

# Quality Tools

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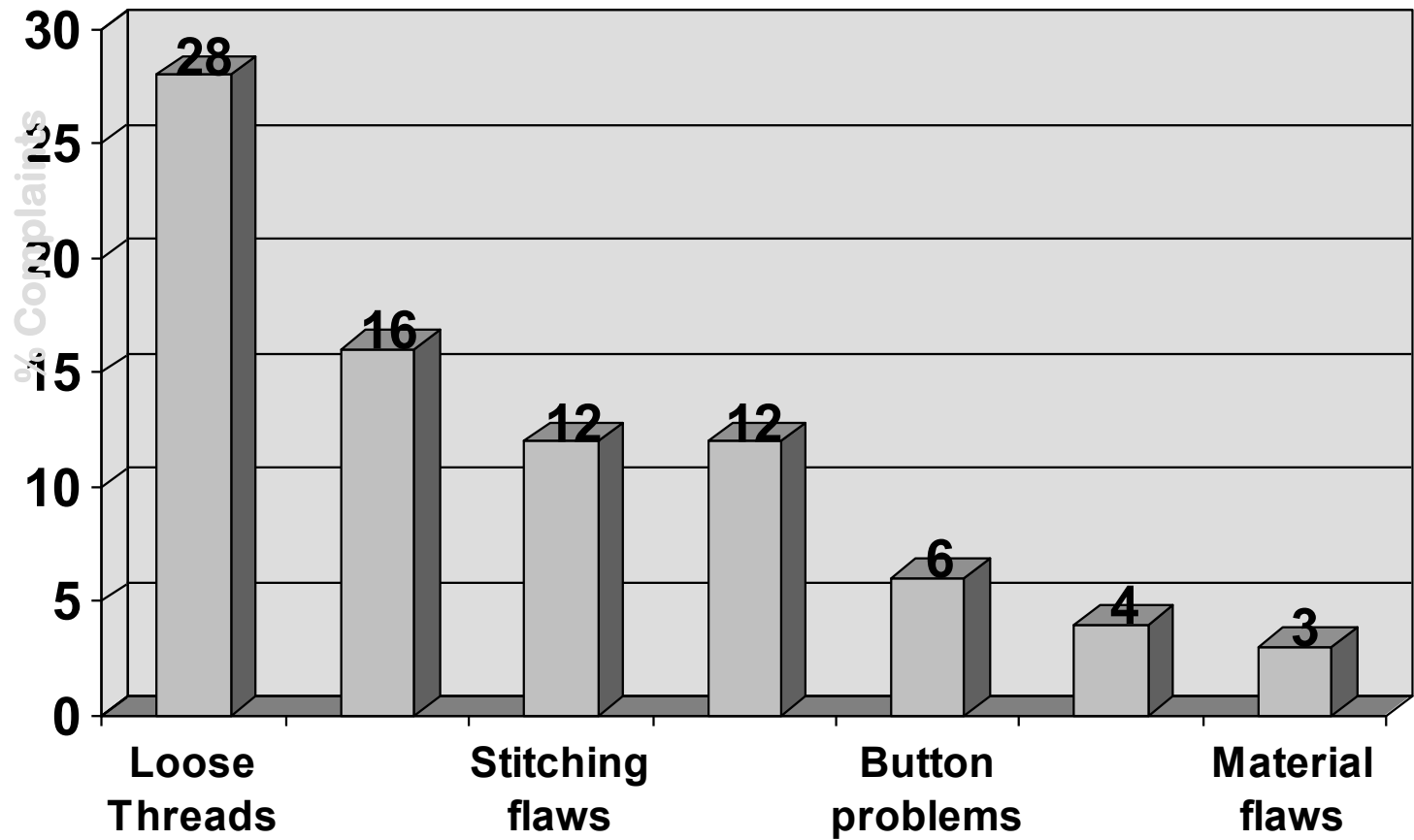
# Quality Control Tools

- Pareto chart
- Histogram
- Process flow diagram
- Check sheet
- Scatter diagram
- Control chart
  - Run chart
- Cause and effect diagram

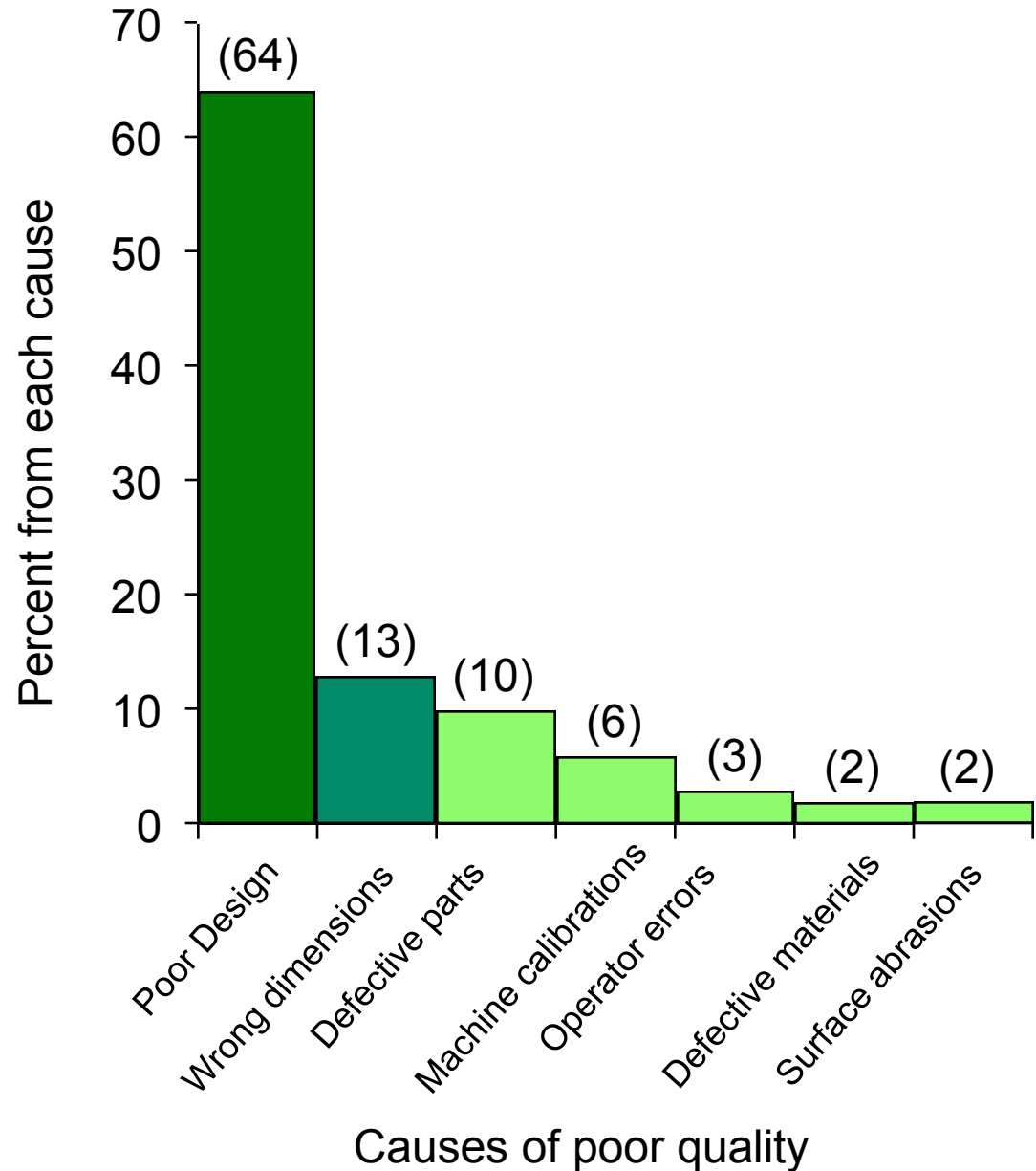
# Pareto Principle

- ◆ Vilfredo Pareto (1848-1923) Italian economist
  - 20% of the population has 80% of the wealth
- ◆ Juran used the term “vital few, trivial many”. He noted that 20% of the quality problems caused 80% of the dollar loss.

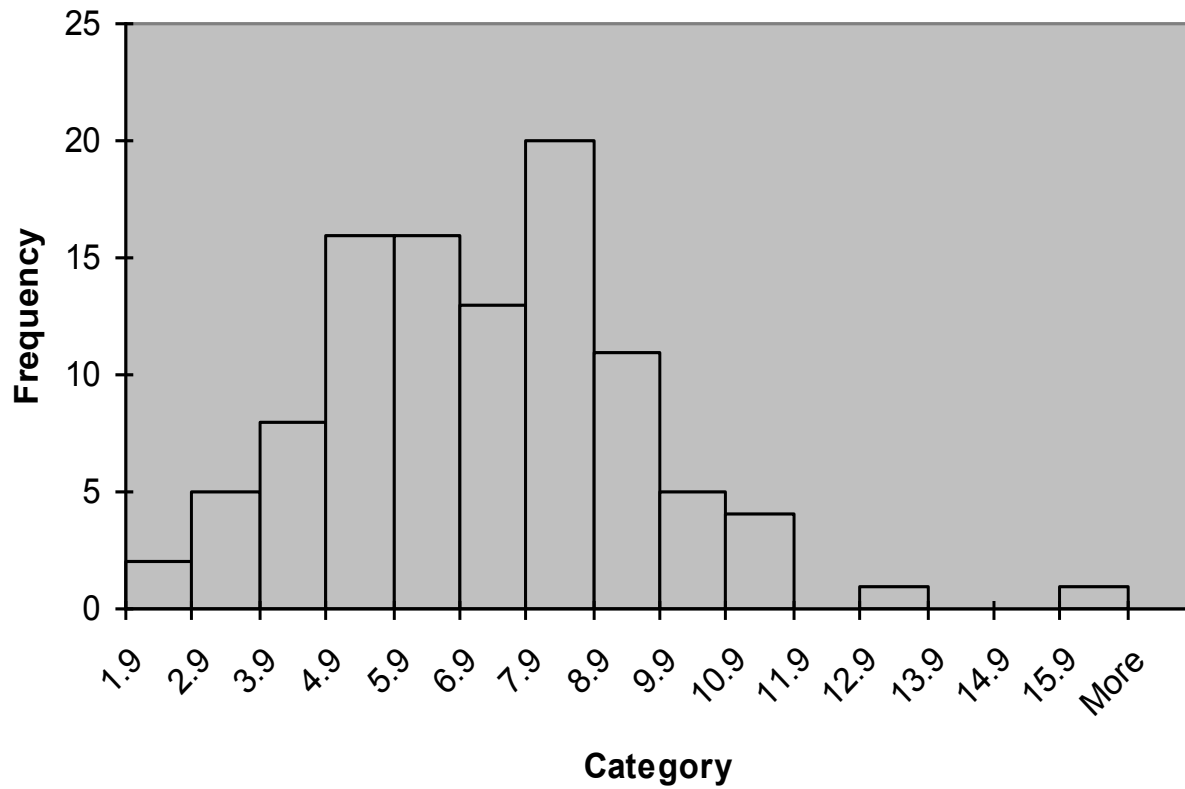
# Pareto chart



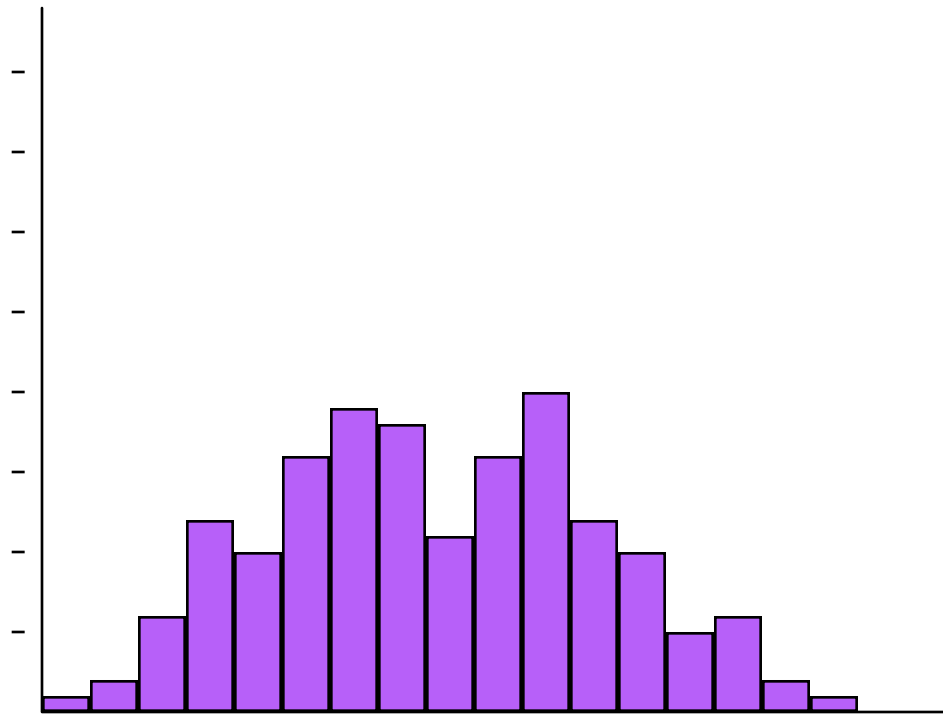
# Pareto Chart



# Histogram



# Histogram



# Flowcharts

## ◆ Flowcharts

- Graphical description of how work is done.
- Used to describe processes that are to be improved.

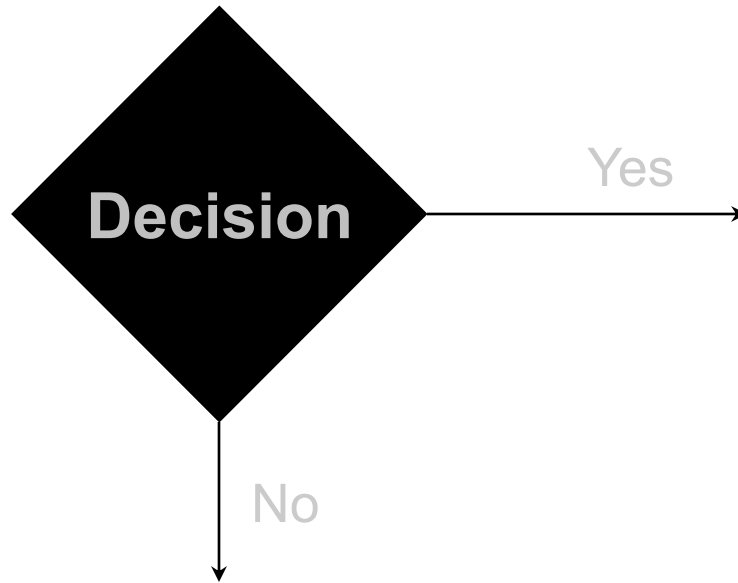


# Flow Diagrams

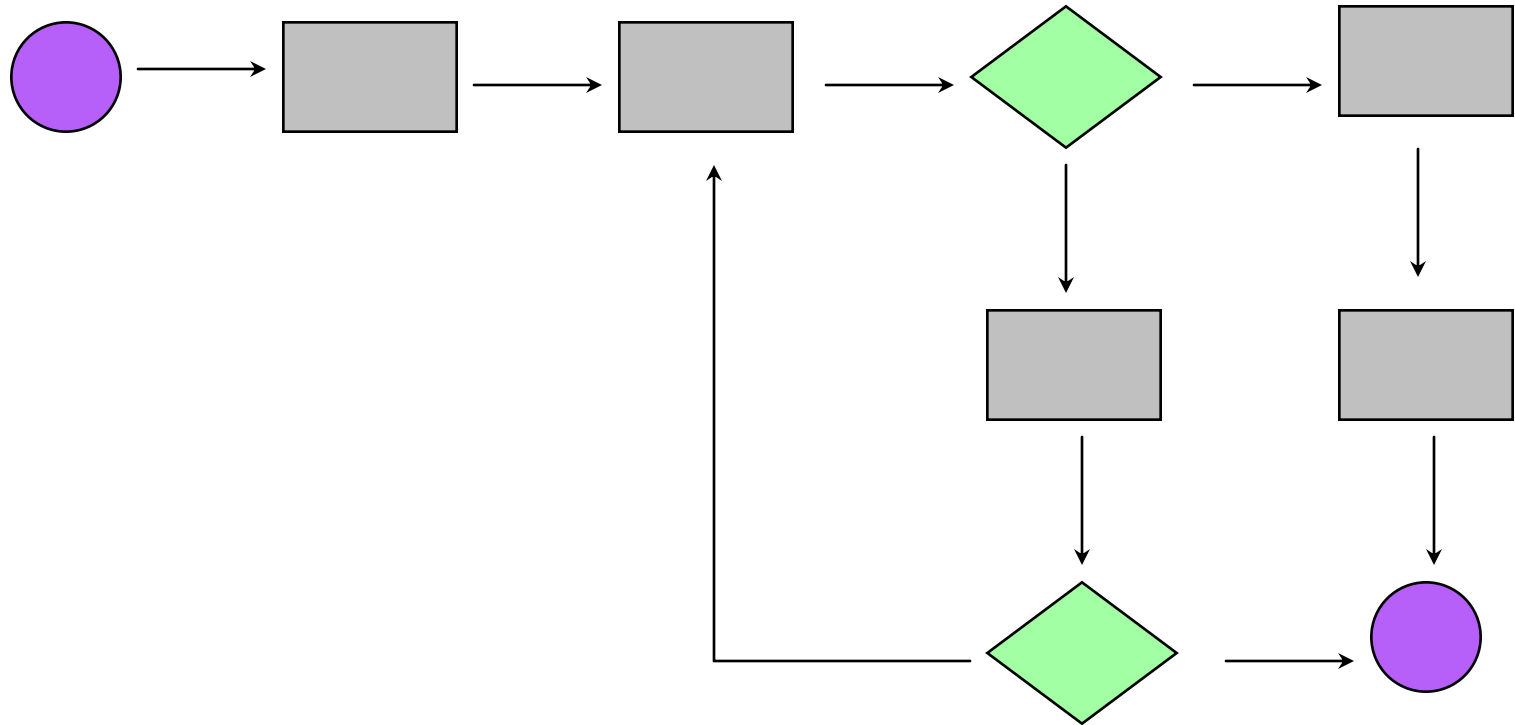
" Draw a flowchart for whatever you do. Until you do, you do not know what you are doing, you just have a job."

-- Dr. W. Edwards Deming.

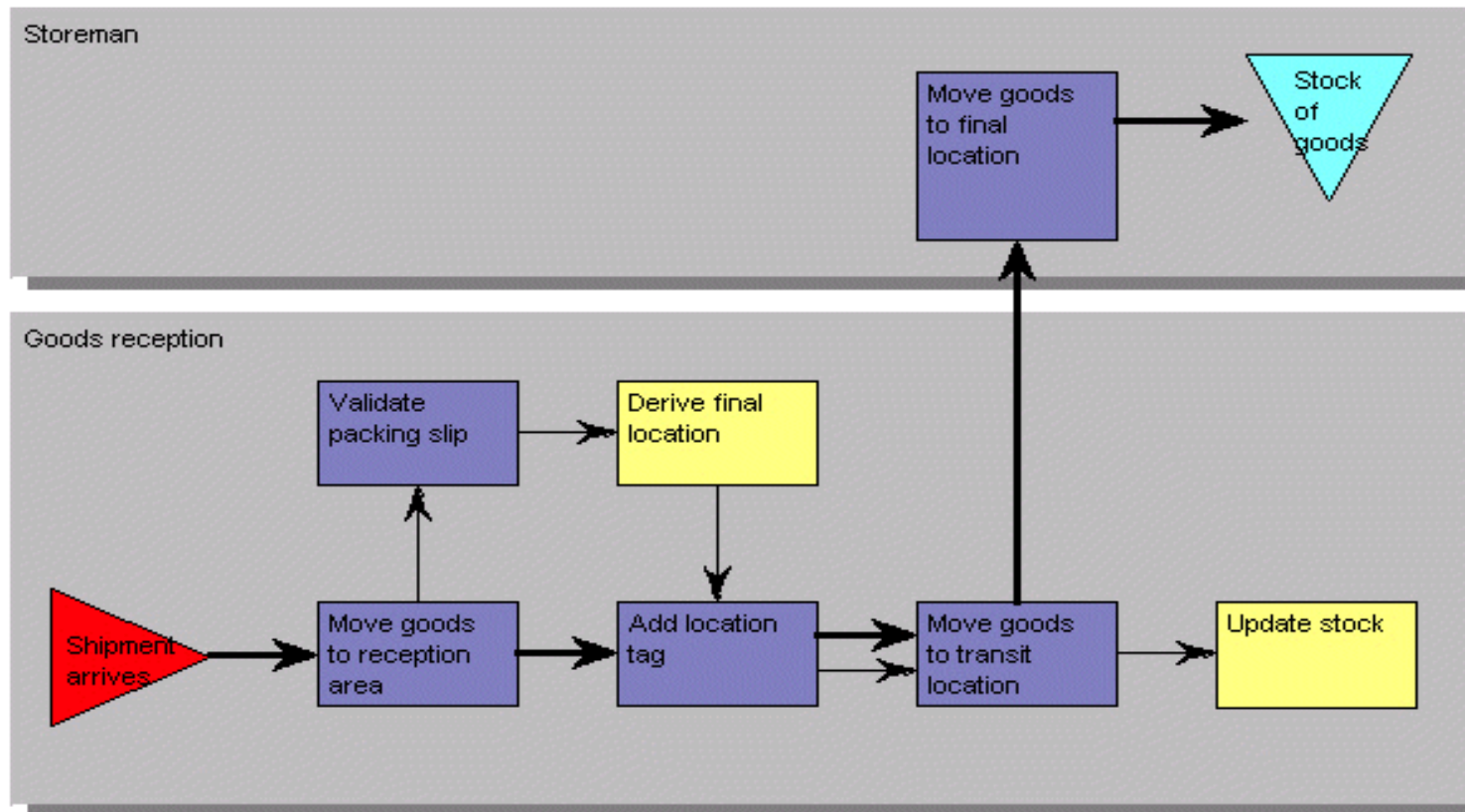
# Flowchart



# Flowchart



# Flow Diagrams

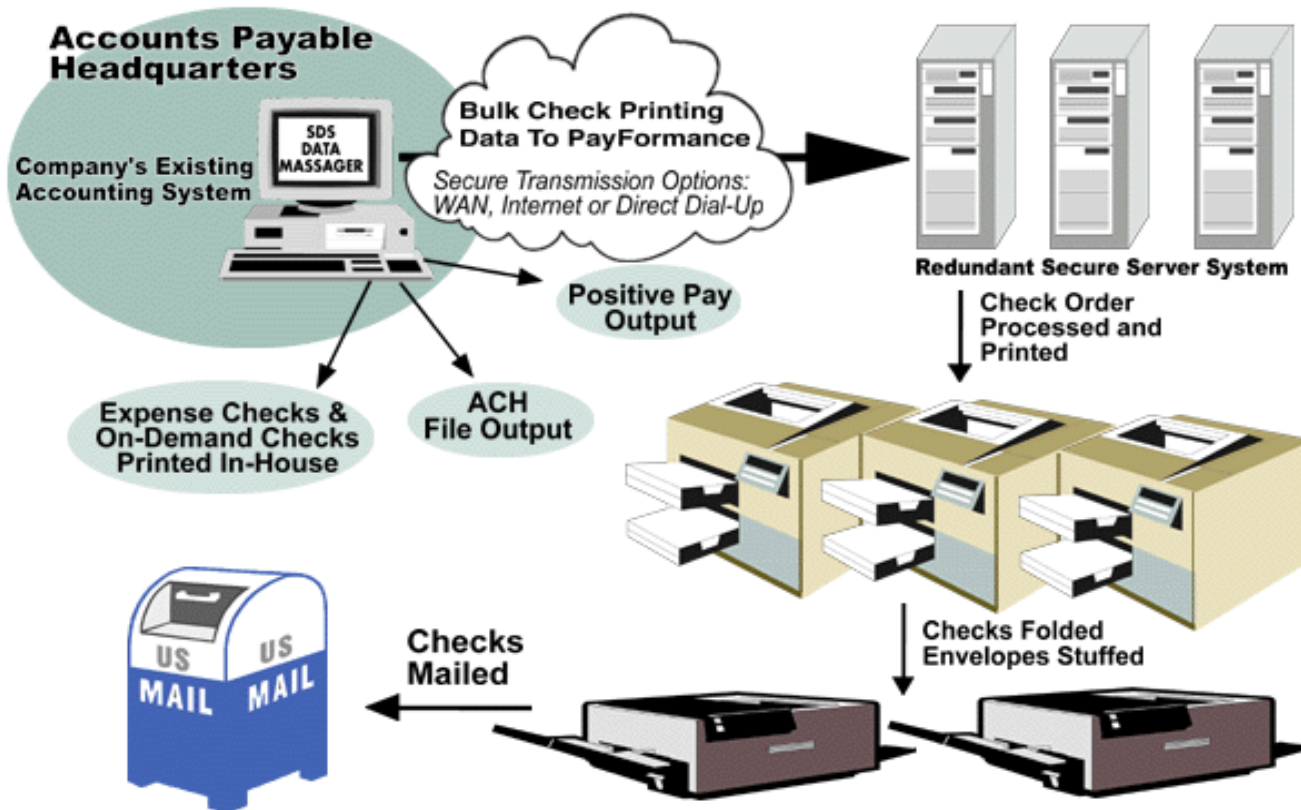


**The thicker flow is the flow of material.**

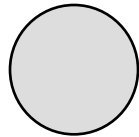
The thinner flow is the flow of operation/information.

Activities can be color coded: yellow means IT support, blue means manual activities.

# Flow Diagrams



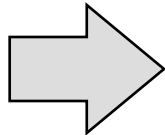
# Process Chart Symbols



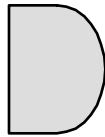
Operations



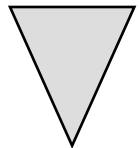
Inspection



Transportation



Delay

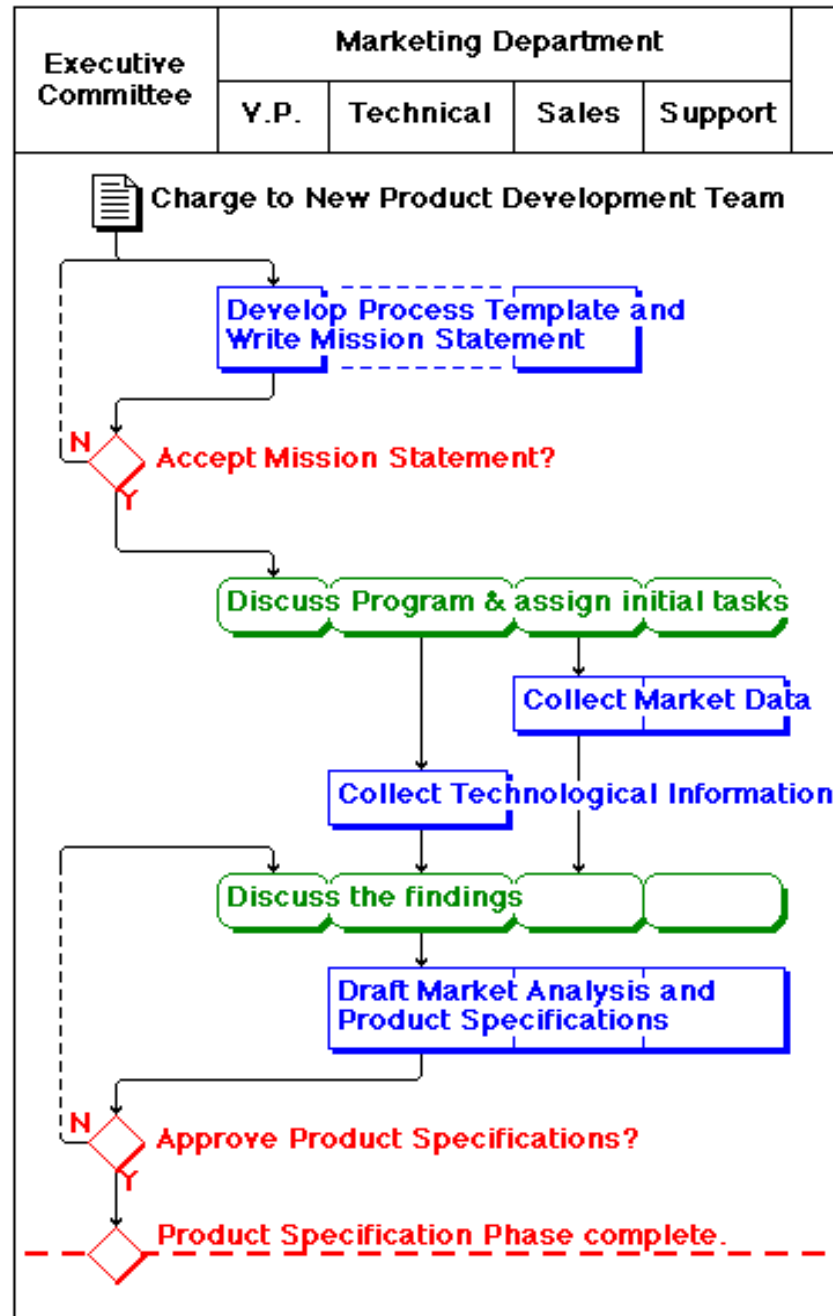
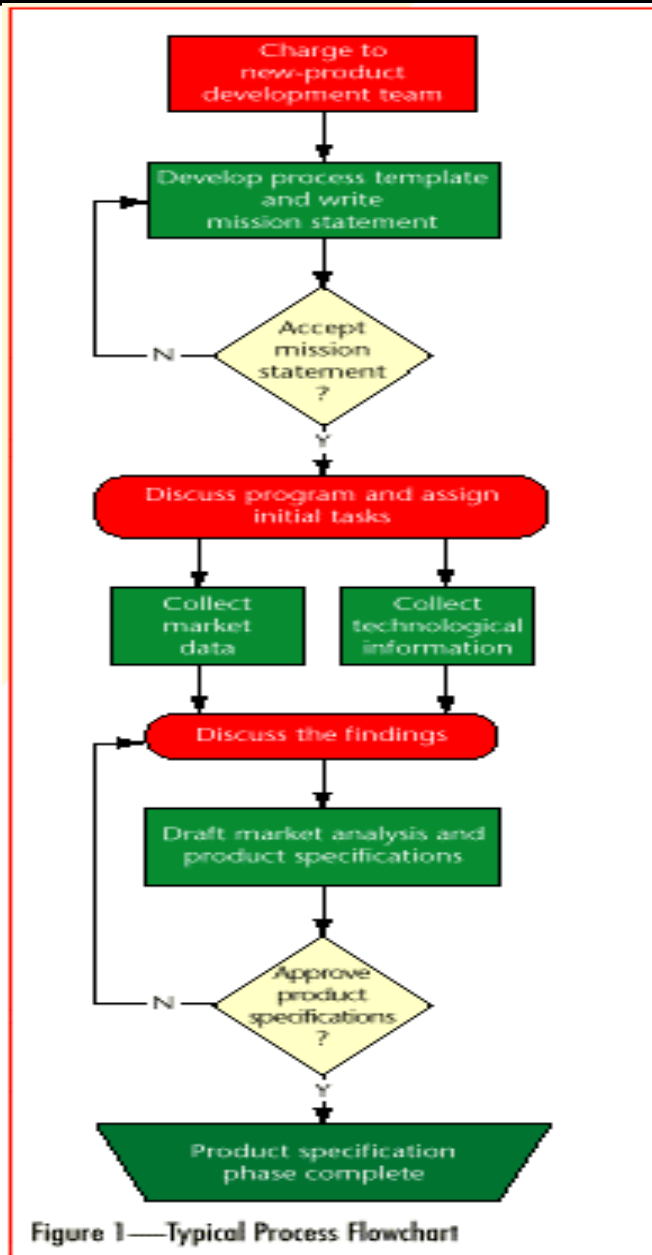


Storage

# Process Chart

Date: 9-30-00		Location: Graves Mountain						
Analyst: TLR		Process: Apple Sauce						
Step	Operation	Transport	Inspect	Delay	Storage	Description of process	Time (min)	Distance (feet)
1	●	→	□	D	▽	Unload apples from truck	20	
2	○	→	□	D	▽	Move to inspection station		100 ft
3	○	→	■	D	▽	Weigh, inspect, sort	30	
4	○	→	□	D	▽	Move to storage		50 ft
5	○	→	□	D	▽	Wait until needed	360	
6	○	→	□	D	▽	Move to peeler		20 ft
7	●	→	□	D	▽	Apples peeled and cored	15	
8	○	→	□	D	▽	Soak in water until needed	20	
9	●	→	□	D	▽	Place in conveyor	5	
10	○	→	□	D	▽	Move to mixing area		20 ft
11	○	→	■	D	▽	Weigh, inspect, sort	30	
Page 1 of 3						Total	480	190 ft

## New Product Development Process - Phase 1





# Check Sheet

		Shifts			
Defect Type		✓ ✓ ✓	✓ ✓ ✓ ✓	✓	✓ ✓ ✓
		✓ ✓	✓ ✓ ✓		
			✓ ✓ ✓ ✓		✓ ✓ ✓
			✓ ✓	✓	

# Check Sheet

COMPONENTS REPLACED BY LAB

TIME PERIOD: 22 Feb to 27 Feb 1998

REPAIR TECHNICIAN: Bob

TV SET MODEL 1013

Integrated Circuits    IIII

Capacitors            IIII / IIII / IIII / IIII / IIII / II

Resistors              II

Transformers          IIII

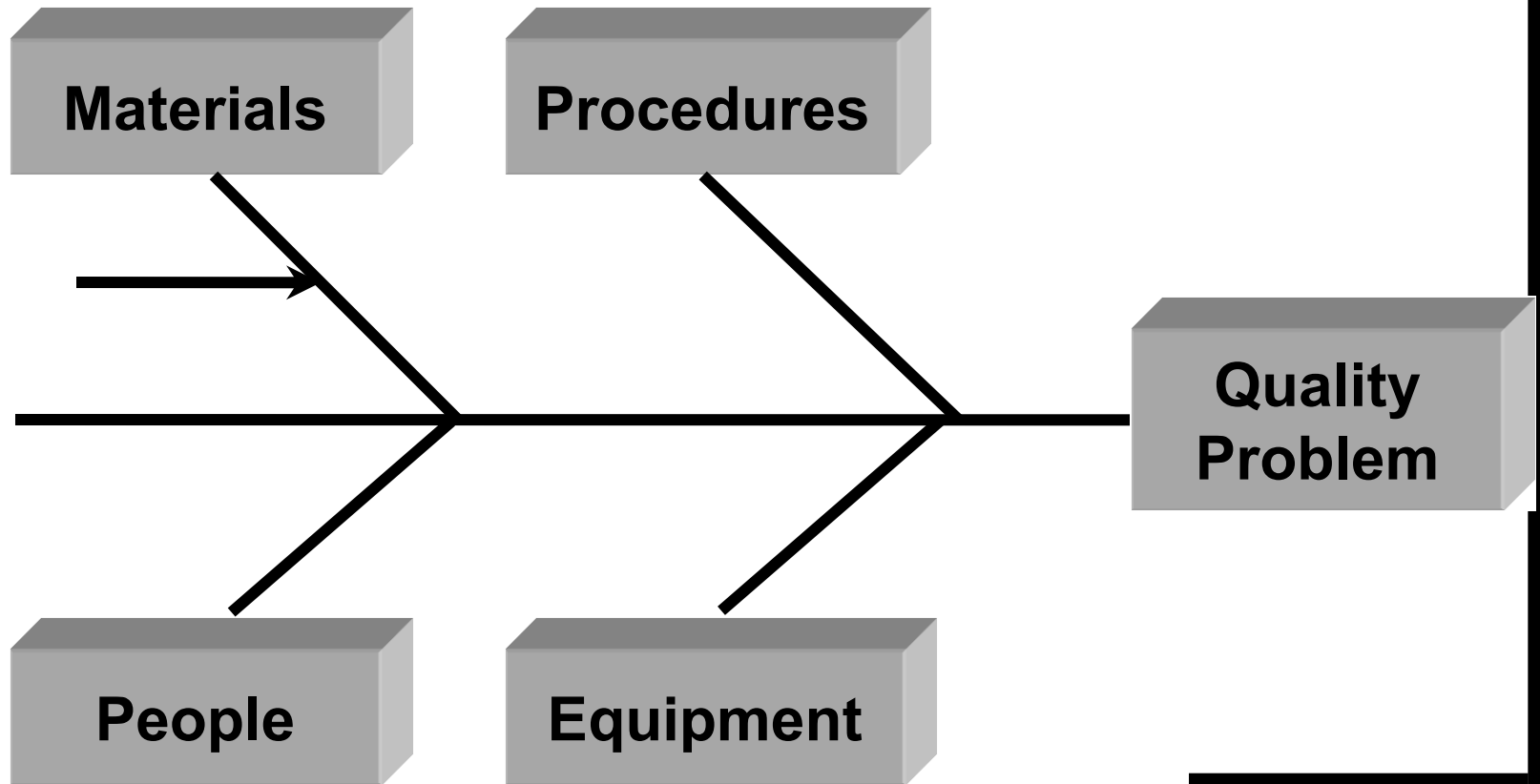
Commands

CRT                    |

# Cause-and-Effect Diagrams

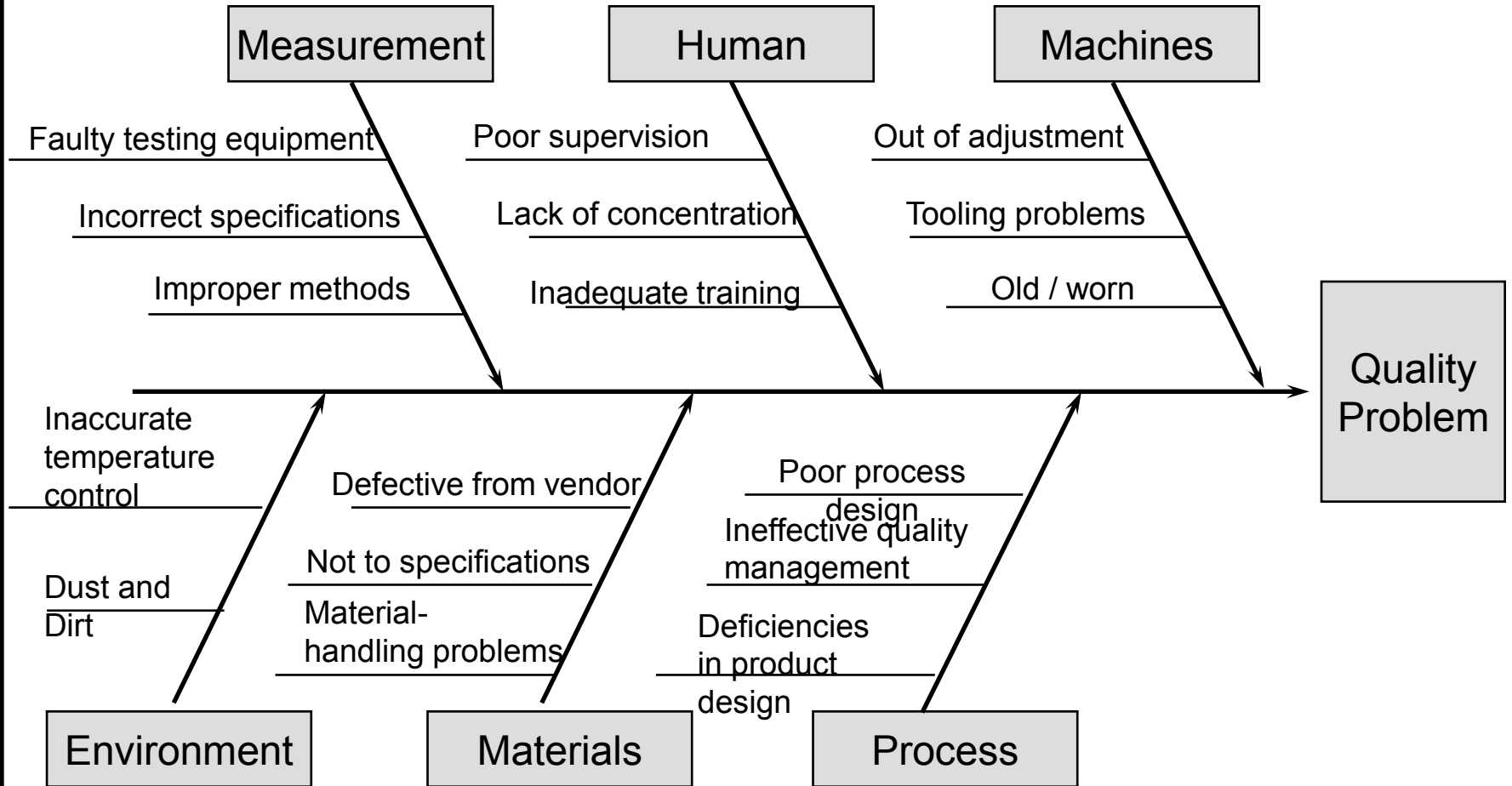
- ◆ Show the relationships between a problem and its possible causes.
- ◆ Developed by Kaoru Ishikawa (1953)
- ◆ Also known as ...
  - Fishbone diagrams
  - Ishikawa diagrams

# Cause and Effect “Skeleton”



7 Quality Tools

# Fishbone Diagram



# Cause and effect diagrams

## ◆ Advantages

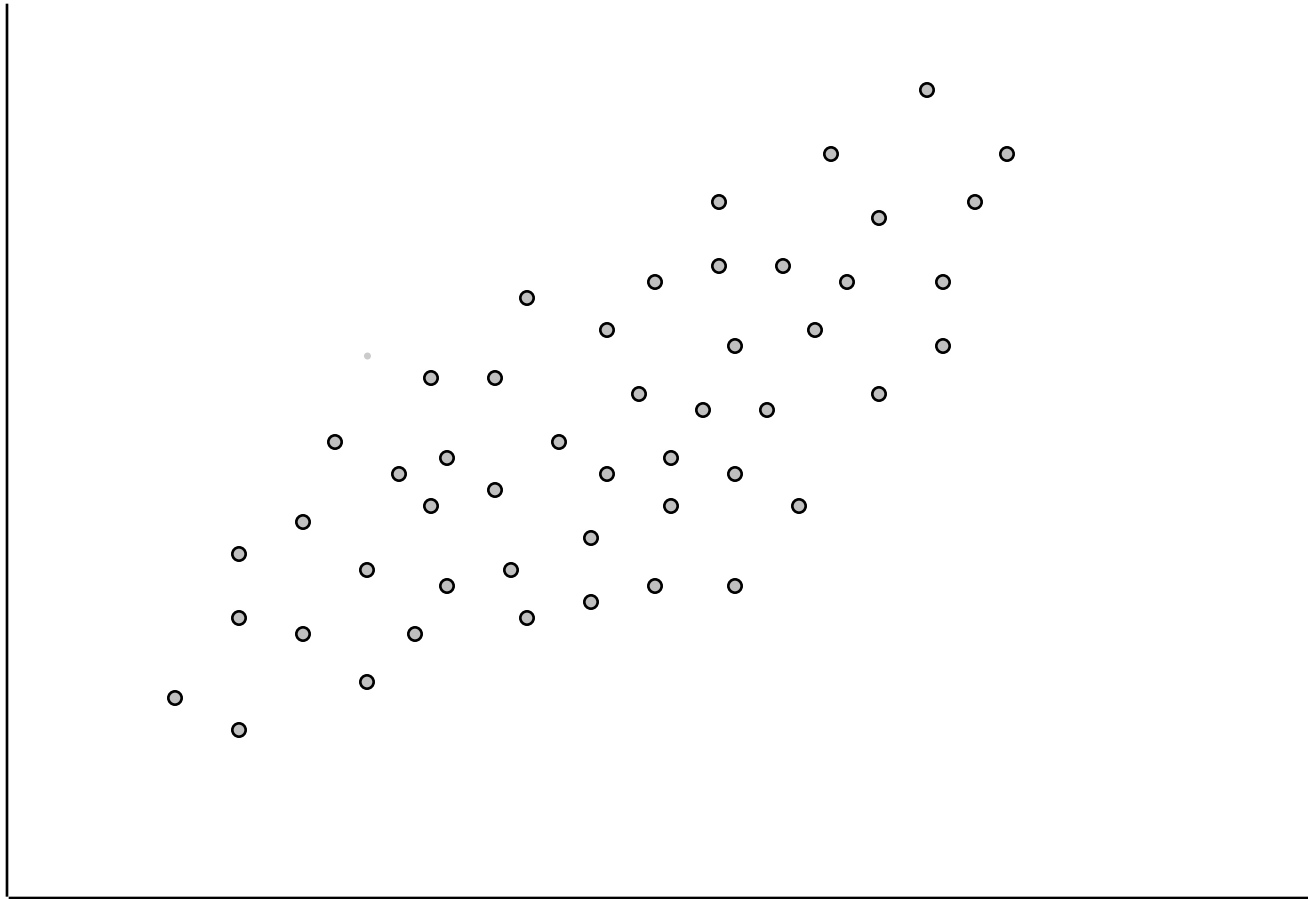
- making the diagram is educational in itself
- diagram demonstrates knowledge of problem solving team
- diagram results in active searches for causes
- diagram is a guide for data collection

# Cause and effect diagrams

To construct the skeleton, remember:

- ◆ For manufacturing - the 4 M's
  - ✓ man, method, machine, material
- ◆ For service applications
  - ✓ equipment, policies, procedures, people

# Scatter Diagram

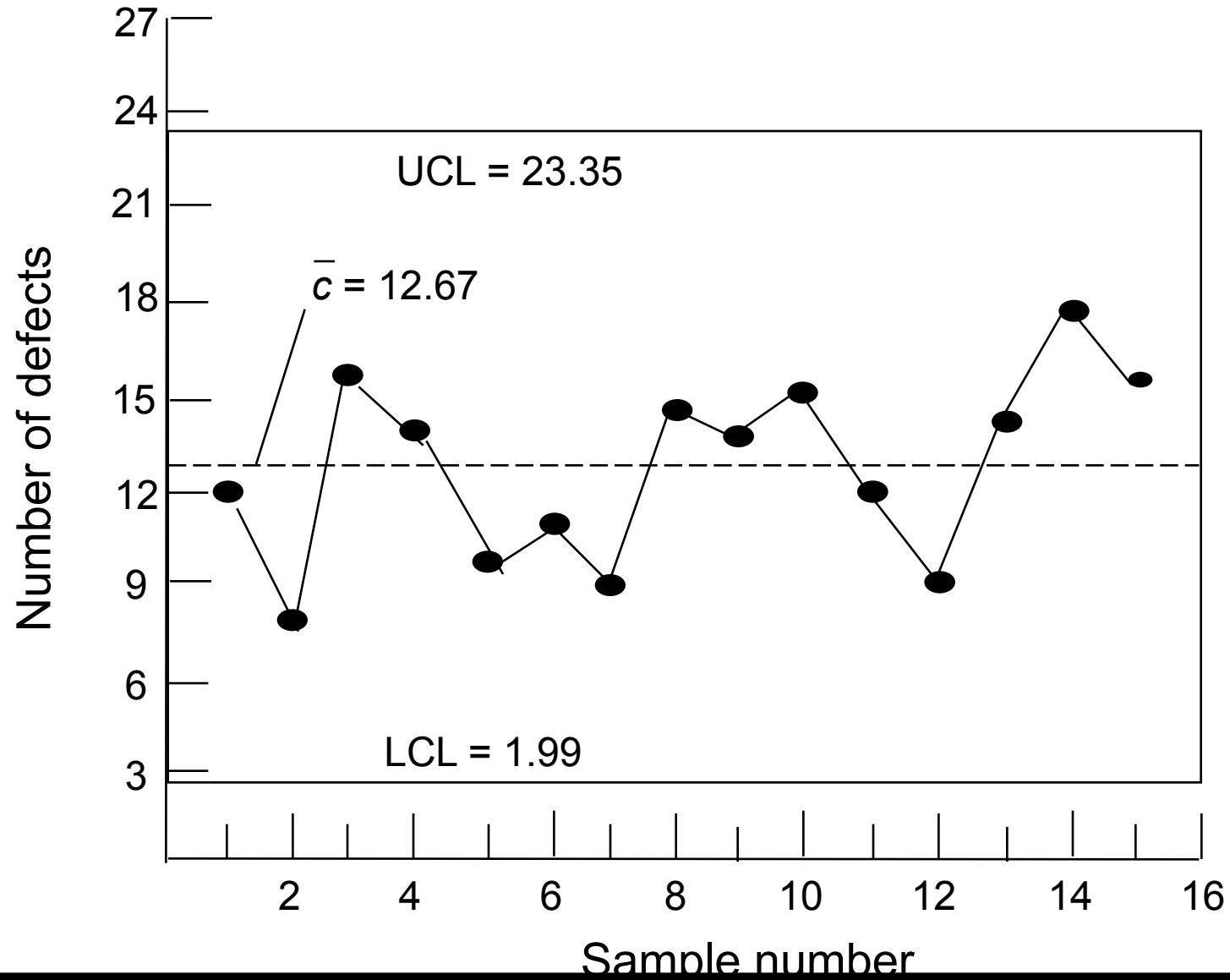




# Run Charts

- ◆ Run Charts (time series plot)
  - Examine the behavior of a variable over time.
  - Basis for **Control Charts**

# Control Chart



# 5. Determining the "Significant Few"

Sub-System	Failure Event	Failure Mode	Frequency	Impact	Total Loss
Sub System 3	Failure Event 1	Failure Mode 1	2000	\$850	\$1,700,000
Sub System 2	Failure Event 2	Failure Mode 2	1000	\$1,250	\$1,250,000
Sub System 4	Failure Event 3	Failure Mode 3	4	\$75,000	\$300,000
Sub System 18	Failure Event 4	Failure Mode 4	2	\$6,000	\$108,000
Etc.	Etc.	Etc.	Etc.	Etc.	Etc.
<b>Total Global Loss</b>					<b>\$3,680,575</b>
<b>Significant Few Losses</b>					<b>80% of \$3,680,575 = \$2,944,460</b>

# Modified FMEA

## 6. Validate Your Results

- ◆ You can use the gap analysis to make sure that all of the events add up to +/- 10% of the gap.
- ◆ If it ends up being less, you have probably left some important failure events off the listing.
- ◆ If you have more than the gap then you probably have not summarized your results well enough.
- ◆ A second validation that you can use is having a group of experienced people from your facility review your findings.
- ◆ This will help ensure that you are not too far off base.
- ◆ ~~A third, and final, validation would be to use your computerized data systems to see if the events closely~~