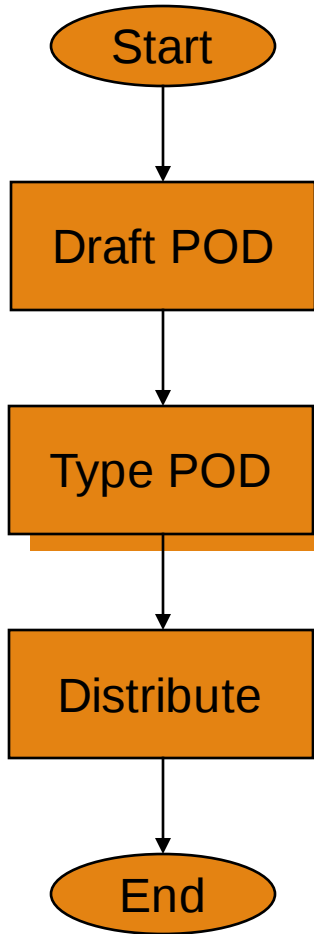
FLOW CHARTS

A BASIC FLOW CHART

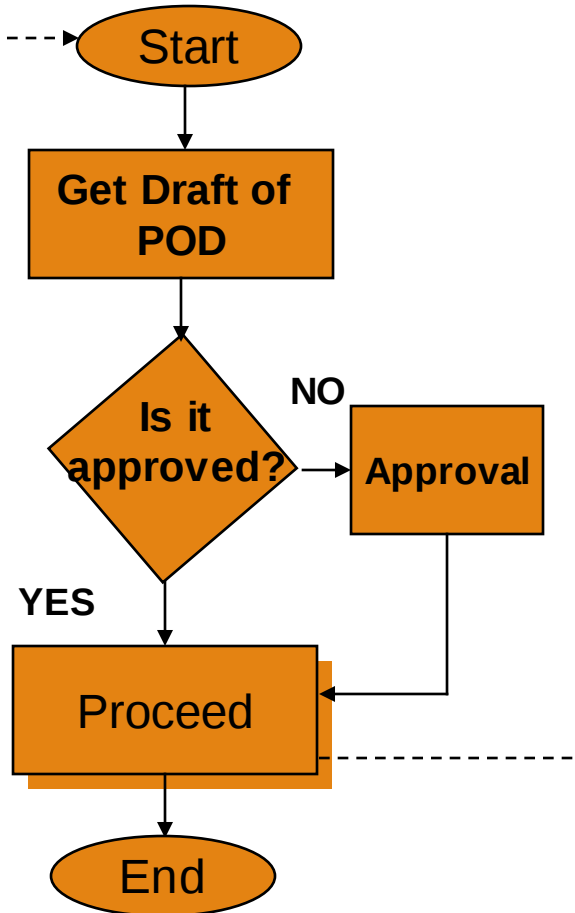


FLOW CHARTS

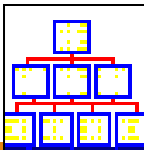
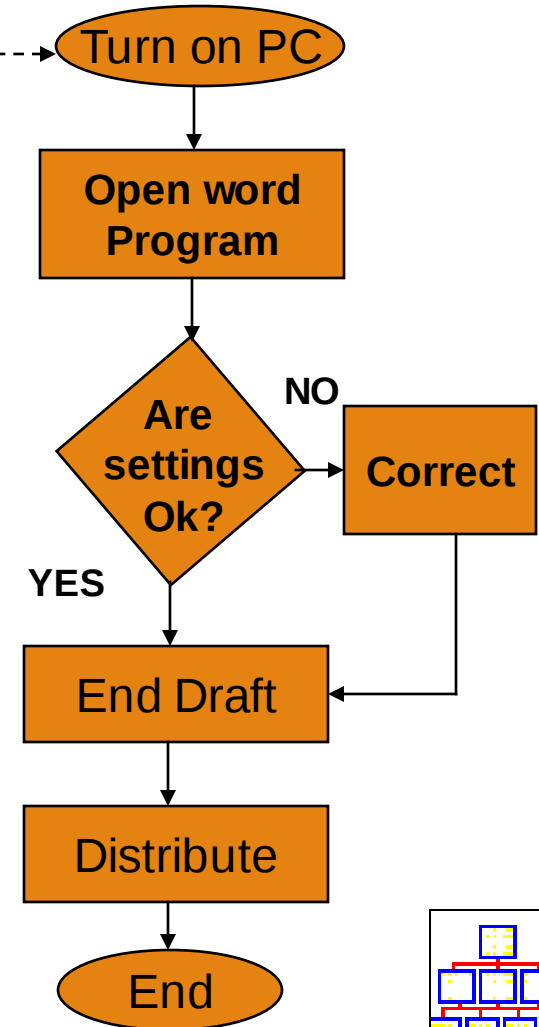
MACRO



MINI



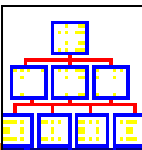
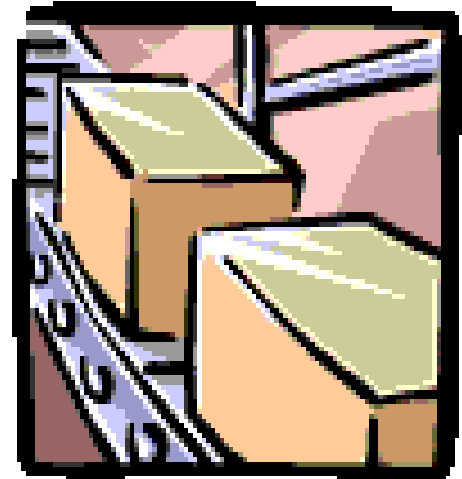
MICRO



FLOW CHARTS

Real world usage of Flow charts

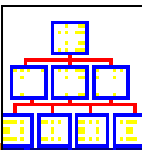
- Production
 - Manufacturing
 - To identify critical path
- Accounting
 - Helps visualising money flow
- Services
 - Restaurants
 - Real estate



FLOW CHARTS

Benefits of Flow Charts

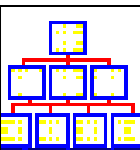
- ❑ Create Visual map of process.
- ❑ To identify time lags & NVA steps.
- ❑ Identify process that need improvement.
- ❑ Determine major & minor inputs in the process.
- ❑ Promotes process understanding.
- ❑ Depicts customer - supplier relationship.



FLOW CHART

1. Examples of Flow chart:

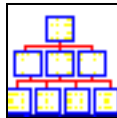
- In-house Process Flow chart
- Supplier Process Flow chart



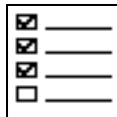
7 QC TOOLS

The 7 QC Tools;

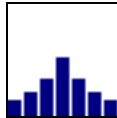
□ Flow chart



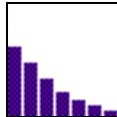
□ **Check sheet**



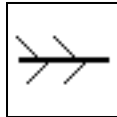
□ Histogram



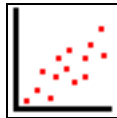
□ Pareto Diagram



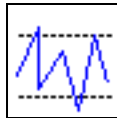
□ Cause & Effect



□ Scatter diagram



□ Control charts



CHECK SHEET

Cause	Place a mark each time it occurs
Slips, trips and falls	/// /// /// ///
Lifting and carrying	/// ///
Cuts	///
Burns	
Contact with substances	/// /// ///



CHECK SHEET

What is a Check sheet ?

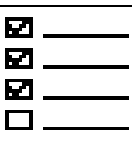
- A graphical presentation of information.
- Data gathering & interpretation tool.
- Simplest way to assess common problems.



CHECK SHEET

When to use a Check sheet ?

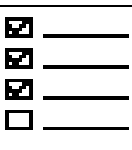
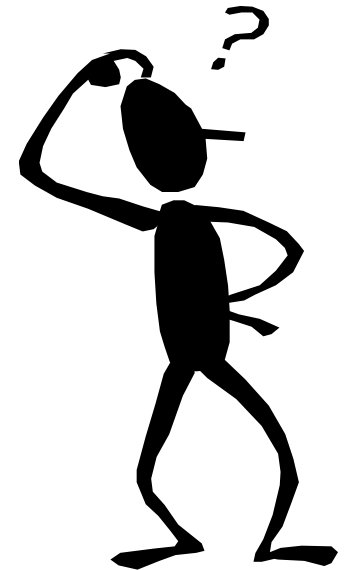
- To distinguish between fact & opinion.
- To gather data about how often a problem occurs.
- To gather data about the type of problem.



CHECK SHEET

How to create a Check sheet ?

- What is the Problem?
- Why should data be collected?
- Who will use the information being collected?
- Who will collect the data?



CHECK SHEET

SAMPLE CHECK SHEET

Defect Type		Totals
1.Assembly	II	2
2.Print Quality	IIIIIIIIII	13
3.Print Detail	IIII	4
4.Edge Flaw	IIIIIIIIIIIIIIIIII	22
5.Cosmetic	IIII	5

Customer Complaints		Totals
1.Missing Ring	II	2
2.Print Quality	IIIIIIIIIIIIIIIIII	23
3.Misplace Print	IIII	4
4.Rough Edge	III	3
5.Type Error	IIIII	6
6.Excess Flash	IIIIIIIIII	13
7.Late Shipment	IIIII	6
8.Bad Count	IIII	4

☒	_____
☒	_____
☒	_____
☐	_____

CHECK SHEET

SAMPLE CHECK SHEET

Cause	Place a mark each time it occurs
Slips, trips and falls	/// /// /// ///
Lifting and carrying	/// ///
Cuts	///
Burns	
Contact with substances	/// /// ///

☒	_____
☒	_____
☒	_____
☐	_____

CHECK SHEET

SAMPLE CHECK SHEET

Door paint check sheet

Sheet number 243

Paint robot number: 03246

Date: 12th Oct

Paint batch number: 172583

Paint operator: Jon Williams

Doors painted: IIII IIII

Defect type	symbol	count...
bubble	○	IIII IIII IIII II
run	△	IIII III
scuff	□	IIII

☒ _____

☒ _____

☒ _____

☐ _____

CHECK SHEET

SAMPLE CHECK SHEET

Pin diameter Check Sheet

Sheet No: 1532

Date: 12th Oct Operator: Steve Jefferson

Lathe number: 32146 Remarks: _____

Cutter type: Ø32

Lower Spec. Limit Upper Spec. Limit

mm: 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3.0 3.1 3.2 3.3 3.4

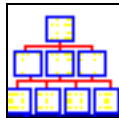
25																									
20																									
15																									
10																									
5																									
0																									
Total:	0	0	0	1	0	1	2	4	7	10	14	18	19	15	13	9	5	4	2	2	1	0	0	1	0

☒	_____
☒	_____
☒	_____
☐	_____

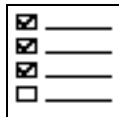
7 QC TOOLS

The 7 QC Tools;

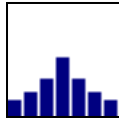
□ Flow chart



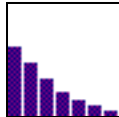
□ Check sheet



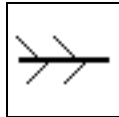
□ **Histogram**



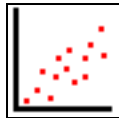
□ Pareto Diagram



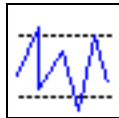
□ Cause & Effect



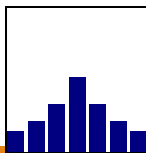
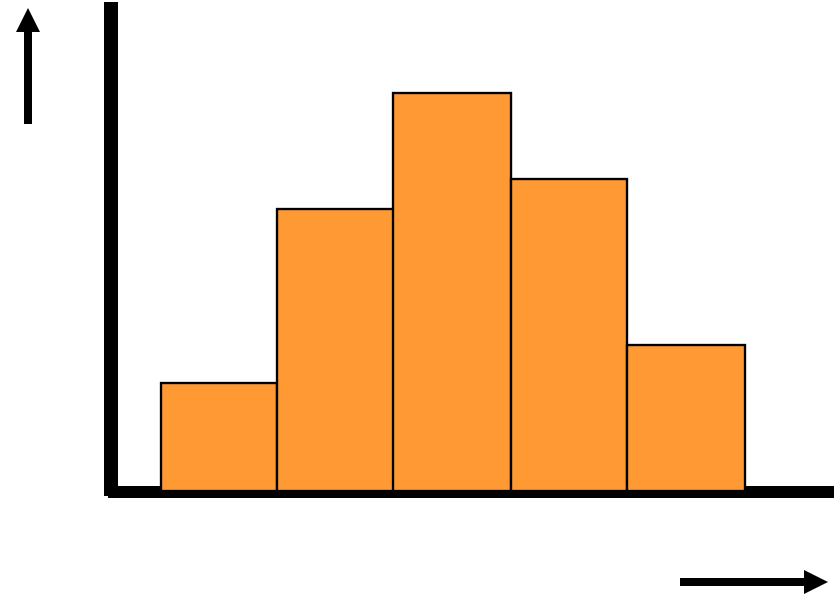
□ Scatter diagram



□ Control charts



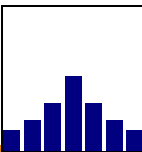
HISTOGRAM



HISTOGRAM

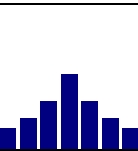
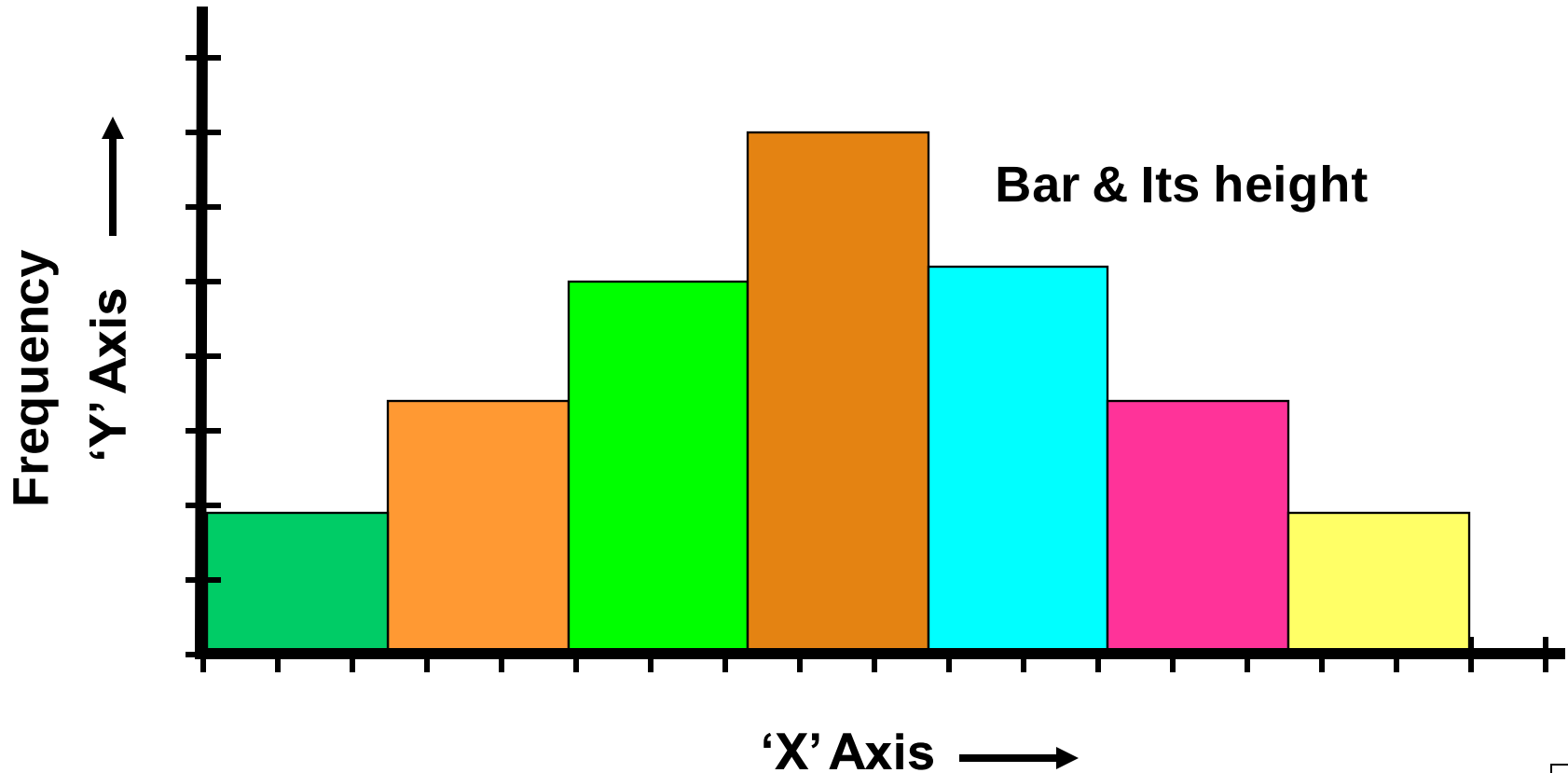
What is a Histogram ?

- A vertical bar chart that depicts distribution of data.
- It is a one time snap shot of a process performance.
- A tool to determine the frequency of occurrence of data.
- A graphical information communicating tool.
- Compares process results with specification limits.



HISTOGRAM

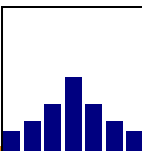
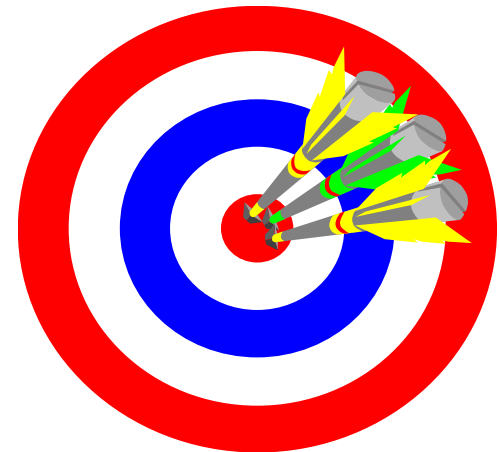
TITLE: _____



HISTOGRAM

When to use a Histogram ?

- To summarize large data sets graphically.
- To compare measurements to specifications.
- To communicate information to the team.
- Assist in decision making.



HISTOGRAM

Constructing a Histogram

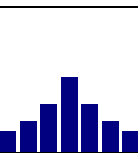
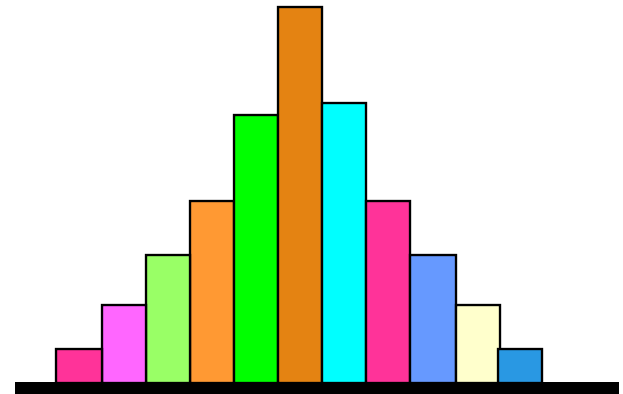
Step 1: Count number of data points

Step 2: Summarize on a tally sheet

Step 3: Compute the range

Step 4: Determine number of intervals

Step 5: Compute interval width



HISTOGRAM

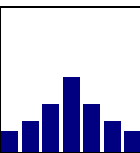
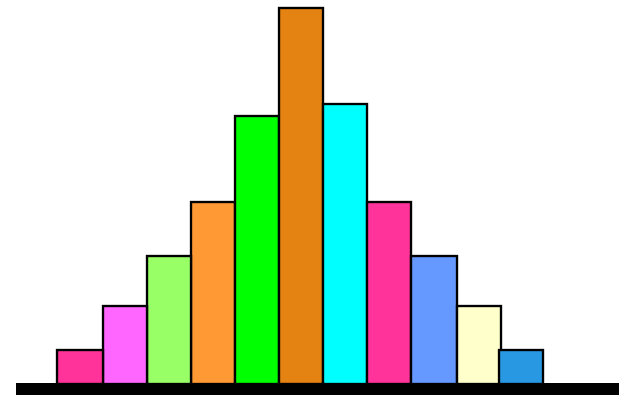
Constructing a Histogram

Step 6: Determine interval starting points

Step 7: Count number of parts in Each interval

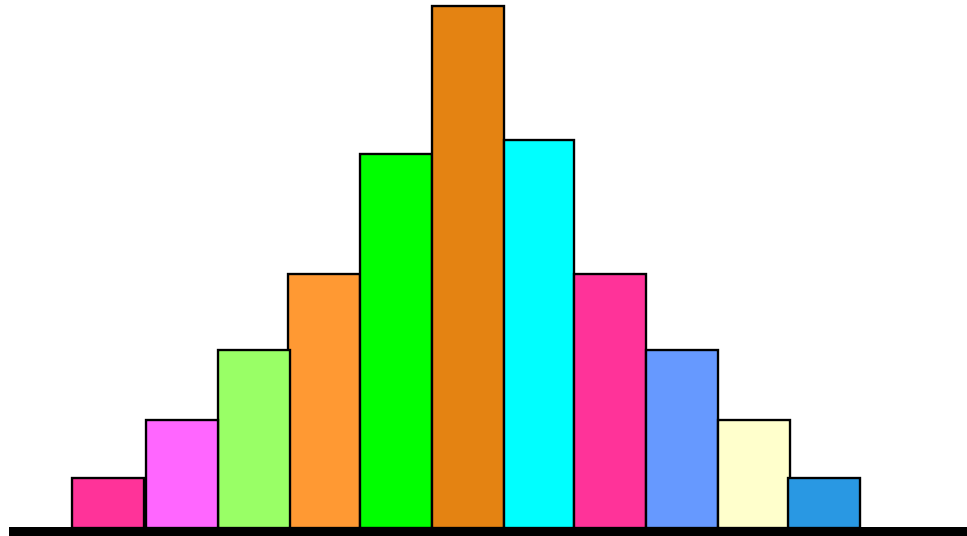
Step 8: Plot the data

Step 9: Add title and legend

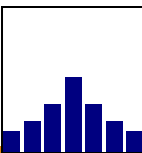


BAR WIDTH & BOUNDARY

1. Find the range of the data set I.e., Highest value - lowest.
2. Bar width = Range of data set / number of bars (as / table)

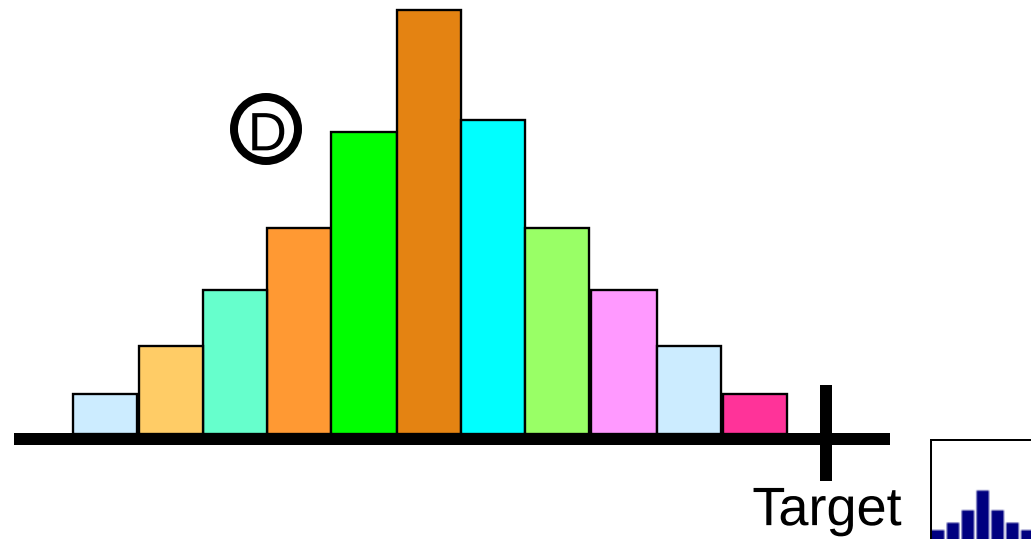
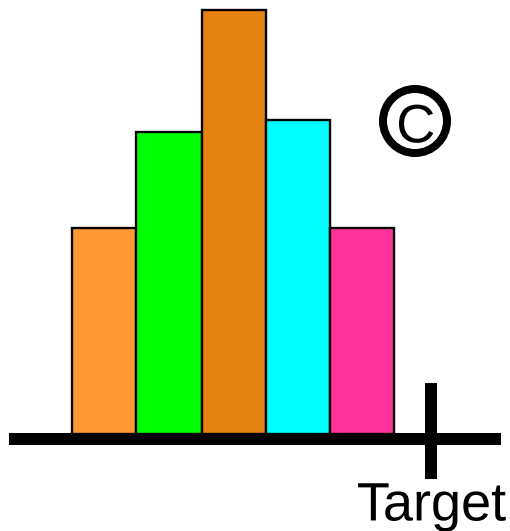
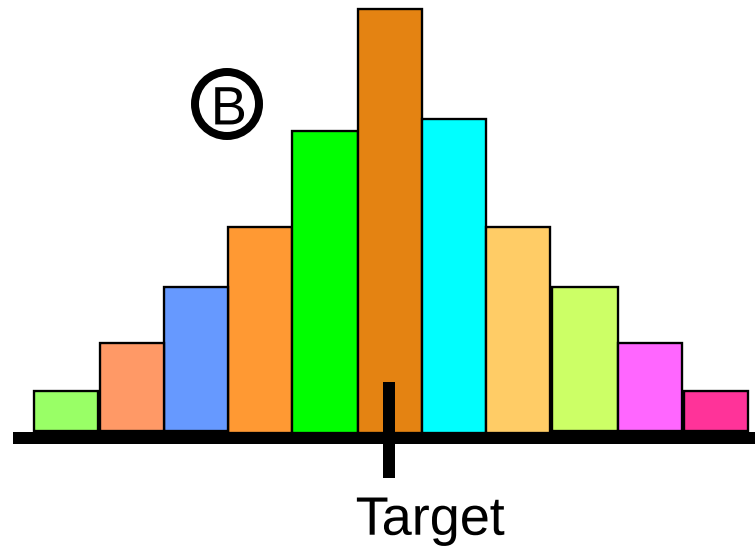
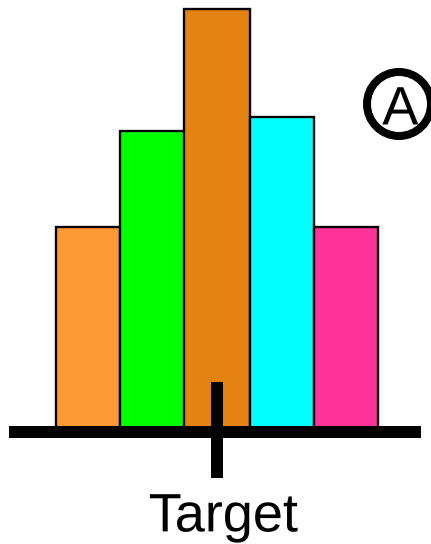


?



INTERPRETING HISTOGRAM

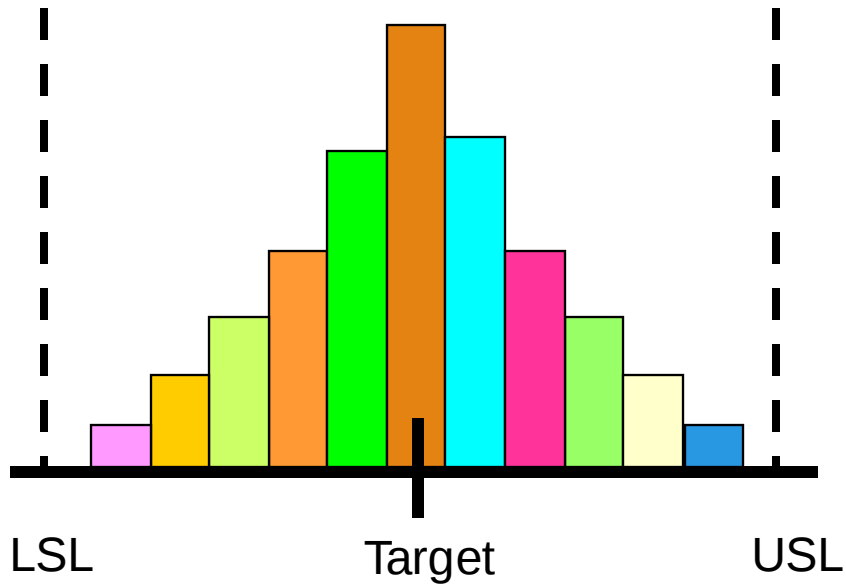
Location & Spread of Data



INTERPRETING HISTOGRAM

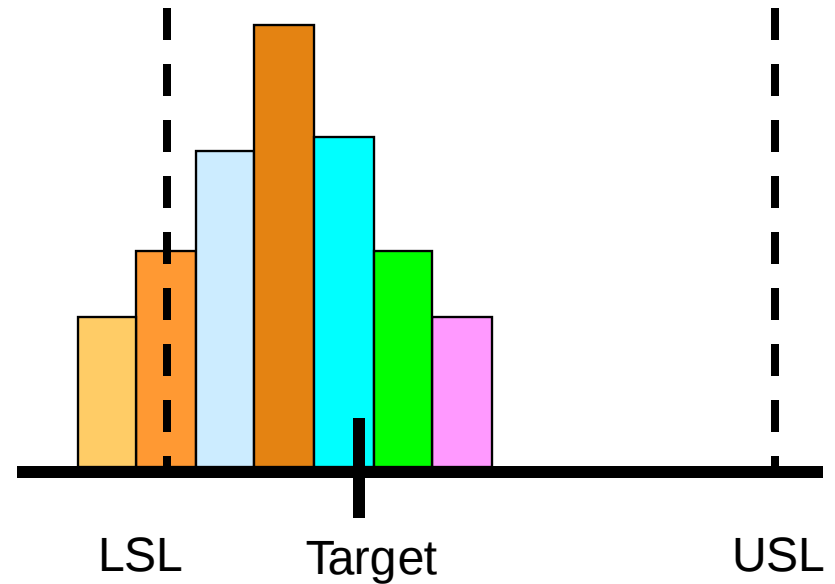
With Process Specification limits

Within Specification

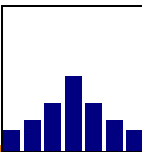


LSL - Lower Specification Limit

Out of Specification

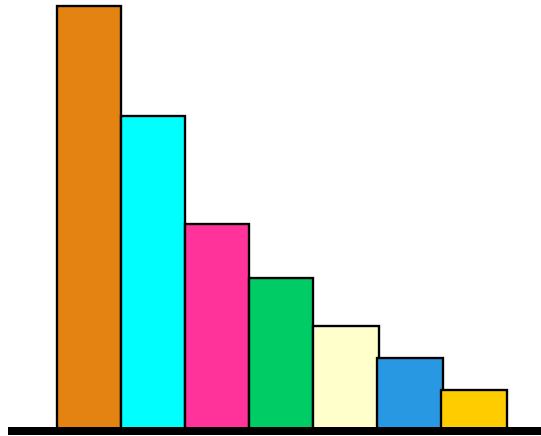


USL - Upper Specification Limit

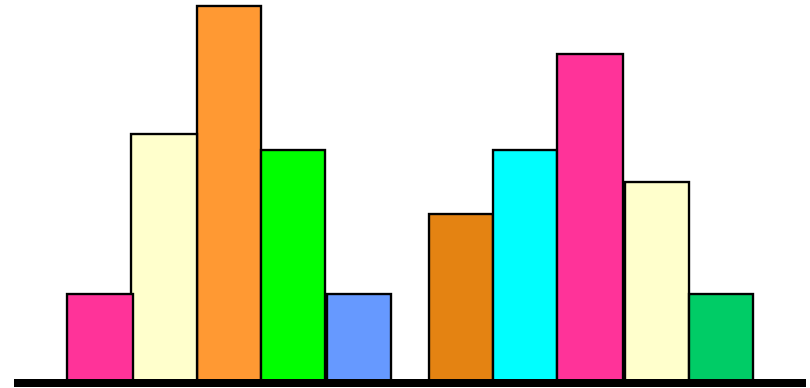


INTERPRETING HISTOGRAM

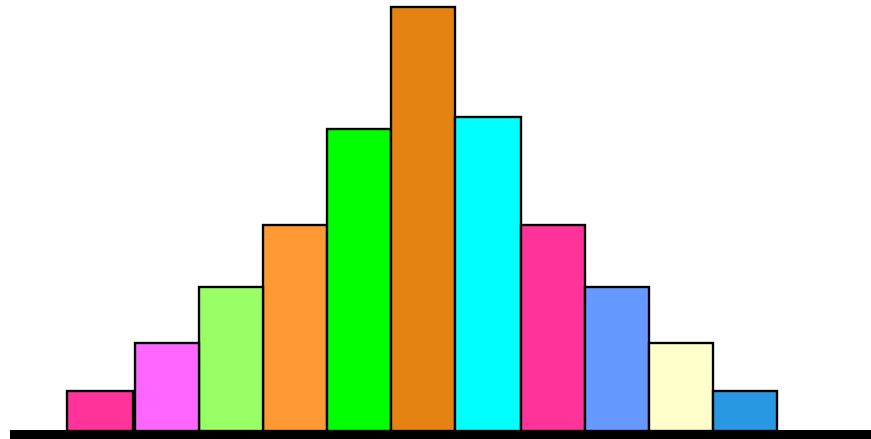
Common Histogram Shapes



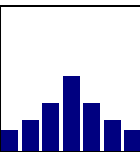
Skewed (Not symmetrical)



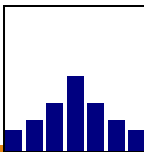
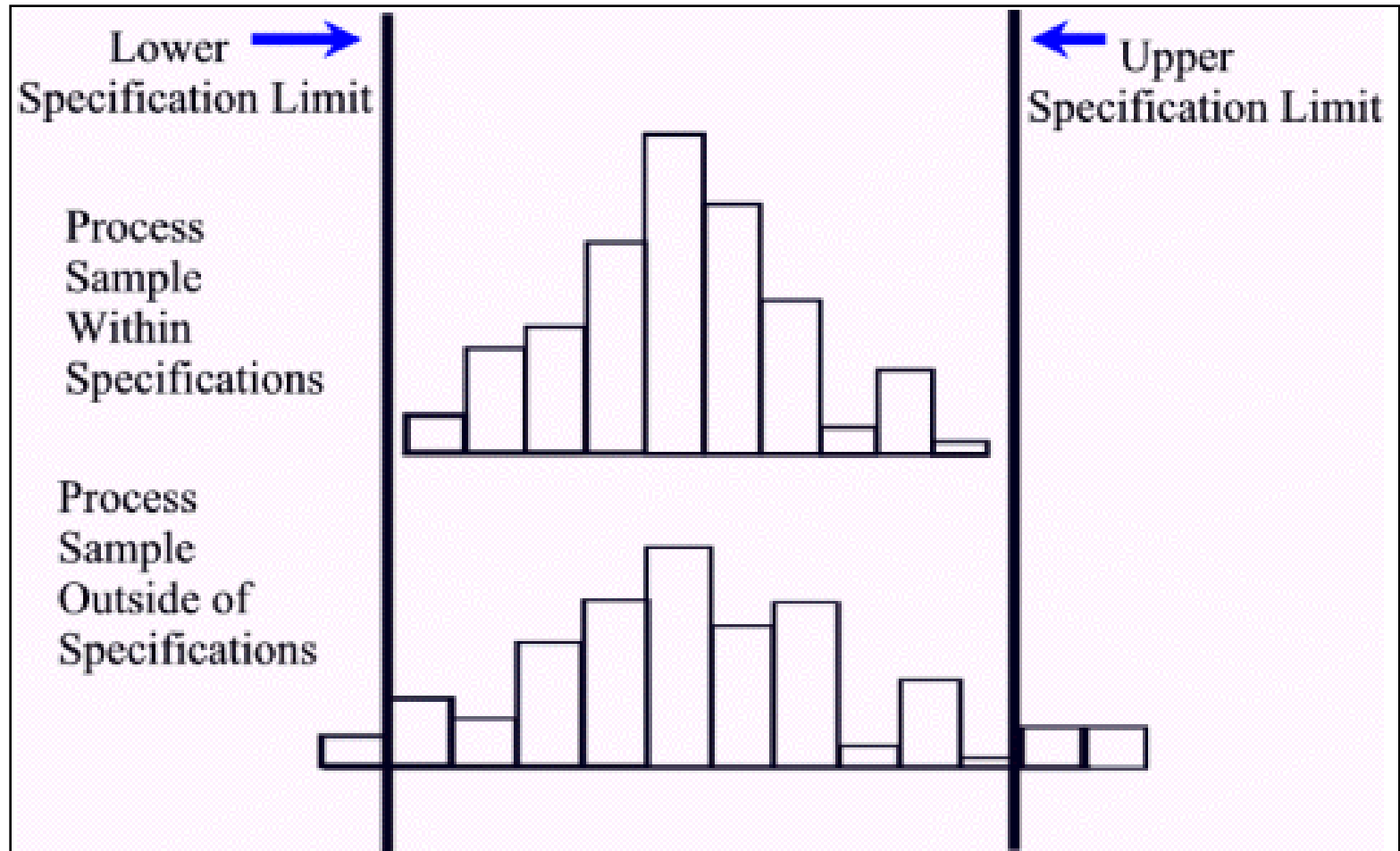
Discontinued



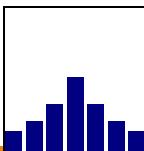
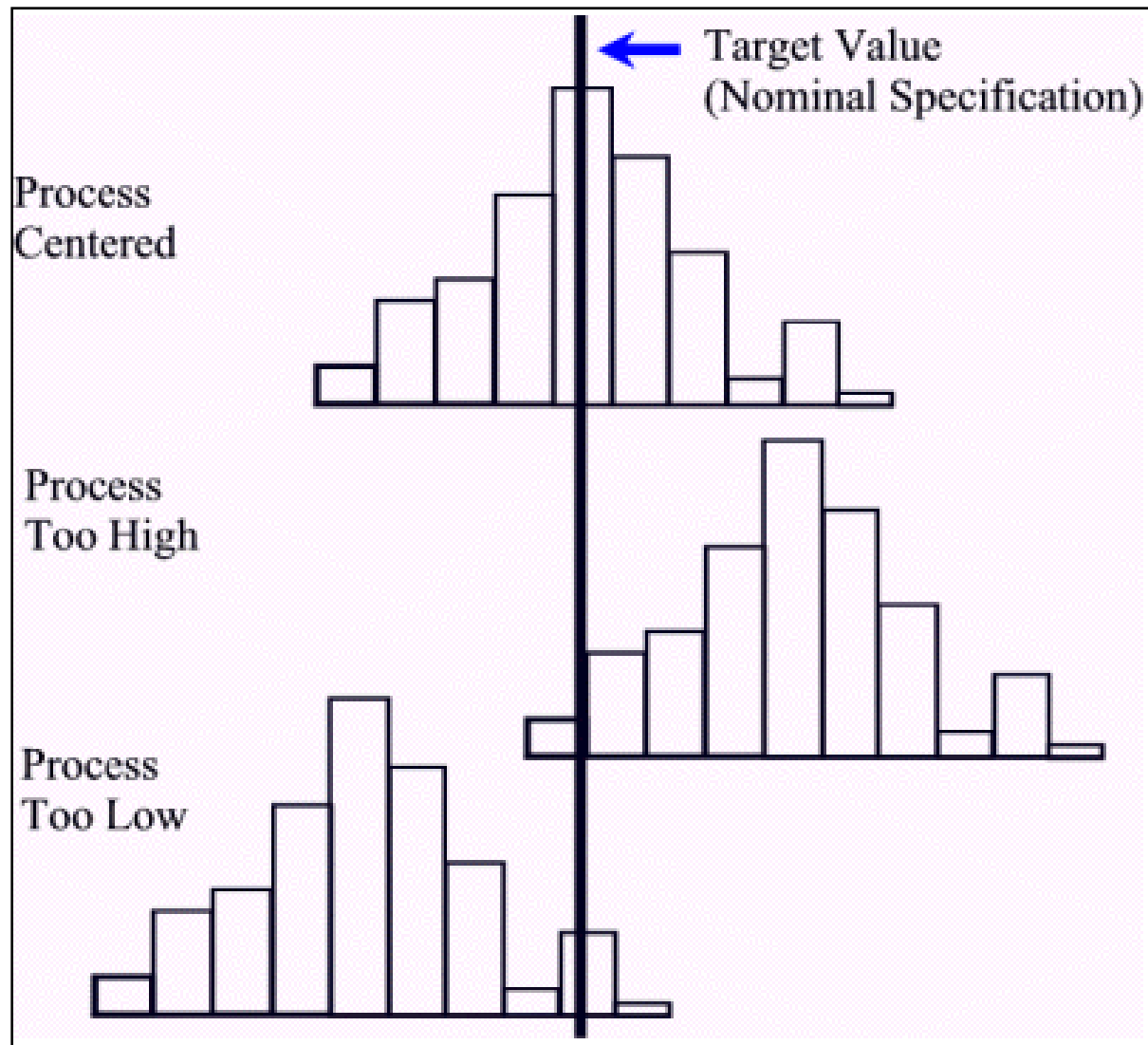
Symmetrical (Mirror imaged)



INTERPRETING HISTOGRAM



INTERPRETING HISTOGRAM



INTERPRETING HISTOGRAM



Normal distribution



Right-skewed distribution



Plateau distribution



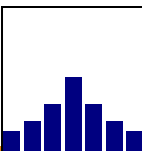
Dog food distribution



Truncated or heart-cut distribution



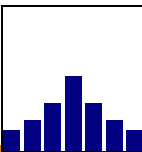
Comb distribution



HISTOGRAM

Benefits of Histogram

- To know whether process produces **within** specification.
- To know whether process is **stable & predictable**.
- Process **monitoring & centering**.

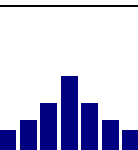


HISTOGRAM

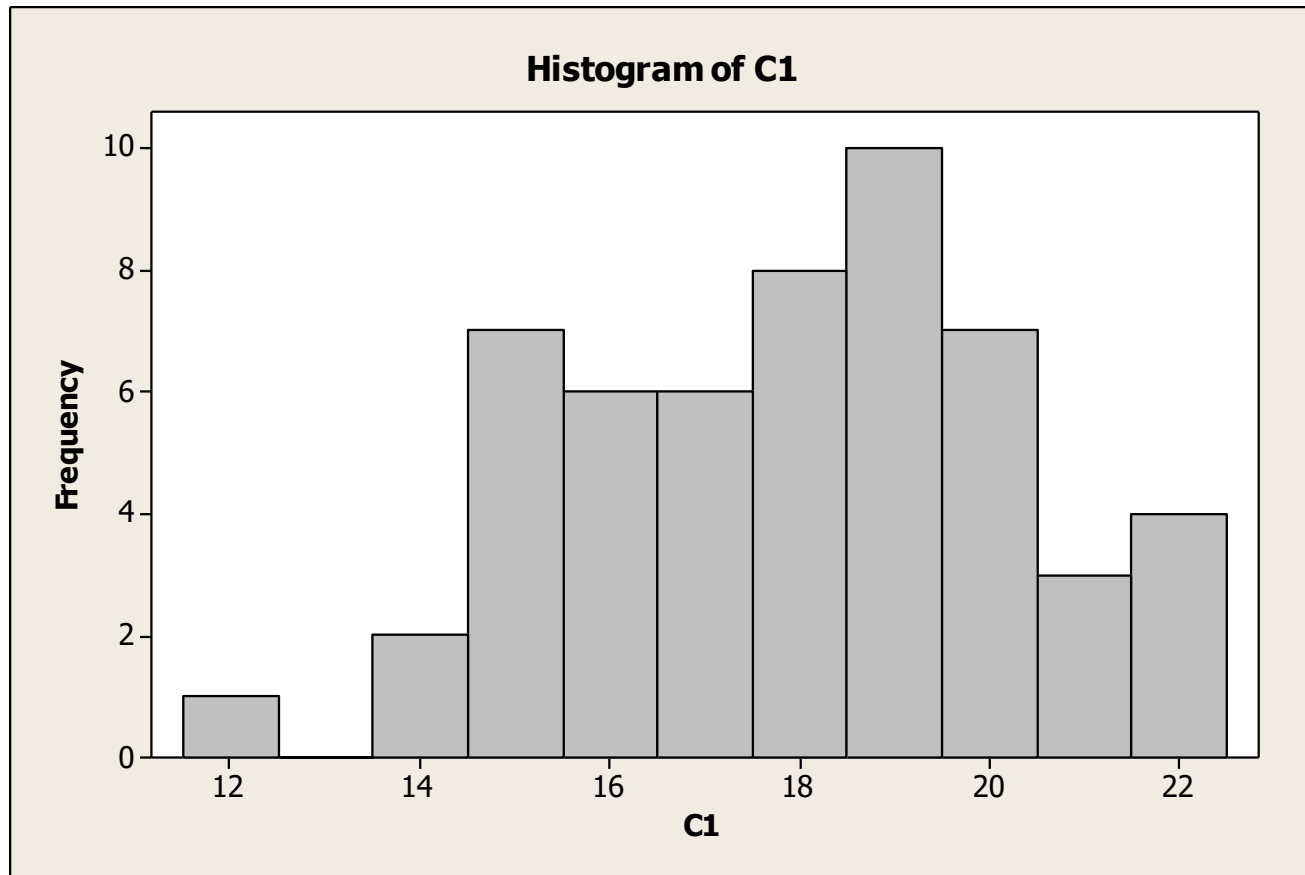
1. Learn to construct a Histogram using:

- [MS Excel](#)
- [Minitab software](#)

2. Exercise on Histogram

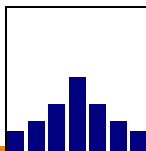


HISTOGRAM

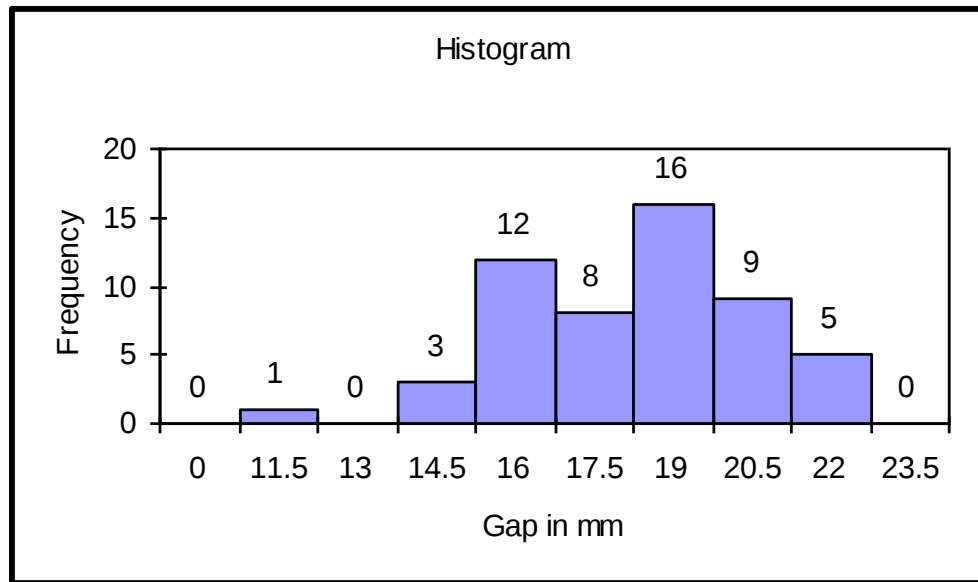


Descriptive Statistics: C1

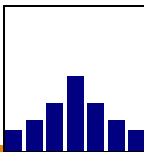
Variable	Mean	St Dev	Minimum	Median	Maximum	Skewness	Kurtosis
C1	17.741	2.357	11.500	18.000	22.000	-0.27	-0.46



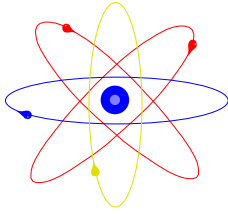
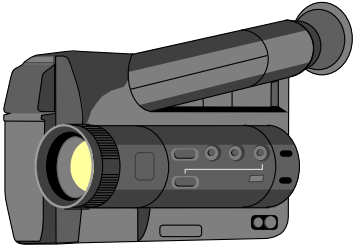
HISTOGRAM



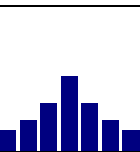
Bin	Frequency
0	0
11.5	1
13	0
14.5	3
16	12
17.5	8
19	16
20.5	9
22	5
23.5	0
More	0



VISUALS



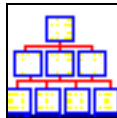
How a Histogram is generated ?



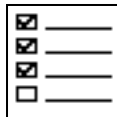
7 QC TOOLS

The 7 QC Tools;

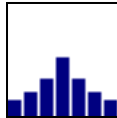
□ Flow chart



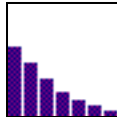
□ Check sheet



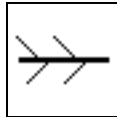
□ Histogram



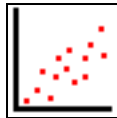
□ **Pareto Diagram**



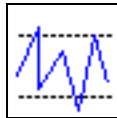
□ Cause & Effect



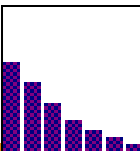
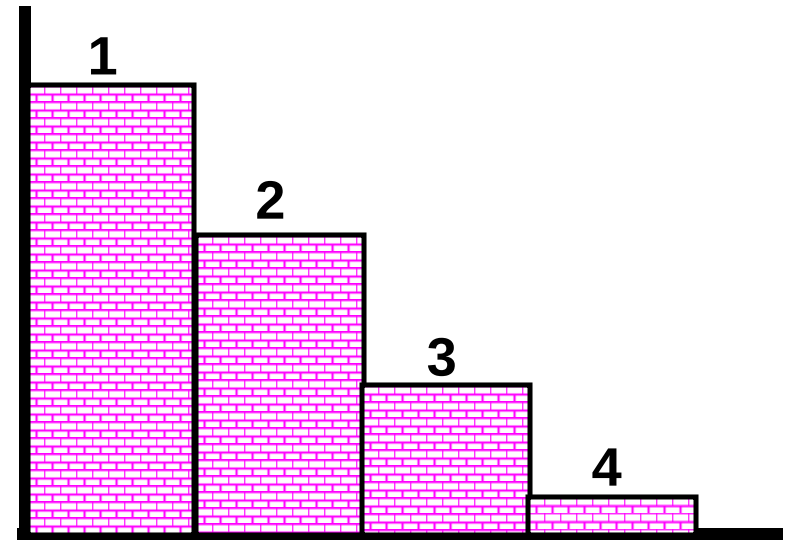
□ Scatter diagram



□ Control charts



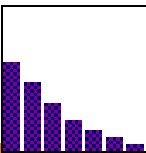
PARETO DIAGRAM



PARETO DIAGRAM

What is a Pareto Diagram ?

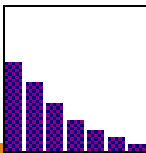
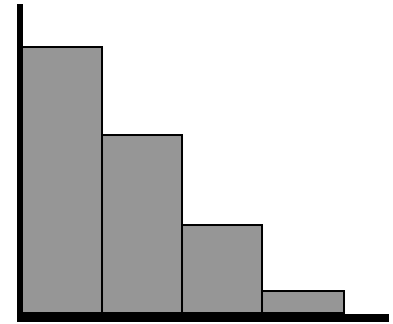
- Shows focus area to get most gains.
- Bar chart arranged in descending order of height.
- Bars on left; relatively important than those in right.
- Separates “Vital few” from “Trivial many”.
- 80 % of trouble comes from 20 % of the problems
- Named after Italian Economist Wilfredo Pareto.



PARETO DIAGRAM

When to use a Pareto Diagram ?

- Starter to Problem solving - What to solve?
- To break big problems into smaller problems.
- To prioritize high impact issues - Where to focus?
- Systematic analysis of causes based on magnitude.
- Allows better use of limited resources.



PARETO DIAGRAM

Constructing a Pareto Diagram

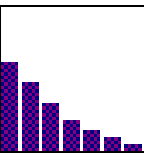
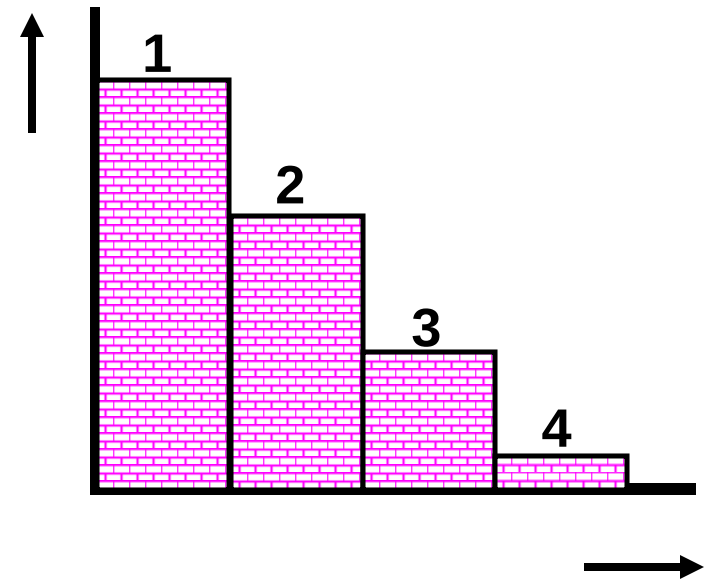
Step 1: Record the data

Step 2: Order the data

Step 3: Label the vertical axis

Step 4: Label the Horizontal axis

Step 5: Plot the Bars



PARETO DIAGRAM

Constructing a Pareto Diagram

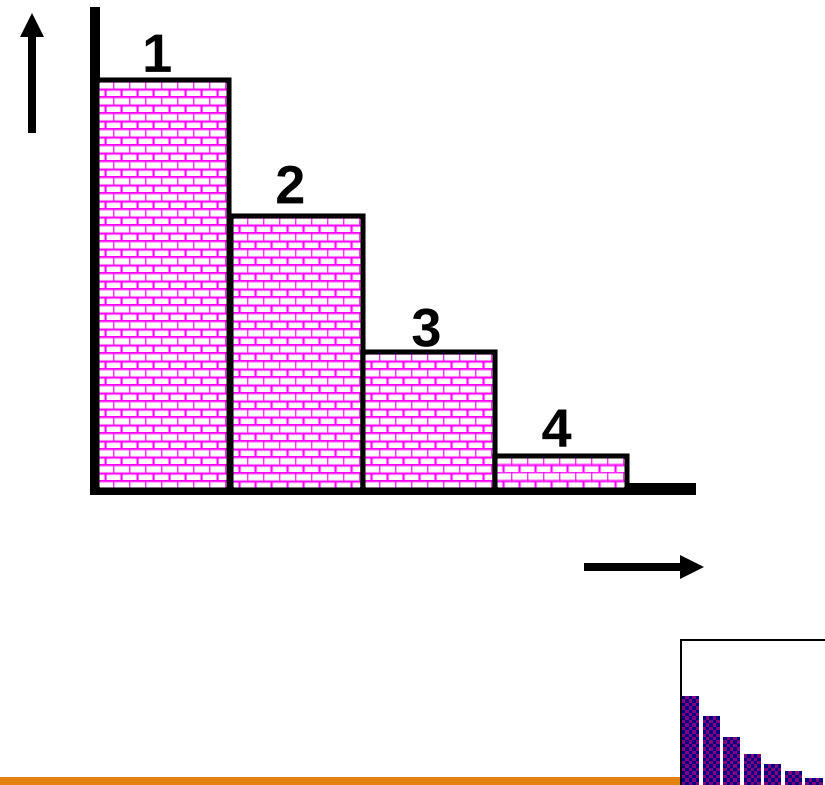
Step 6: Add up the counts

Step 7: Add a cumulative line

Step 8: Add title, Legend and Date

Step 9: Analyze the Diagram

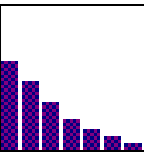
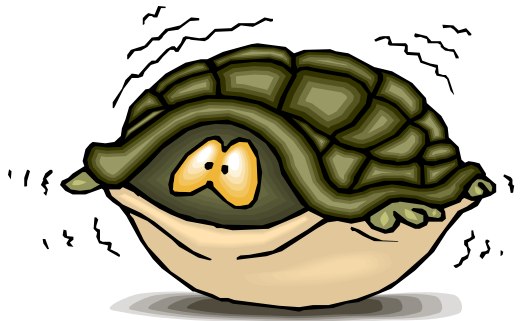
Step 10: Interpret the results



PARETO DIAGRAM

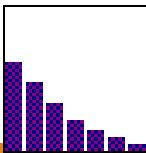
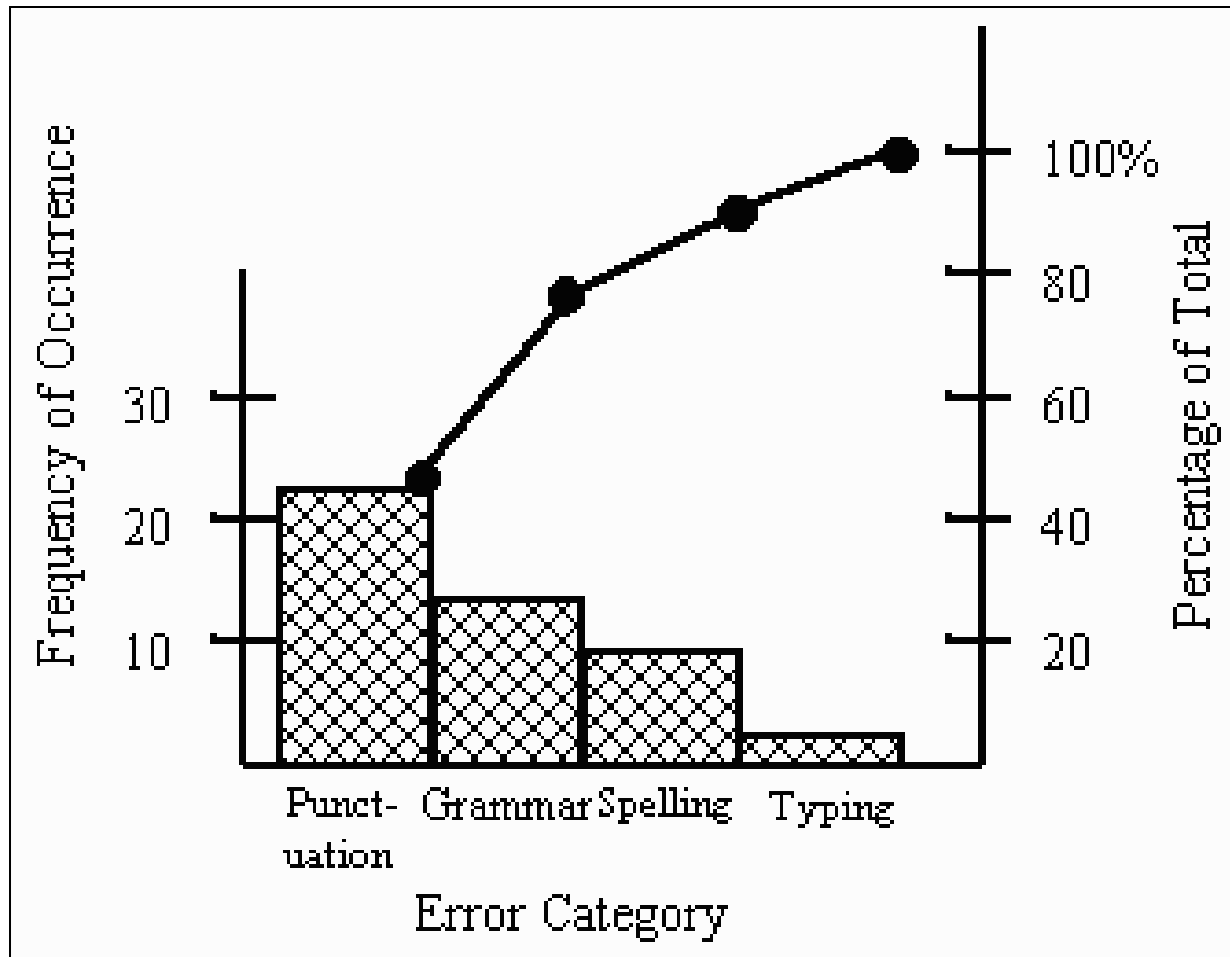
Benefits of Pareto Diagram

- Identifies '**Major Few**' problems.
- Improves team performance & effectiveness.
- **Before & After** tracking of a problem in single chart.



PARETO DIAGRAM

A SAMPLE PARETO CHART

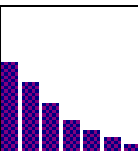


PARETO DIAGRAM

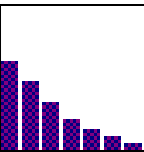
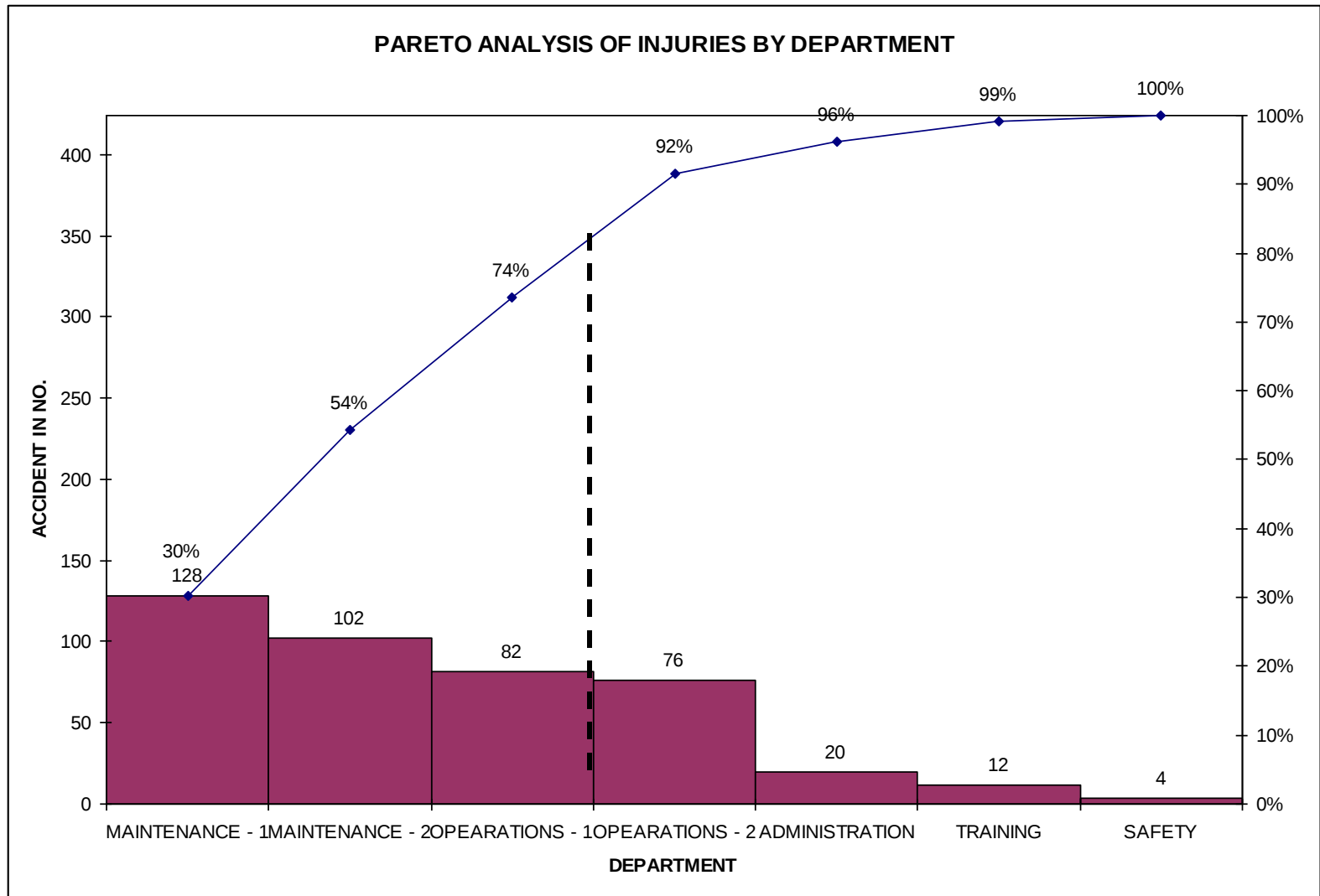
1. Learn to construct a Pareto Diagram using:

- [Pareto Excel - Example](#)
- [Minitab software](#)

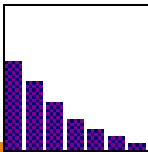
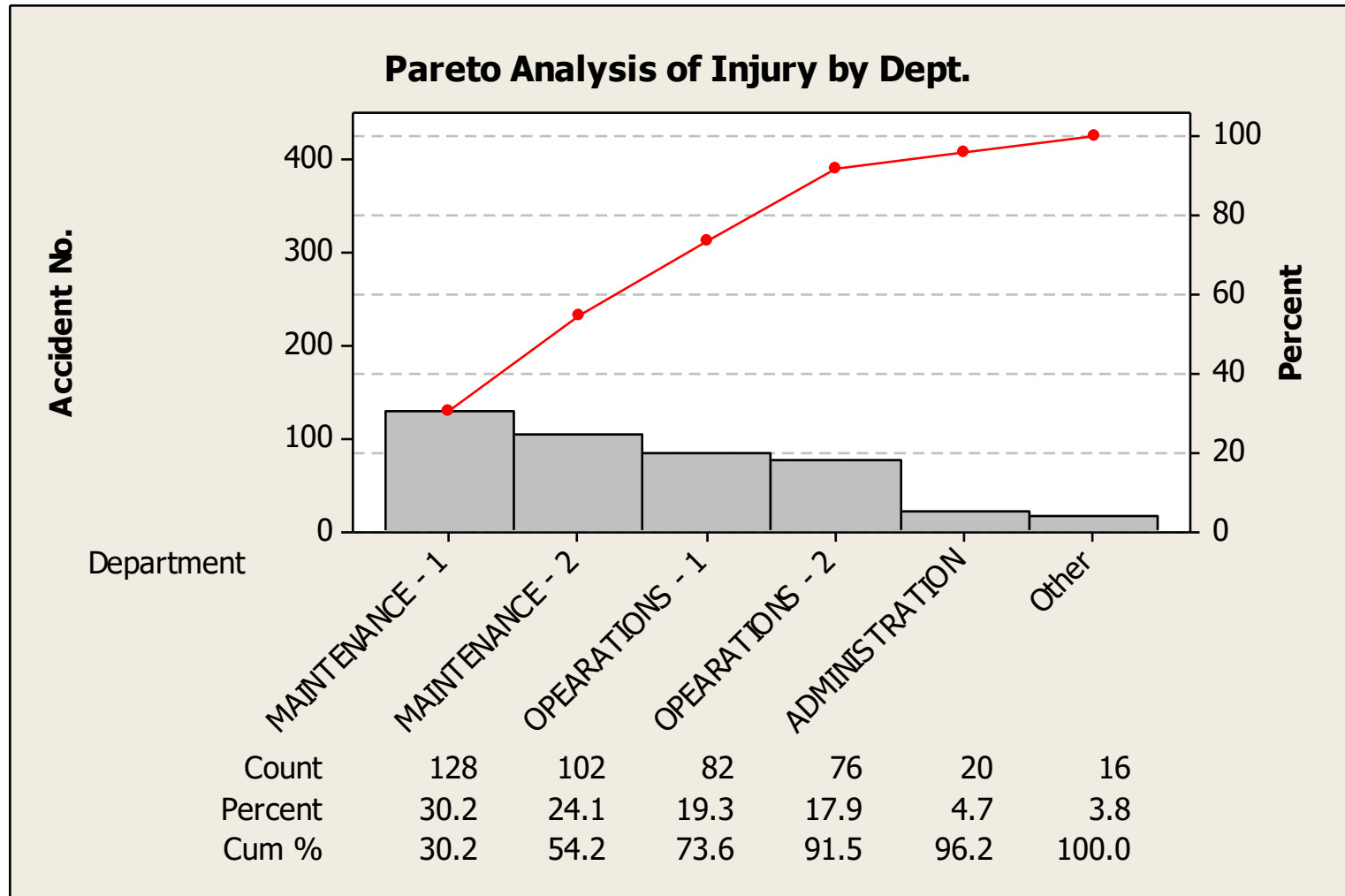
2. Exercise on Pareto Diagram.



PARETO DIAGRAM



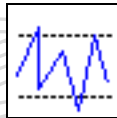
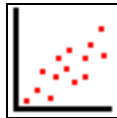
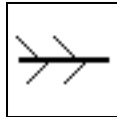
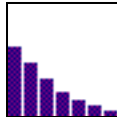
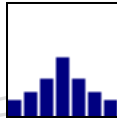
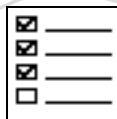
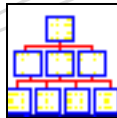
PARETO DIAGRAM



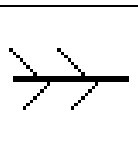
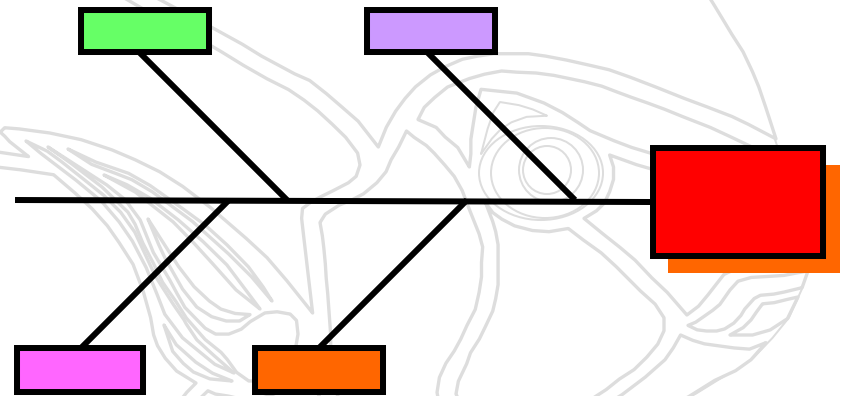
7 QC TOOLS

The 7 QC Tools;

- Flow chart
- Check sheet
- Histogram
- Pareto Diagram
- **Cause & Effect**
- Scatter diagram
- Control charts



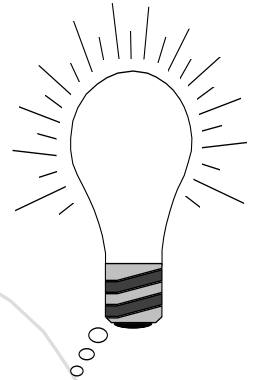
CAUSE & EFFECT DIAGRAM



CAUSE & EFFECT DIAGRAM

What is a Cause & Effect Diagram ?

A graphical tool that helps identify, sort and display possible causes of a problem or Quality characteristic.



CAUSE & EFFECT DIAGRAM

About Cause & Effect Diagram ?

- ❑ Developed by **Kaoru Ishikawa** of Japan.
- ❑ Also called, Ishikawa or **Fish bone** diagram.
- ❑ Used to explore **potential & real causes**.
- ❑ Compares relative importance of each cause.
- ❑ Helps to identify **root cause**.



CAUSE & EFFECT DIAGRAM

When to use a Cause & Effect Diagram ?

- During Problem solving to focus on problem.
- To sort out interactions among factors for a cause.
- To analyze existing problems.



CAUSE & EFFECT DIAGRAM

Why to use Cause & Effect Diagram ?

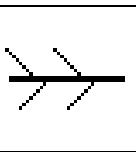
- ❑ Helps to determine root cause of a Problem.
- ❑ Group participation & knowledge sharing.
- ❑ Indicates possible cause for variation in a process.
- ❑ Increases knowledge of a process, its factors etc.,
- ❑ Identifies areas of further data collection.



CAUSE & EFFECT DIAGRAM

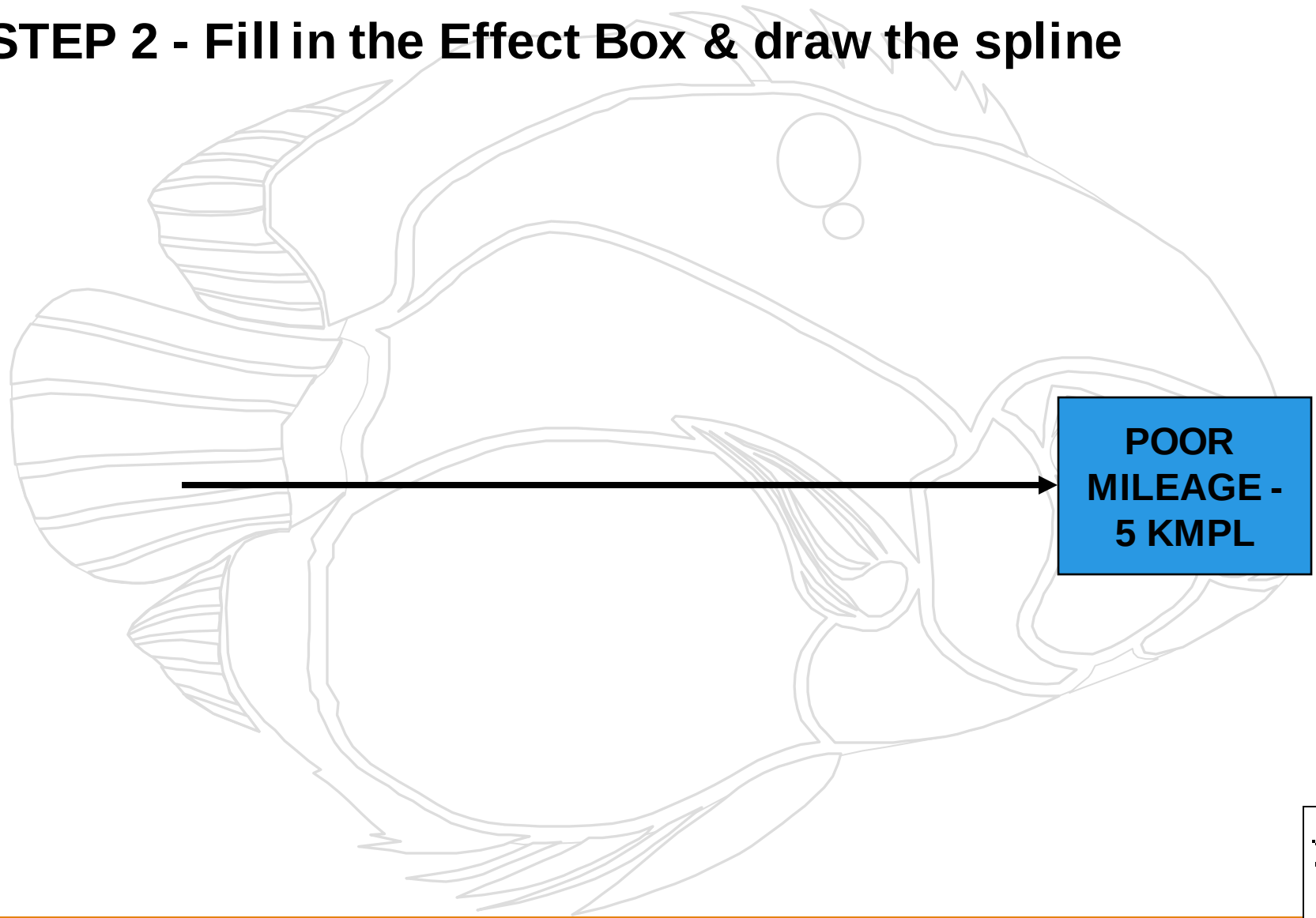
STEP 1 - Identify & define the effect

- Decide on the effect to examine.
- Use operational definitions.
- Phrase effect and quantify
 - Positive (an objective) or
 - Negative (a problem)



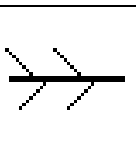
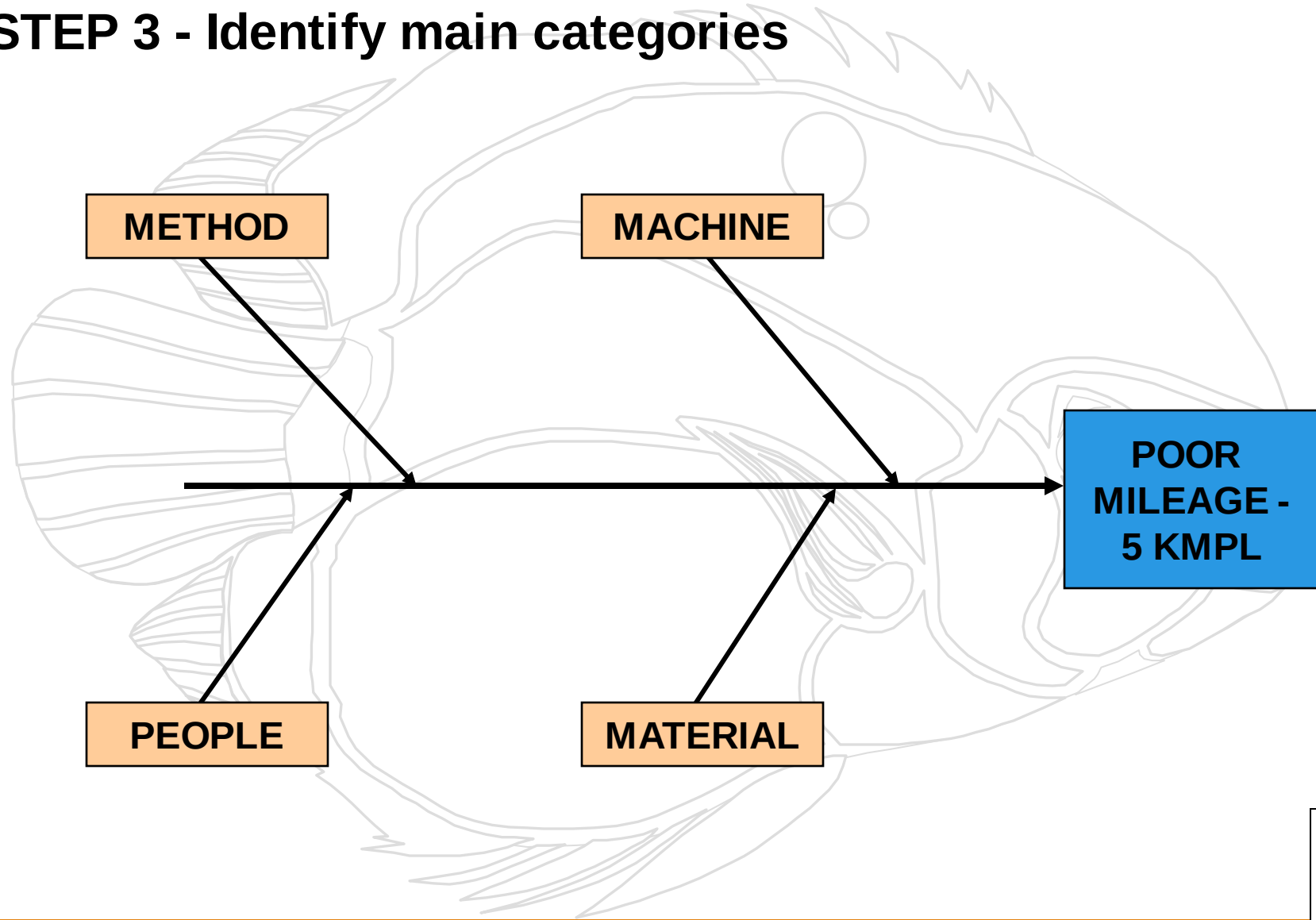
CAUSE & EFFECT DIAGRAM

STEP 2 - Fill in the Effect Box & draw the spline



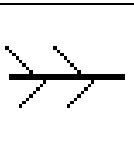
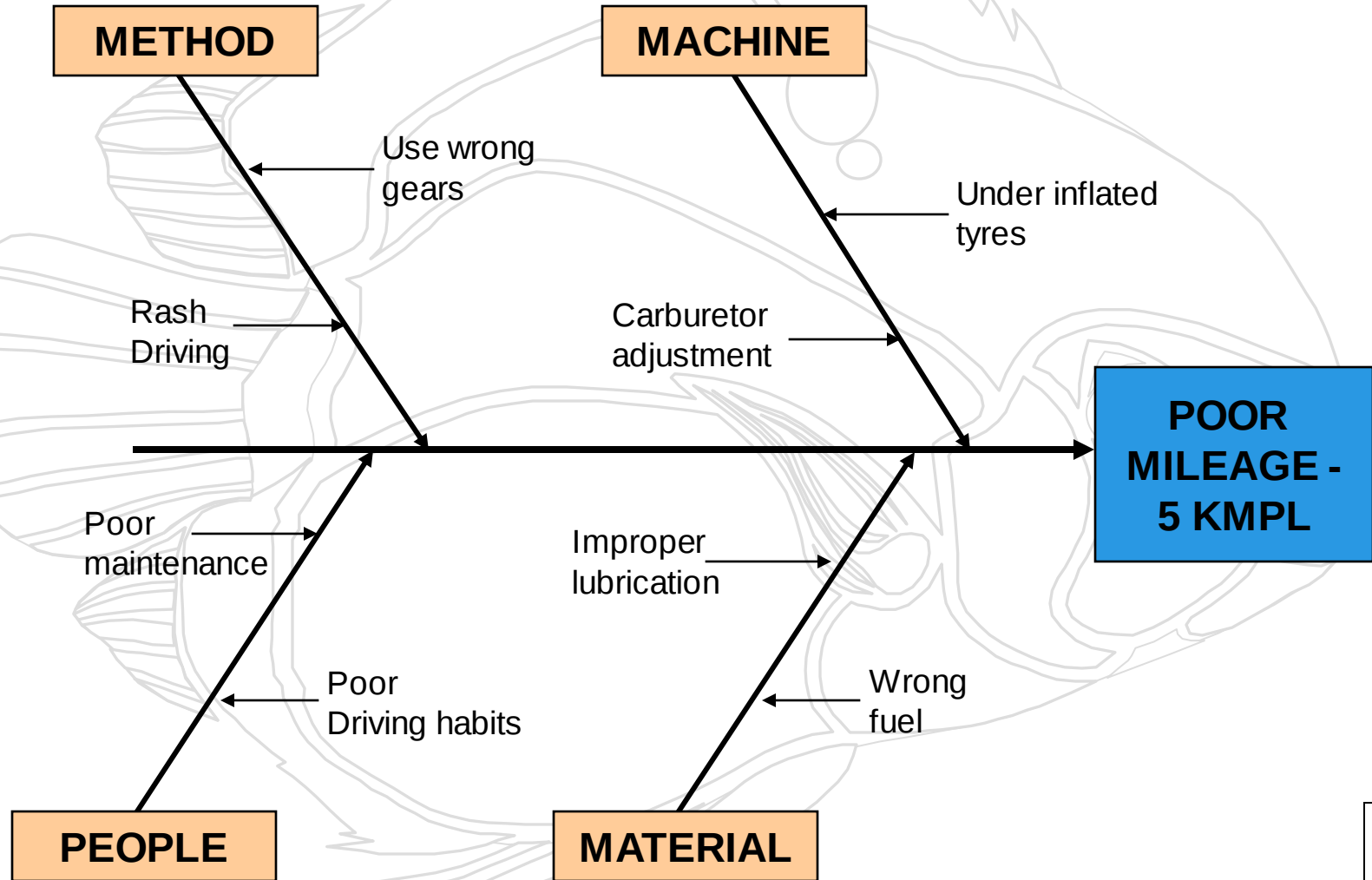
CAUSE & EFFECT DIAGRAM

STEP 3 - Identify main categories



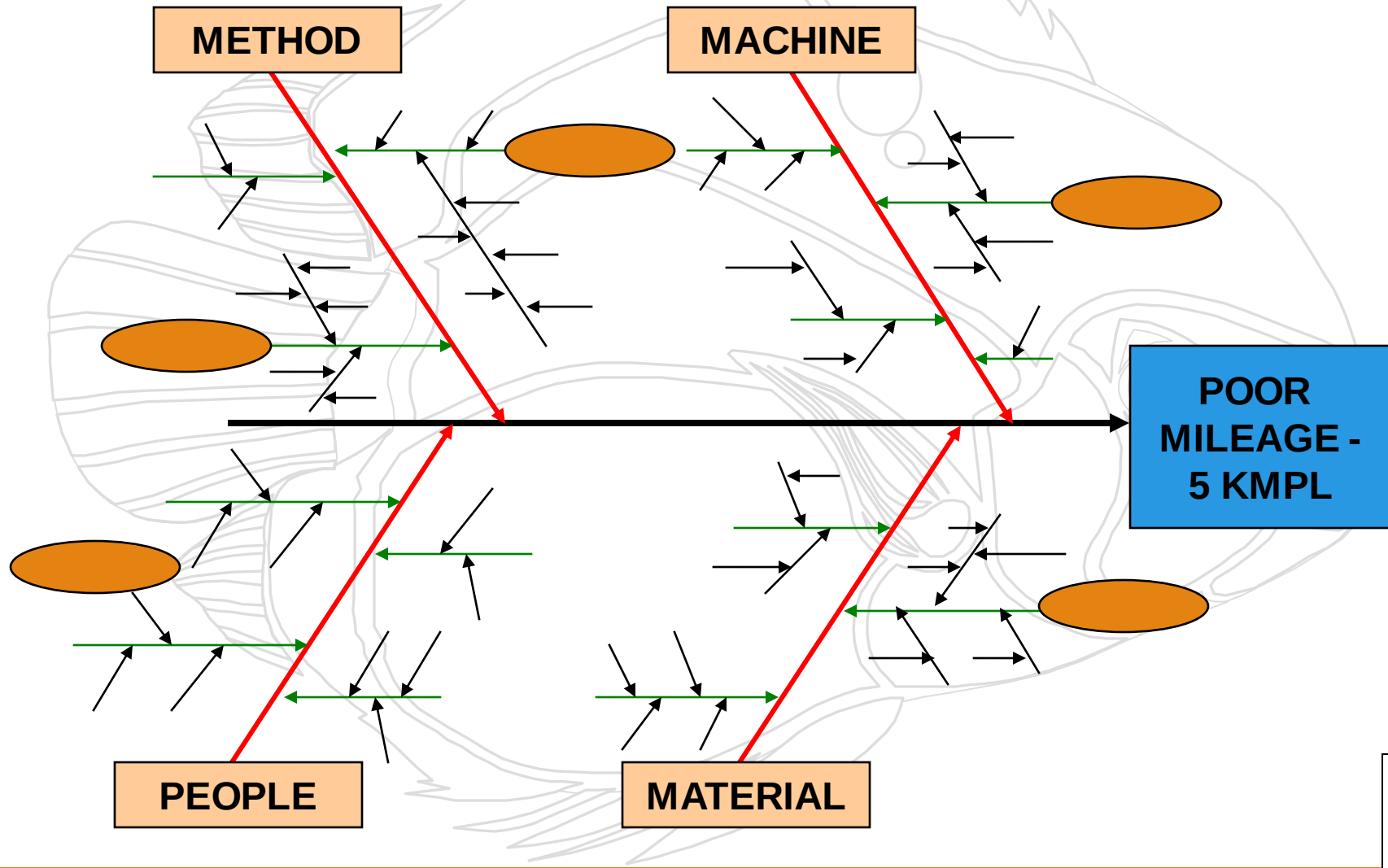
CAUSE & EFFECT DIAGRAM

STEP 4 - Identify Causes influencing the factors

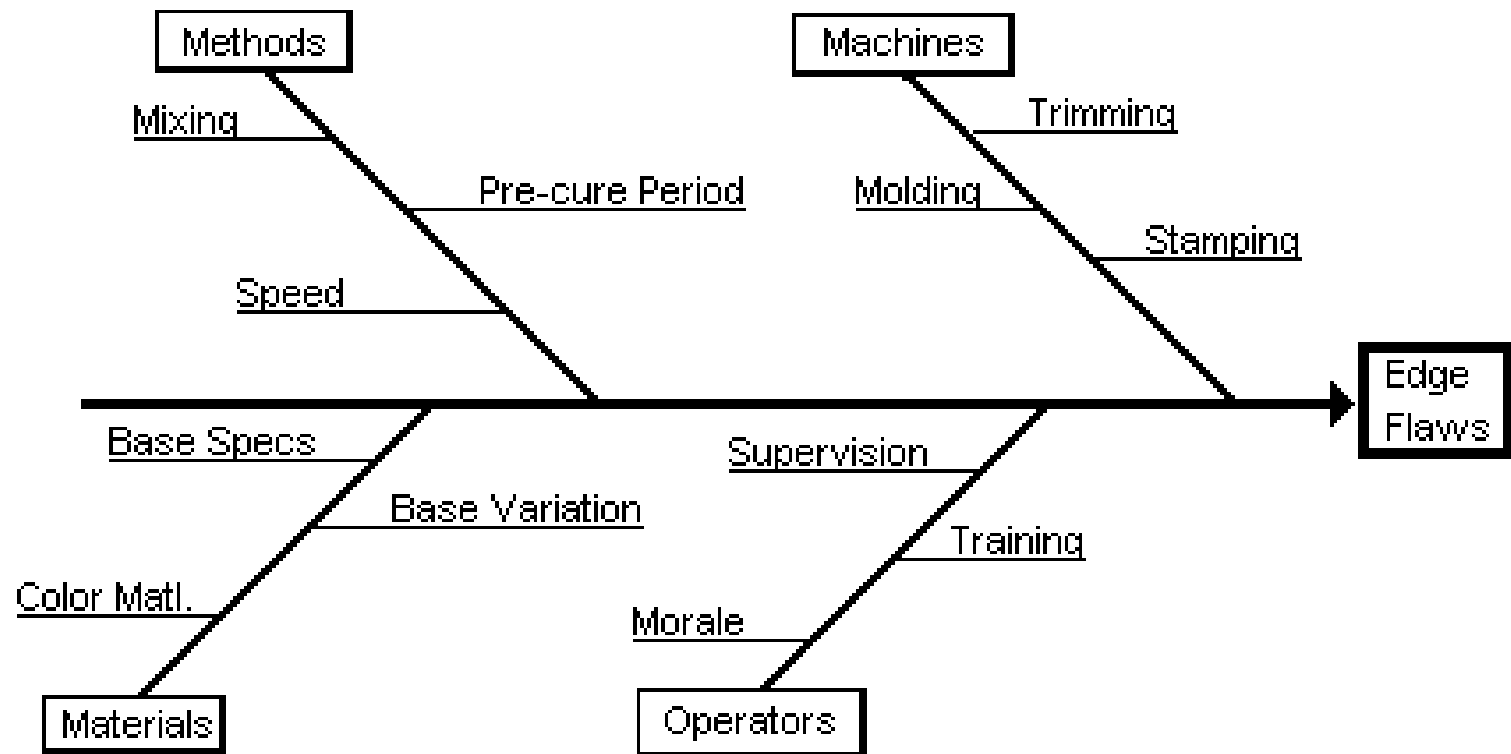


CAUSE & EFFECT DIAGRAM

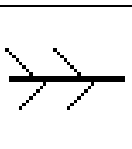
STEP 5 - Add detailed levels & Analyze the diagram



CAUSE & EFFECT DIAGRAM

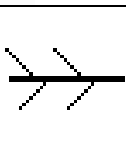
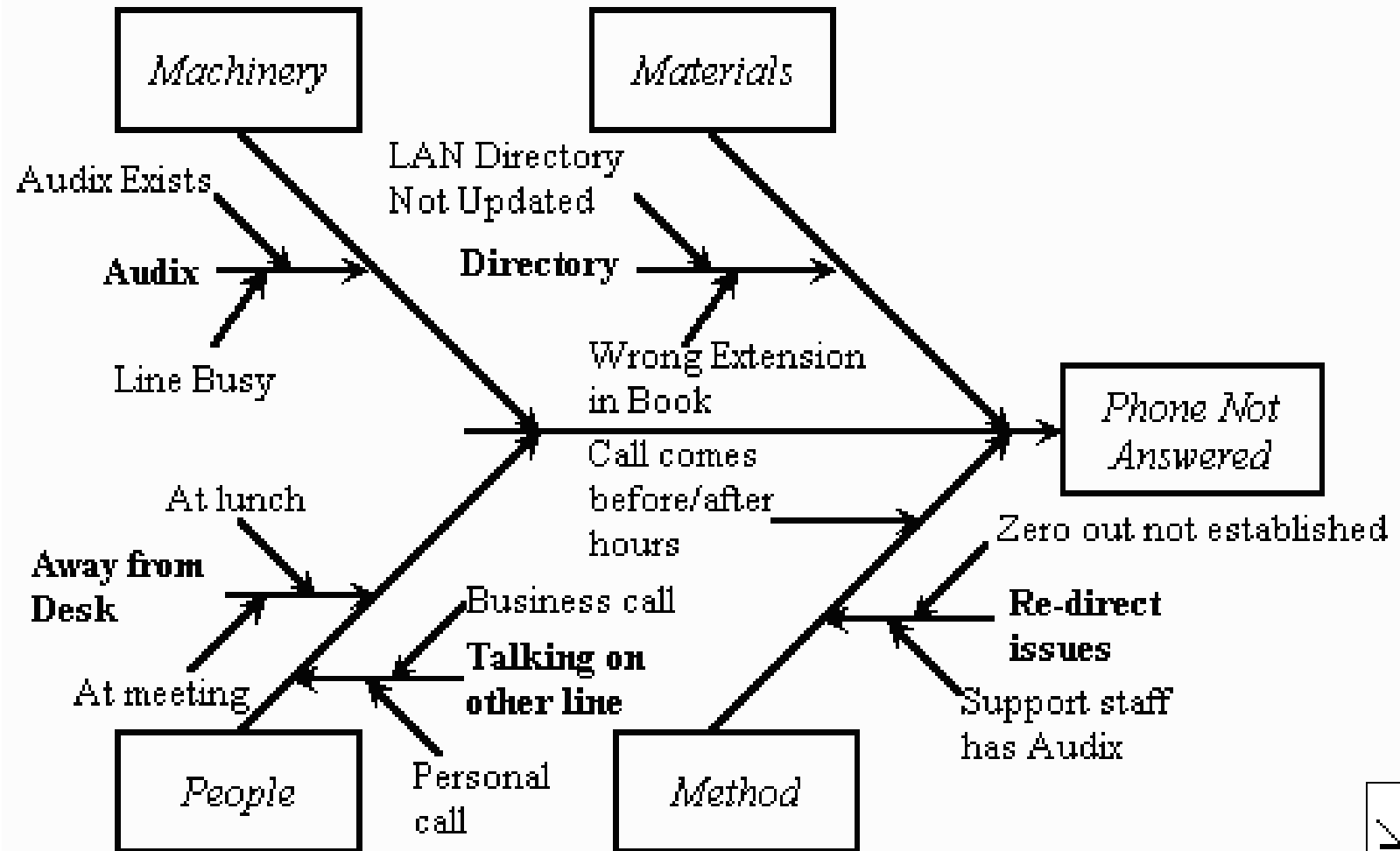


Cause and Effect Diagram for Edge Flaws



CAUSE & EFFECT DIAGRAM

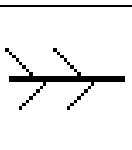
Reason Phone Not Answered



CAUSE & EFFECT DIAGRAM

Benefits of Cause & Effect Diagram

- ❑ Focus is on 'Causes' rather than on 'Symptoms'
- ❑ Indicates possible causes of variation.
- ❑ Improves team performance & effectiveness.
- ❑ Improves process knowledge.
- ❑ Encourages group participation.

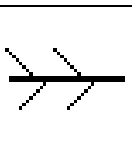


CAUSE & EFFECT DIAGRAM

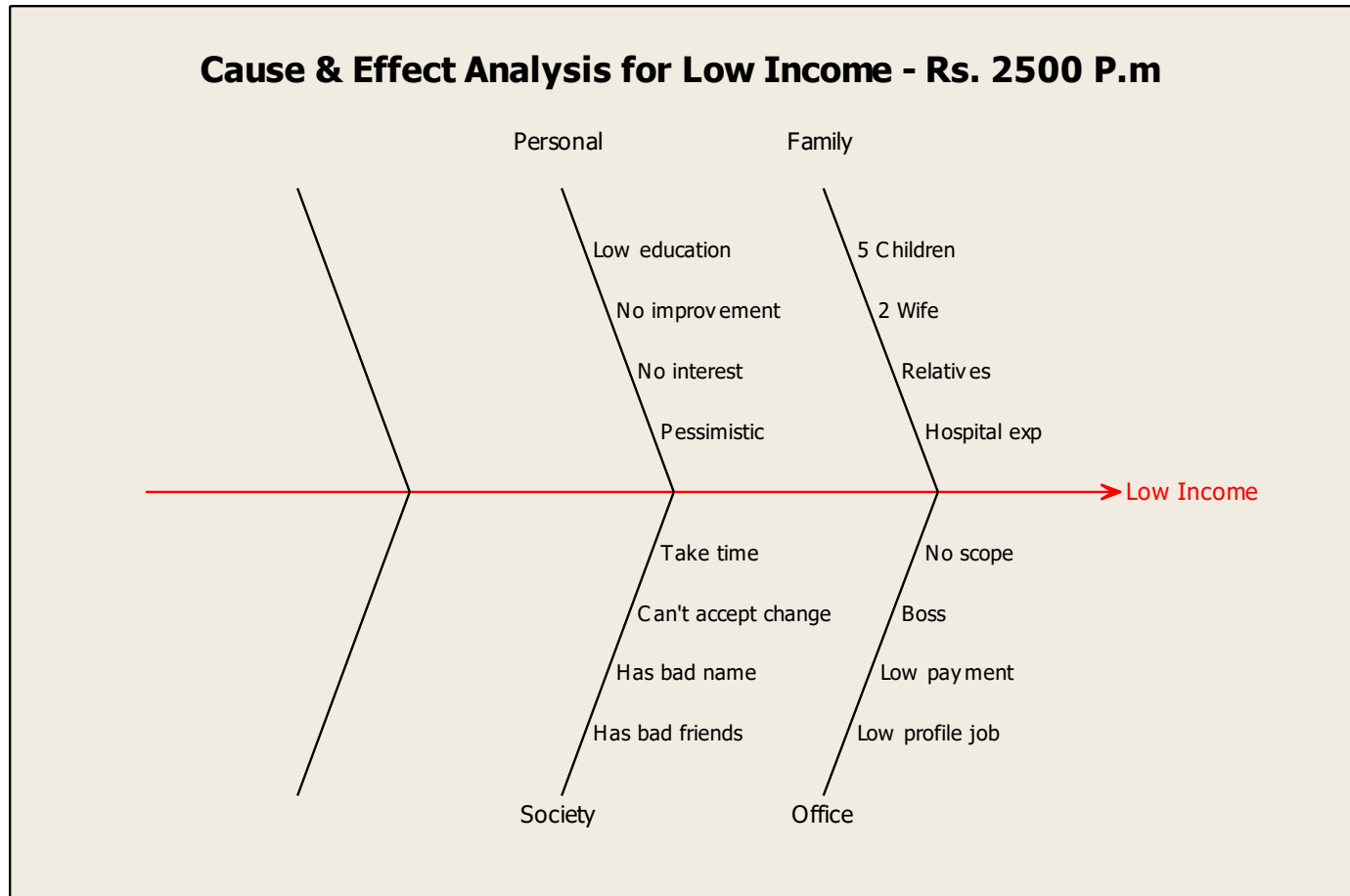
1. Learn to construct a Cause & Effect Diagram using:

- [Cause & Effect Diagram Generator](#)
- [Minitab software](#)

2. Exercise on Cause & Effect Diagram



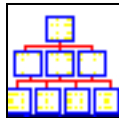
CAUSE & EFFECT DIAGRAM



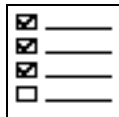
7 QC TOOLS

The 7 QC Tools;

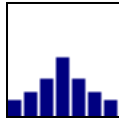
□ Flow chart



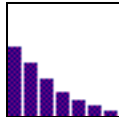
□ Check sheet



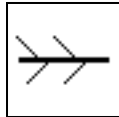
□ Histogram



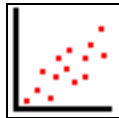
□ Pareto Diagram



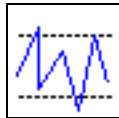
□ Cause & Effect



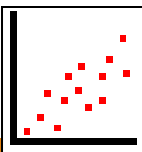
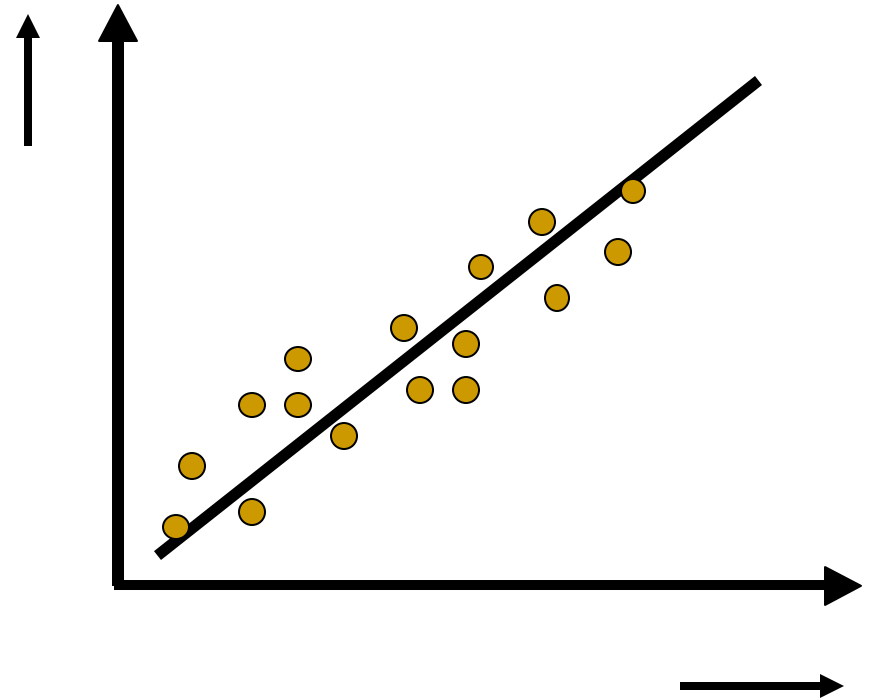
□ **Scatter diagram**



□ Control charts



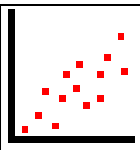
SCATTER DIAGRAM



SCATTER DIAGRAM

What is a Scatter Diagram ?

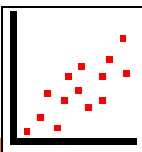
- A visual & statistical testing tool.
- Analyzes strength & relationship between 2 variables.
- Involve correlation to establish significant relationship.
- Arrive at Quantitative conclusion on relationship.



SCATTER DIAGRAM

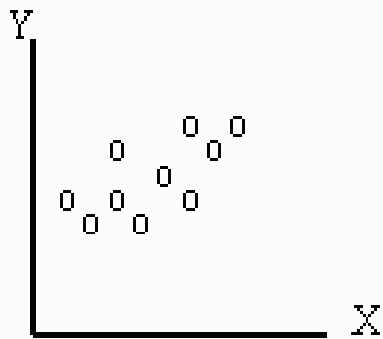
When to use a Scatter Diagram ?

- ❑ In problem solving to establish a root cause.
- ❑ Examine root cause theories in C & E.
- ❑ To confirm a Hypothesis.

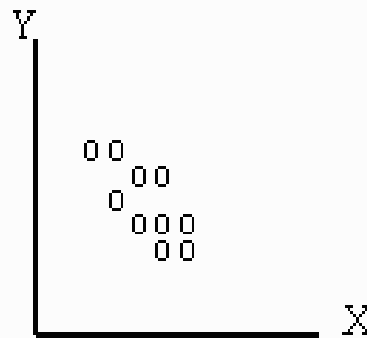


SCATTER DIAGRAM

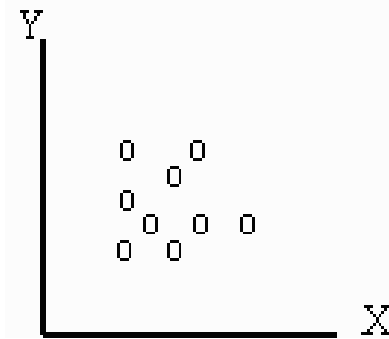
INTERPRETATION OF SCATTER DIAGRAM



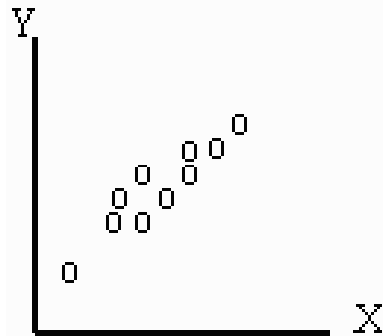
Positive Correlation



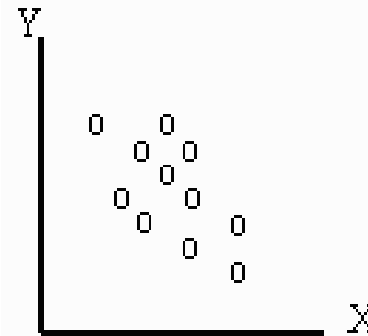
Negative Correlation



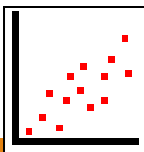
No Correlation



Strong positive Correlation

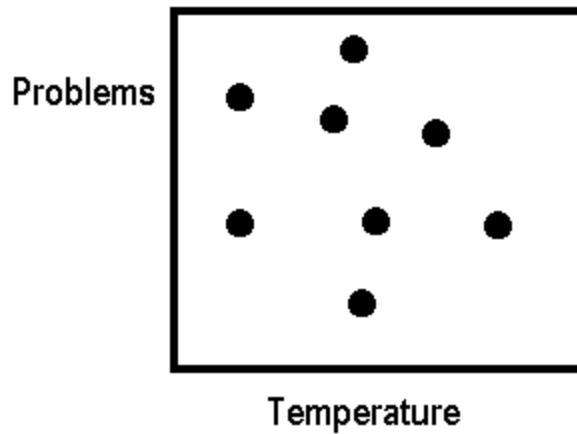


Weak negative Correlation

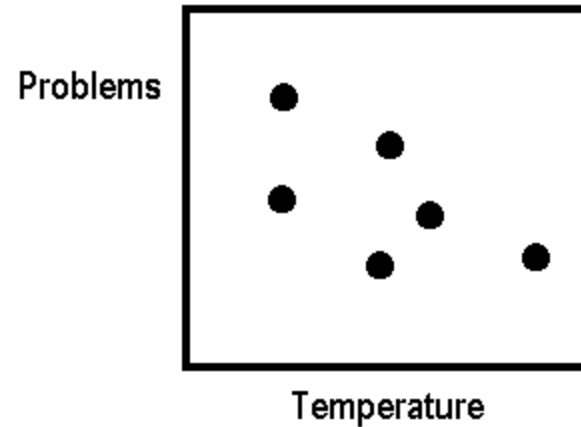


SCATTER DIAGRAM

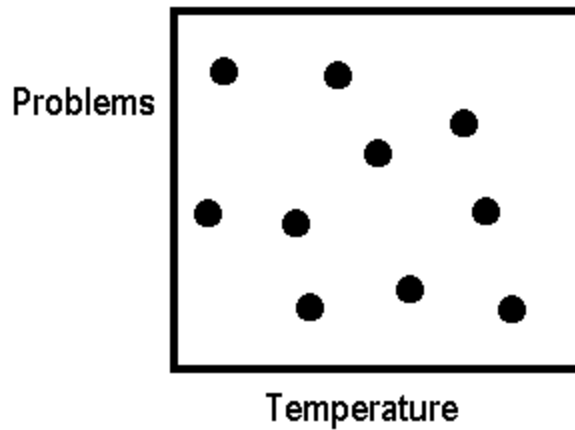
No correlation



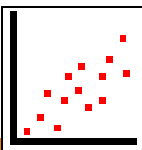
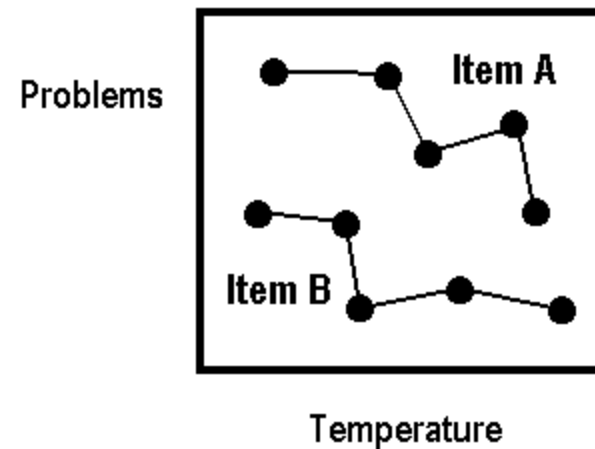
Temperature correlation



No apparent correlation



Obvious correlation

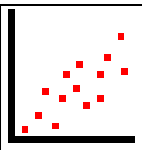


SCATTER DIAGRAM

SCATTER PLOT STATISTICS:

For scatter plots, the following statistics are calculated:

Mean X and Y	Average of all the data points.
Maximum X and Y	Maximum value in the series.
Minimum X and Y	Minimum value in the series.
Sample Size	Number of values in the series.
X Range and Y Range	Maximum value - minimum value.



SCATTER DIAGRAM

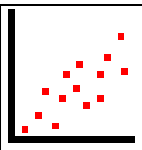
SCATTER PLOT STATISTICS:

X Range and Y Range Maximum value - minimum value.

Stdev of X and Y values Indicates spread of data around the mean. **Line**

of Best Fit - Slope Slope of the line

Line of Best Fit - Y Intercept Point at which line of best fit crosses Y axis



SCATTER DIAGRAM

INTERPRETATION OF SCATTER DIAGRAM

Strong correlation

r -value range of between 0.85 to 1, or -0.85 to -1.

Moderate correlation

r -value ranges from 0.75 to 0.85 or, -0.75 to -0.85.

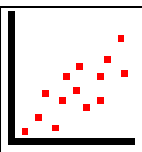
Weak correlation

r ranges from 0.60 to 0.74 or -0.60 to 0.74.

Though an entirely random relationship equals, 0.00,

r -value that is 0.59 and below is not considered to be a reliable predictor.

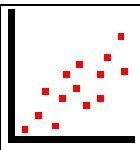
(Tan 45 degree = 1)



SCATTER DIAGRAM

Benefits of Scatter Diagram

- Trends & patterns of different measures are tracked.
- Better process management in variable analysis.
- Relationship establishment tool.

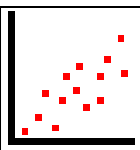


SCATTER DIAGRAM

1. Learn to construct a Scatter Diagram using:

- [Scatter diagram using MS Excel](#)
- [Minitab software](#)

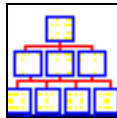
2. Exercise on Scatter Diagram



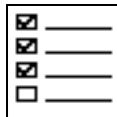
7 QC TOOLS

The 7 QC Tools;

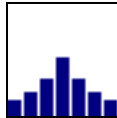
□ Flow chart



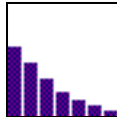
□ Check sheet



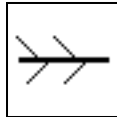
□ Histogram



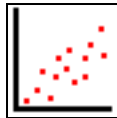
□ Pareto Diagram



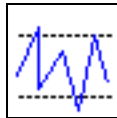
□ Cause & Effect



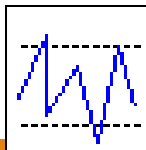
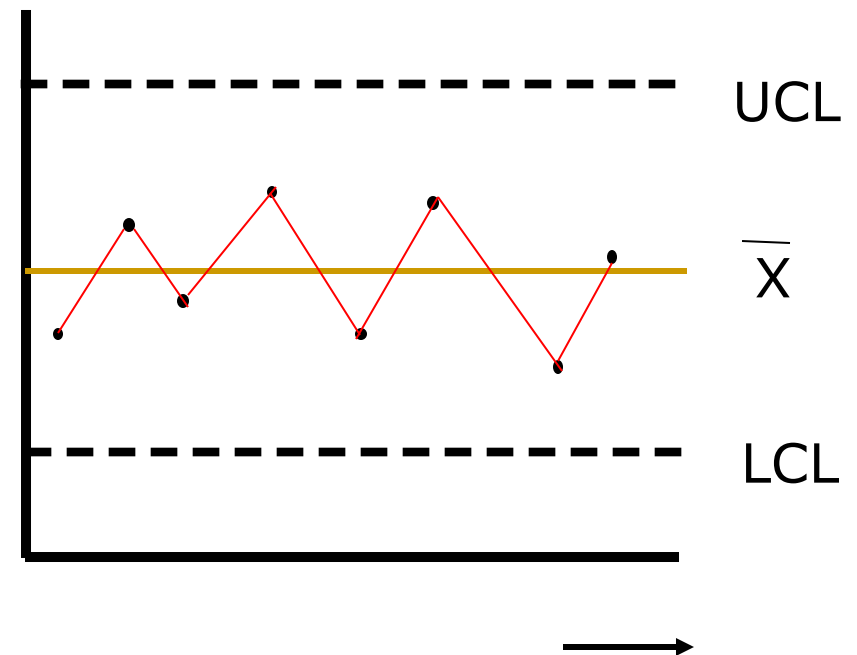
□ Scatter diagram



□ **Control charts**



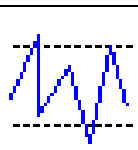
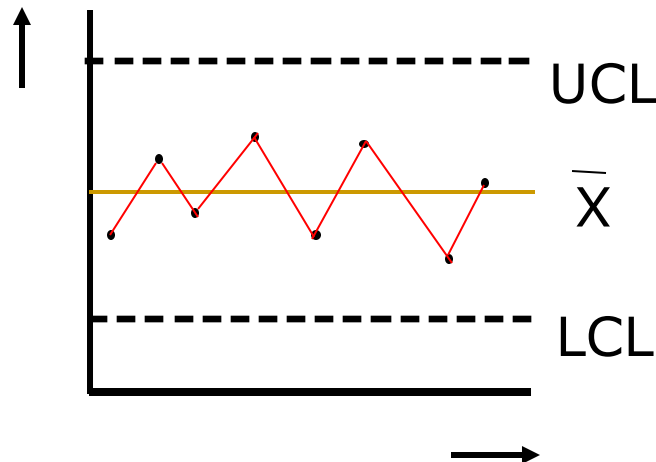
CONTROL CHARTS



CONTROL CHARTS

What is a Control chart ?

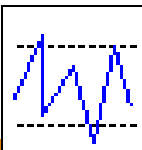
- Statistical tool for monitoring & improving quality.
- Distinguishes between Common & Special cause.
- Measure consistency of a machine or process.



CONTROL CHARTS

When to use a Control chart ?

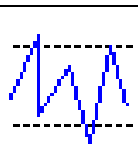
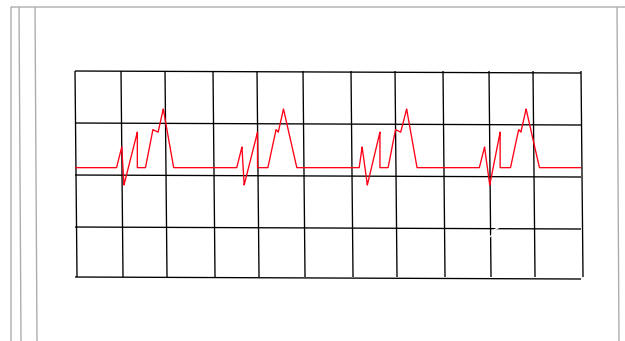
- Visual display for Process output.
- To monitor, control & improve process performance.
- To identify variation at its source.



CONTROL CHARTS

Benefits of Control charts

- Common visual language to predict process.
- Provides cues for taking action.
- Easy & simple to maintain.

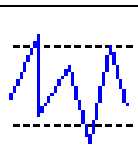


CONTROL CHARTS

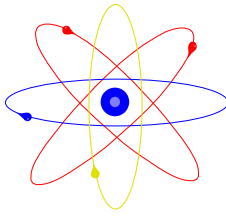
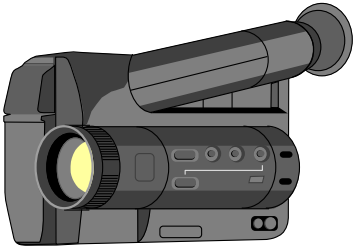
1. Learn to construct a Control Chart using:

- [MS Excel](#)
- [Minitab software](#)

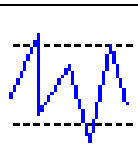
2. Exercise on Control charts



VISUALS



How a Control chart is generated ?



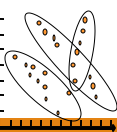
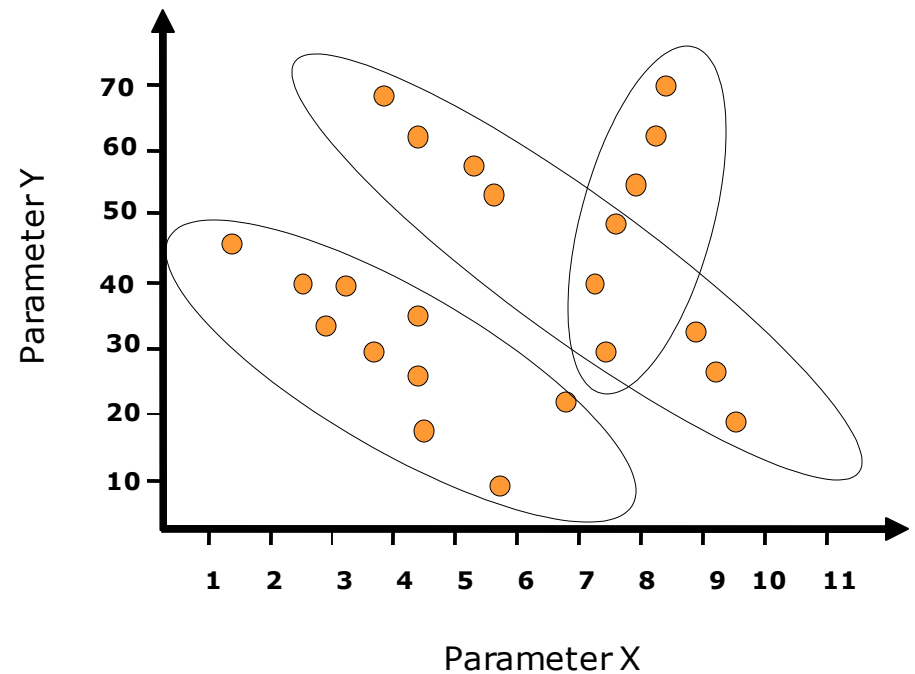
OTHER QC TOOLS

7 QC TOOLS

The 7 QC Tools;

- **Stratification**
- Graphs & Charts
- Brain storming

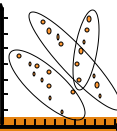
STRATIFICATION



STRATIFICATION

What is Stratification ?

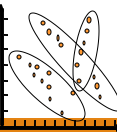
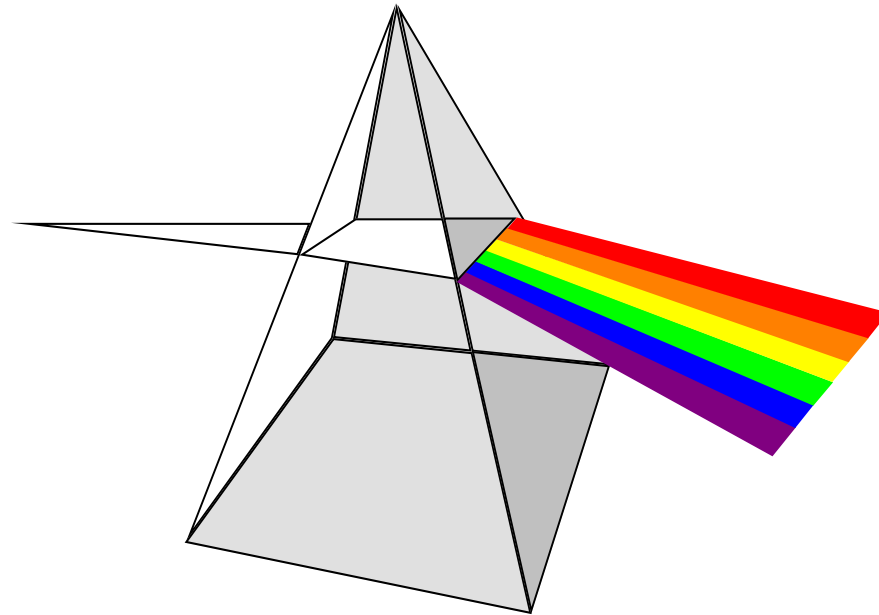
- A technique used to analyze and divide a universe of data into homogeneous groups (Strata)
- Involves observing data, splitting them into distinct layers & doing analysis to see a different process.
- Often these events, represent multiple sources that need to be treated separately.



STRATIFICATION

How it is carried out ?

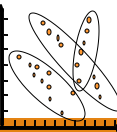
- It involves looking at process data, splitting it into distinct layers and doing analysis to possibly see a different process.



STRATIFICATION

Example:

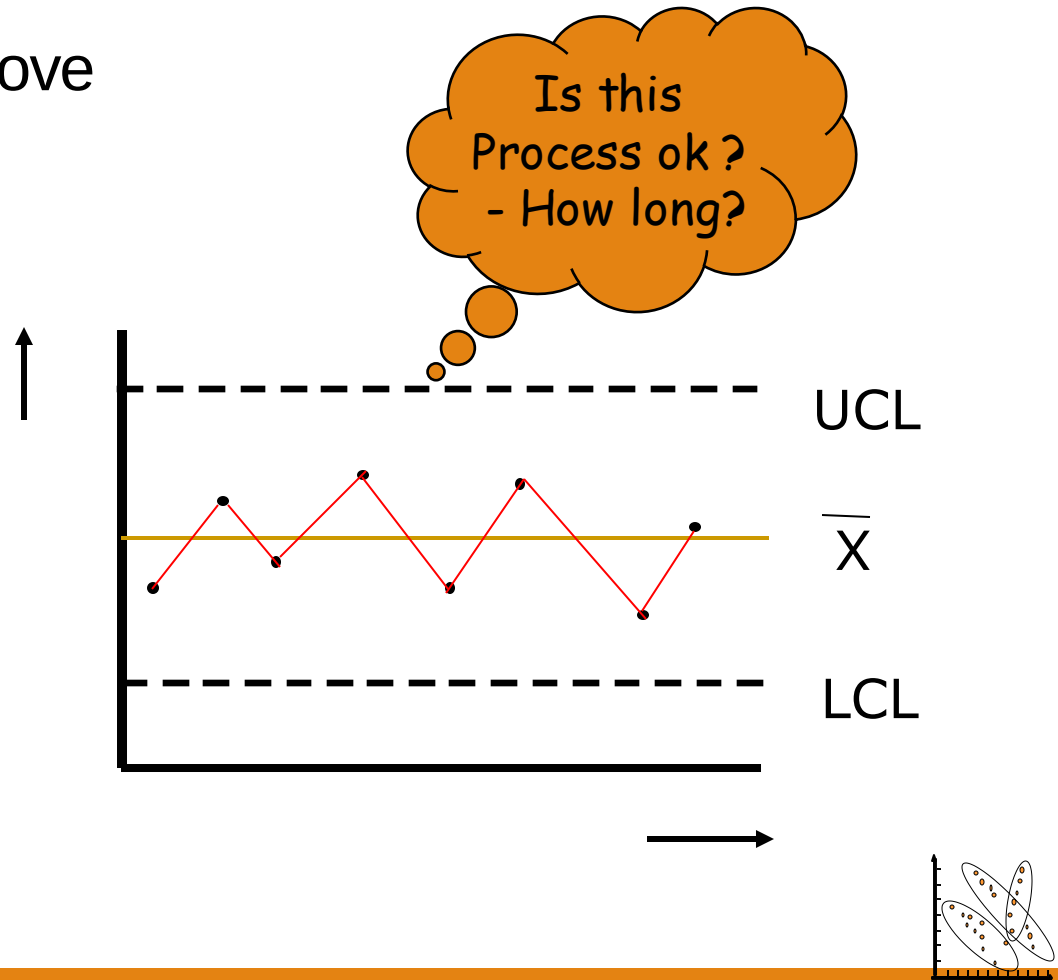
- For instance, analysing 'Quality' cost.
 - Prevention cost
 - Internal Failure cost
 - External Failure cost
 - Appraisal cost
- World class companies have a Quality cost of around 2 to 5 %



STRATIFICATION

When to use Stratification ?

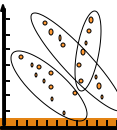
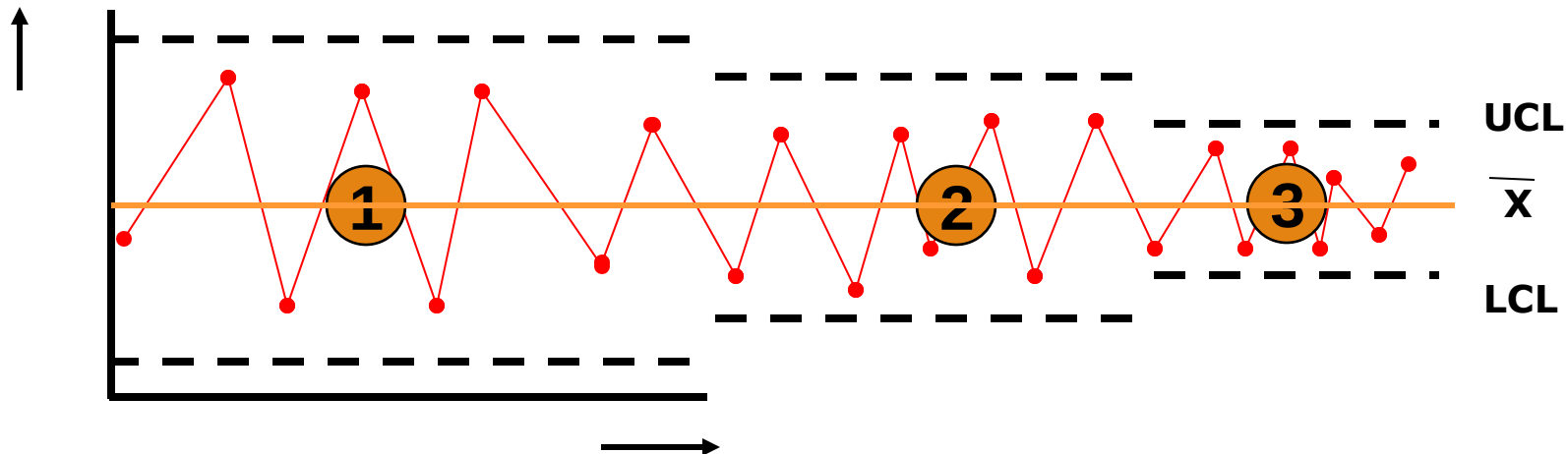
- Used extensively to improve
 - In control process &
 - Stable process



STRATIFICATION

Benefits of Stratification

- Unknown strands of data can be identified.
- Systematic reduction of Common cause variation.
- Overall increase in product quality.

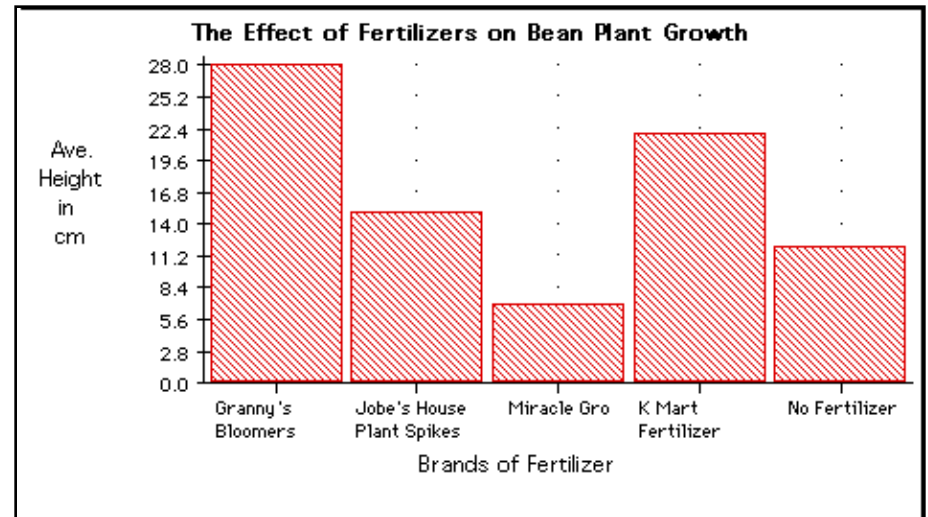


7 QC TOOLS

The 7 QC Tools;

- Stratification
- **Graphs & Charts**
- Brain storming

GRAPHS & CHARTS



GRAPHS & CHARTS

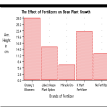
What are Graphs & Charts?

□ A technique used to communicate information visually.

Complicated information is made easy to understand individually and comparatively using Graphs & Charts.

□ Basic types include;

1. Bar graph
2. Line graph
3. Pie or Circle graph

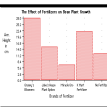


GRAPHS & CHARTS

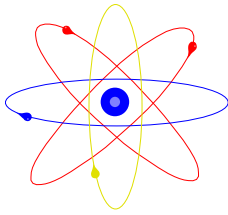
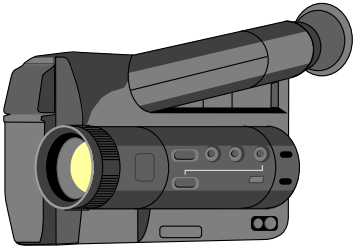
1. Learn to construct Graphs & Charts using:

- [MS Excel worksheet](#)

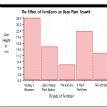
2. Exercise on Graphs & Charts



VISUALS



Some Sample Graphs ...



7 QC TOOLS

The 7 QC Tools;

- Stratification
- Graphs & Charts
- **Brain storming**

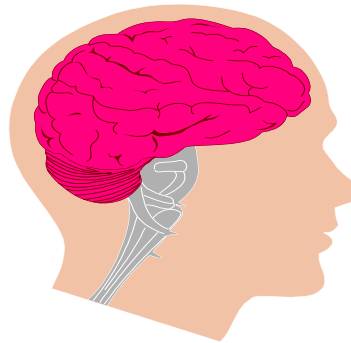
BRAINSTORMING



BRAINSTORMING

What is Brainstorming?

- A tool used by teams for creative exploration of options in an environment of free criticism.
- Provides creative and unrestricted exploration of options or solutions.



BRAINSTORMING

Benefits of Brainstorming

- Creativity
- Large number of ideas
- Involvement of team members
- Sense of ownership in decisions
- Input to other tools



BRAINSTORMING

Ground Rules

- Active participation by everyone
- No discussion / No debate
- Build on others' ideas
- Contribute to the best extent
- Display ideas presented - clarify & combine



BRAINSTORMING

Brainstorming sequence

- Review the rules
- Set a time limit
- State / pose the question
- Collect ideas - Structured & Unstructured
- Collate & analyze



BRAINSTORMING

1. A Demo on Brainstorming:

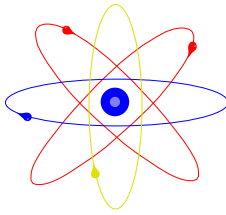
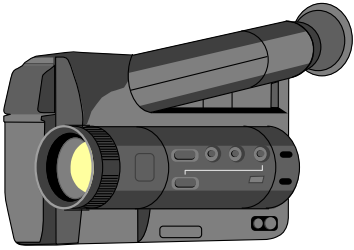
- Go to Brainstorming video.

2. Exercise on Brainstorming

- As an input to Cause & Effect diagram.



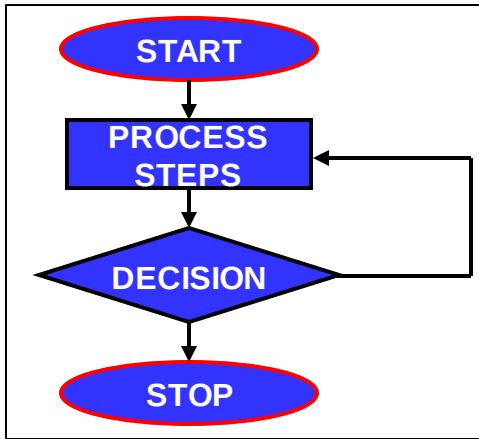
VISUALS



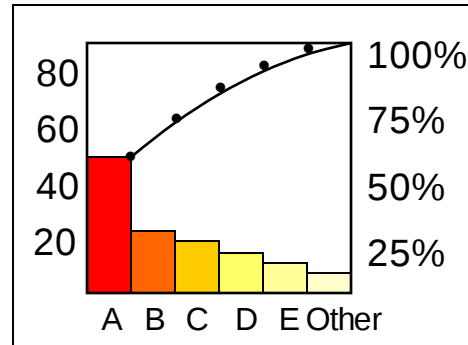
A Sample Brainstorming Session ...



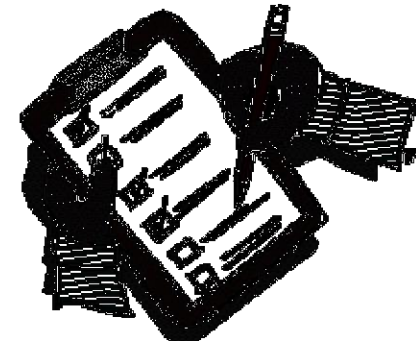
DEFINING THE PROBLEM



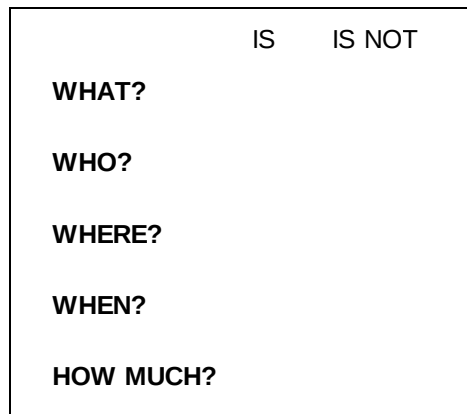
**Flow
Chart**



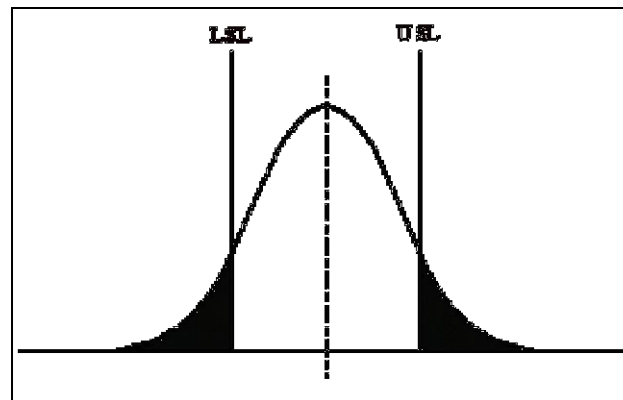
Pareto Chart



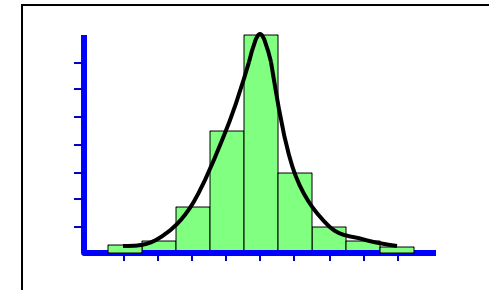
Check Sheet



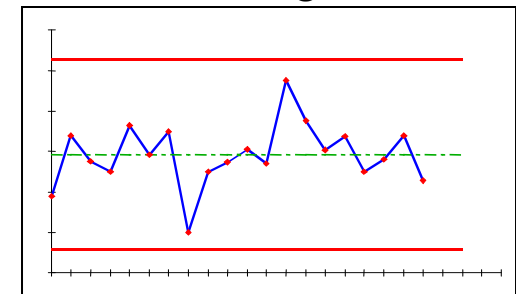
Is/Is Not Analysis



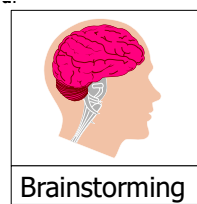
Capability Study



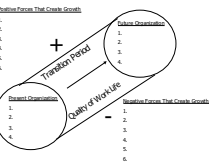
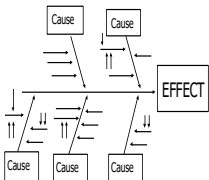
Histogram



Control Chart

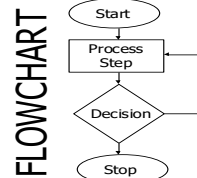


Brainstorming

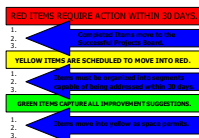


CHECKLIST			
Date	→		Total
Category 1	Data	Data	
Category 2	Data	Data	
Category 3	Data	Data	
Category 4	Data	Data	

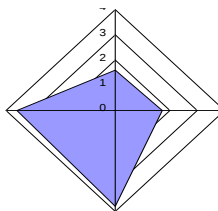
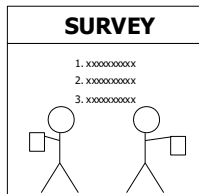
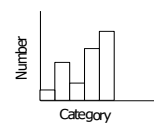
Quality Improvement Story Board		
1. Problem Statement	2. Current Situation	3. Proposed Solution
4. Implementation Plan	5. Results	6. Lessons Learned



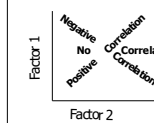
Project Bulletin Board



COLUMN CHART



CORRELATION CHART



A Quality Tool Belt

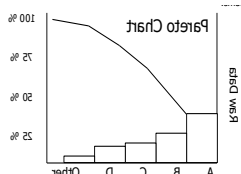
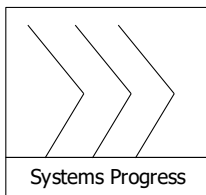
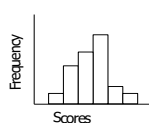


	Total
A	1 3 1 1 6
B	3 4 4 2 13
C	2 1 3 3 9
D	4 2 2 4 12

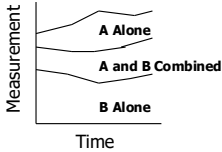
NGT

Consensogram	
100 %	☐
90 %	☐
80 %	☐
70 %	☐
ETC.	☐

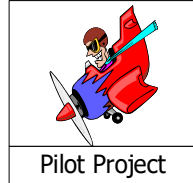
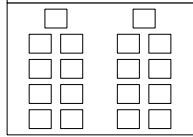
HISTOGRAM



Stratification



Affinity Diagram



Pilot Project

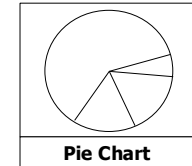


Purpose & Vision

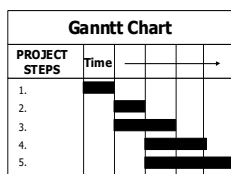
STRATEGIC PLAN



ACTION PLAN

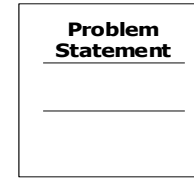


Pie Chart



Why? Why?
Why?
Why? Why?

Five Whys?

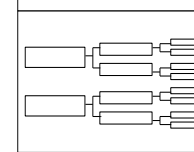


Problem Statement

Imagineering

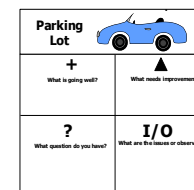


Flow Tree

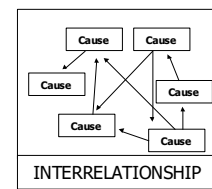
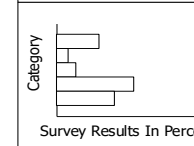


Capacity Matrix

Aim or Result	Capacity	Breakdown	Knowledge	Application	Analysis



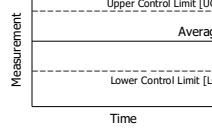
BAR CHART



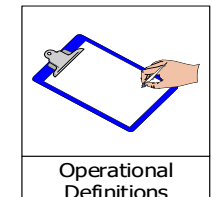
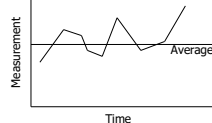
FORCE FIELD ANALYSIS



CONTROL CHART



RUN CHART



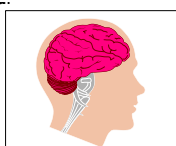
Define the Team

Team Members	
Name	Role
John	Team Leader
Mary	Coach
Bob	Teacher
Susan	Custodian
Bill	Secretary
Jane	Driver
Wayne	Student

Quality Improvement Story Board

1. Describe the OFI identified in the Baldrige Assessment.*

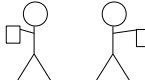
STRATEGIC PLAN



Brainstorming

SURVEY

1. xxxxxxxxxxxx
2. xxxxxxxxxxxx
3. xxxxxxxxxxxx



	Total
A	1 3 1 1 6
B	3 4 4 2 13
C	2 1 3 3 9
D	4 2 2 4 12

NGT

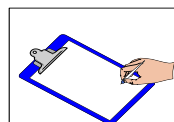
*Use BOTH the Building Bullet Book and the Baldrige Feedback Report along with the annual Baldrige Survey Results to identify OFIs.

- 2.a. Identify the team members who will address the issue. Define the Team

Team Members	
Name	Role
John	Team Leader
Mary	Coach
Bob	Teacher
Susan	Custodian
Bill	Secretary
Jane	Driver
Wayne	Student

- b. Establish operational definitions to be used.

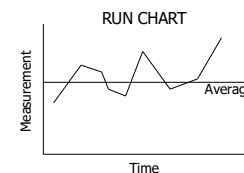
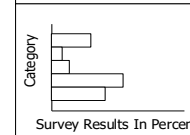
Problem Statement



Operational Definitions

3. Collect data regarding the current situation. Use any or all of the following:

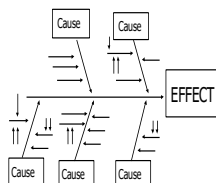
BAR CHART



CHECKLIST

Date	→		Total
Category 1	Data	Data	
Category 2	Data	Data	
Category 3	Data	Data	
Category 4	Data	Data	

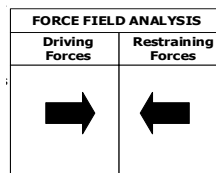
4. Identify causes for the current situation.



and/or

Affinity Diagram

5. Develop a plan for improvement and how success will be measured.

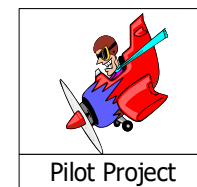


ACTION PLAN

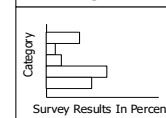
Imagineering



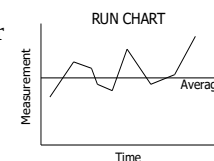
6. Report results.



BAR CHART



and/or



THE IMPROVEMENT CYCLE

Define

- Select Project
- Define Project Objective
- Form the Team



- Map the Process
- Identify Customer Requirements



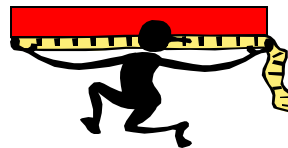
- Identify Priorities
- Update Project File

Phase Review

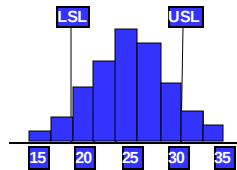


Measure

- Define Measures (y's)
- Evaluate Measurement System



- Determine Process Stability
- Determine Process Capability



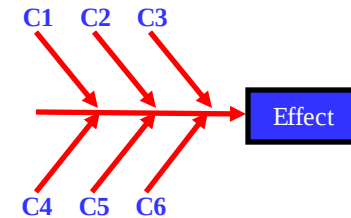
- Set Targets for Measures

Phase Review



Analyse

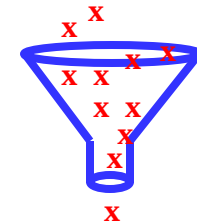
- Identify Potential x's



- Analyse x's

Run	1	2	3	4	5	6	7
1	1	1	1	1	1	1	1
2	1	1	1	2	2	2	2
3	1	2	2	1	1	2	2
4	1	2	2	2	2	1	1
5	2	1	2	1	2	1	2
6	2	1	2	2	1	2	1
7	2	2	1	1	2	2	1
8	2	2	1	2	1	1	2

- Select Critical x's



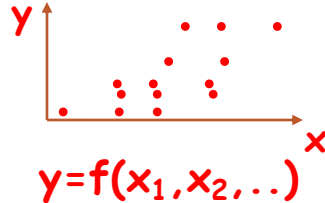
Phase Review



THE IMPROVEMENT CYCLE

Improve

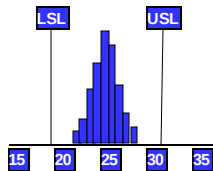
- Characterise x's



- Optimise x's



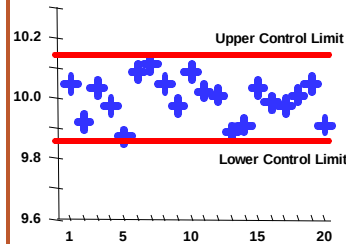
- Set Tolerances for x's
- Verify Improvement



Phase Review

Control

- Control Critical x's



- Monitor y's



- Validate Control Plan

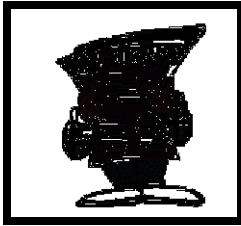


- Close Project

Phase Review



PDCA LOOP IN ACTION



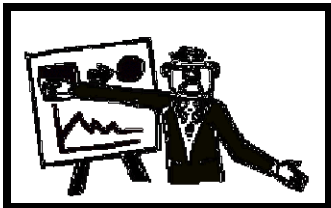
8. Standardise and Future Actions



1. Define the Problem



2. Interim Actions

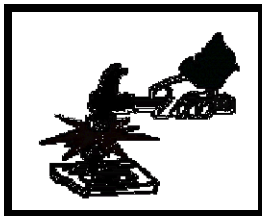


7. Verify the Results

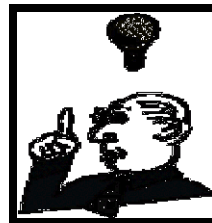
Team Problem
Solving Process



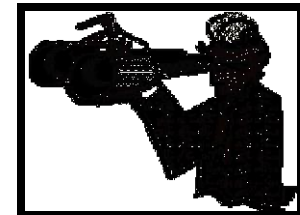
3. Acquire and Analyse Data



6. Action Plan and Implement

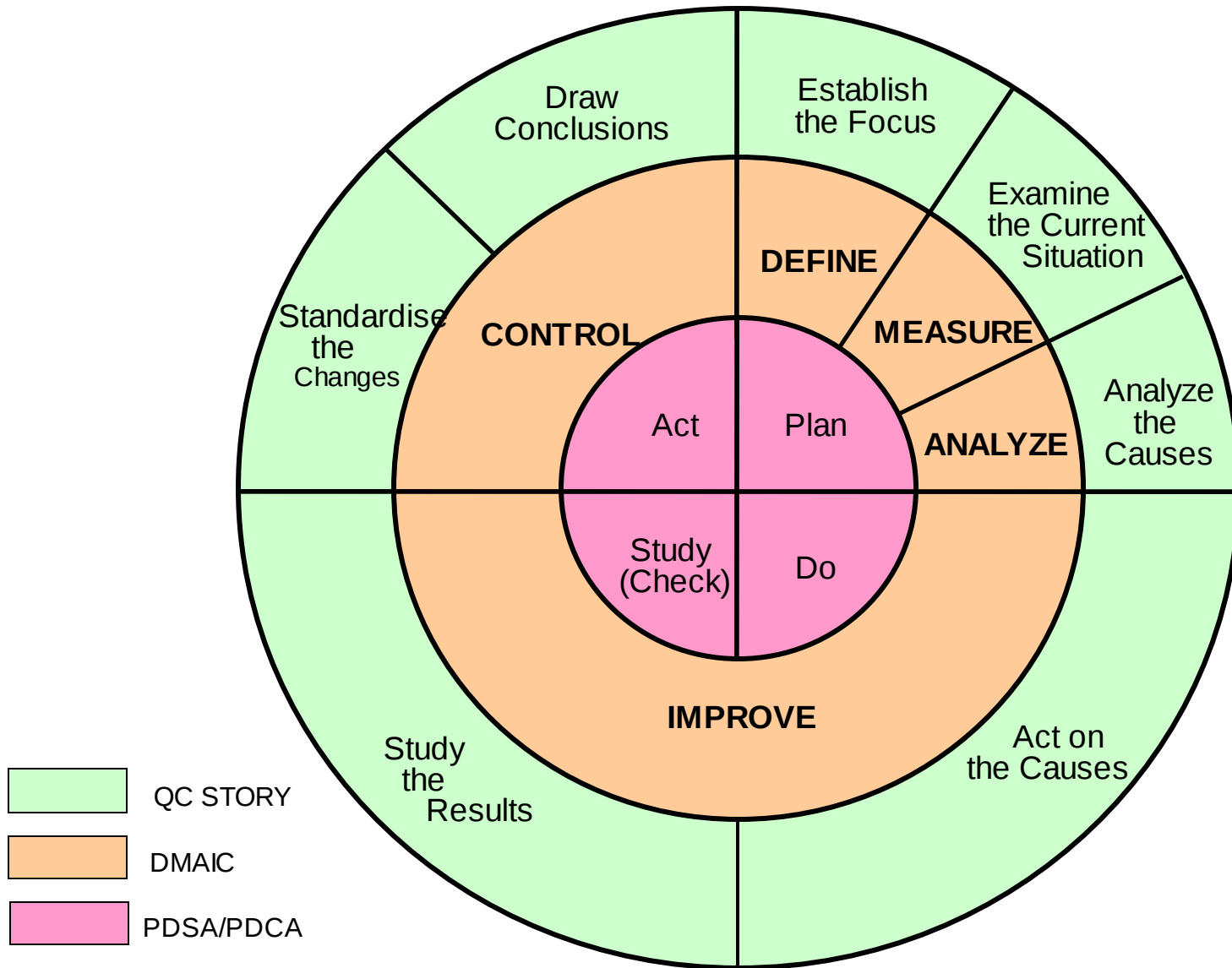


5. Evaluate Possible Solutions



4. Determine Root Cause

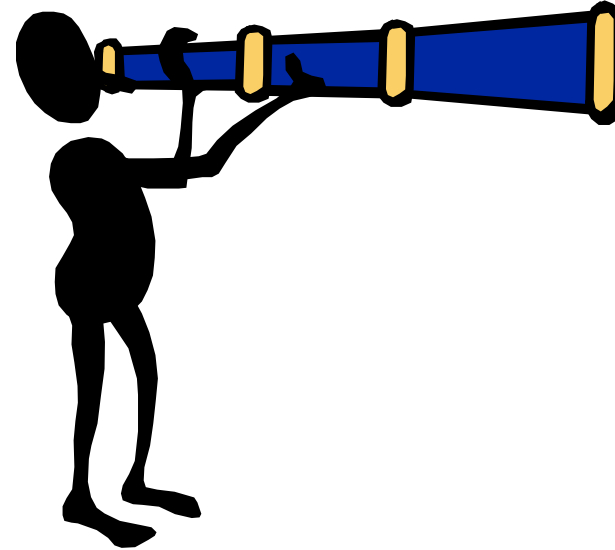
PDCA LOOP IN ACTION



SUMMARY

The tools listed above are ideally utilized in reducing the process variability or identifying specific problems in the process. In any case, the tools should be utilized to ensure that all attempts at process improvement include:

- Analysis
- Improvement
- Monitoring
- Implementation



QUESTIONS ?

