

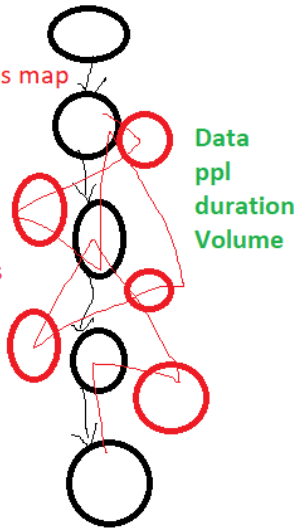
What you think it is



What it is actually

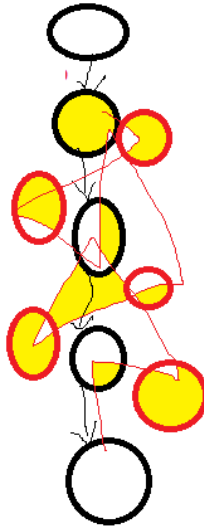
As- Is Process map
CVSM
SD

45 minutes



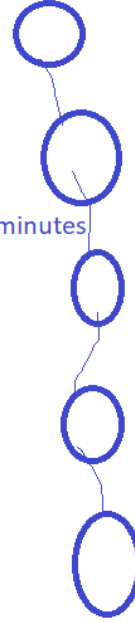
Data
ppl
duration
Volume

Identify waste or NVA



Proposed Map
Ideal VSM

15 minutes



To- Be map
Should Be map
FVSM

20 minutes



- **Overall Equipment Effectiveness (OEE) = A * P * Q**, where A is Machine Availability, P is Performance efficiency & Q is Quality rate

A = Operating time / Planned production time

P = (Total pieces / operating time) / Ideal run rate

Q = Good pieces produced / total pieces produced

A, P & Q factor for down time loss, speed loss & Quality loss respectively. The **OEE value** is a **Lean / TPM metric**, which can also be used to prioritise a process for improvement projects. **World class OEE value** is taken as **85%** & individual values for A, P & Q are 90%, 95% & 99.9% respectively.

OEE Factor	Shift 1	Shift 2
Availability	90.0%	95.0%
Performance	95.0%	95.0%
Quality	99.5%	96.0%
OEE	85.1%	86.6%

OEE - Overall Equipment Efficiency

$$\text{OEE} = A * P * Q$$

Availability =

Performance =

Quality =

WC = 85%

Ind std = 50-60%

Data for OEE calculation

Particulars	Data/ value
Shift length	480 mins
Short breaks	2 @ 15 mins = 30 mins
Meal break	30 mins
Down time	47 mins
Ideal run rate (IRR)	60 pieces per min
Total pieces	19,722 pieces
Reject pieces	453 pieces
Planned prodn time	Shift length – total breaks
Operating time	Pl prodn time - down time
Good pieces	Total pieces – reject pieces
Availability	Op time / pl prodn time
Performance	(Tot pieces/op time) / IRR
Quality	Good pieces/total pieces

OEE calculation

- Planned prodn time = 420 mins
- Operating time = 373 mins
- Good pieces = 19,269

- $A = 373/420 = 0.8881$
 - $P = (19269/373)/60 = 0.8812$
 - $Q = 19269/19722 = 0.97703$
- So, A = 88.81%, P = 88.12% &
Q = 97.70%
- OEE = 76.46%**

We see that A (Machine Availability) & P (Performance) needs to be improved to improve OEE value further. And among A & P, P needs more improvement.

POKA-YOKE TYPES



Screw Poka Yoke



Screwdriver can slip
and scratch surface



Screwdriver can't slip
and scratch surface

From Sarah to Everyone 05:09 PM

equipment "pinch point" warning label

From Nick to Everyone 05:09 PM

We use a 2" hose and a 3" hose to ensure the incorrect tank does not get attached

From Trey Case to Everyone 05:10 PM

Coastal uses an 8mm x 8mm notch that is wire cut into foam design

From Jake\ Koetsier to Everyone 05:10 PM

lot codes could be scanned in by a barcode rather than manually typing

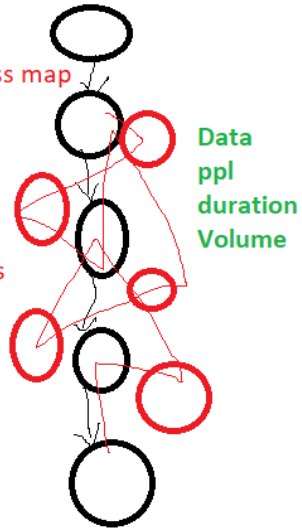
D
What you think it is



M
What it is actually

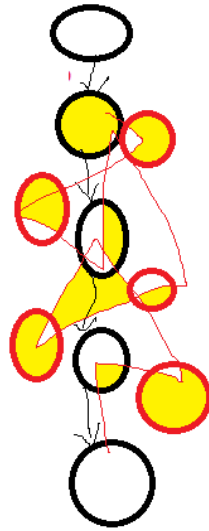
As- Is Process map
CVSM
SD

45 minutes



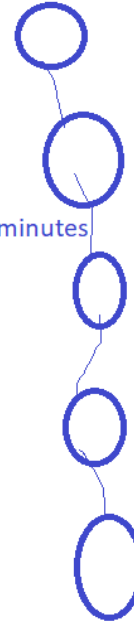
Data
ppl
duration
Volume

A
Identify waste or NVA



I
Proposed Map
Ideal VSM

15 minutes



C
To- Be map
Should Be map
FVSM

20 minutes



SMED

100 units per hour = 700 units per day

3 dies * 15 minutes = 45 minutes

3 dies * 10 minutes = 30 minutes

3 dies * 5 minutes = 15 minutes

3 dies * 3 minutes = 9 minutes

30 minutes ✓

3 minutes

30 seconds

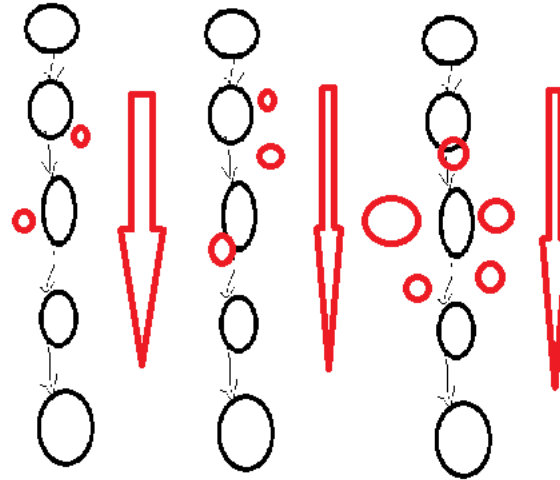
10 seconds ✓

Seconds

Nano-Seconds

Single minute (digit)

SMED - Single minute Exchange of Dies



F1 car race- Pit stop

Racer- Productive

Change of tyres= UnProductive

1 to 2 hours

45 mins

30 mins

15 mins

10 mins

5 mins

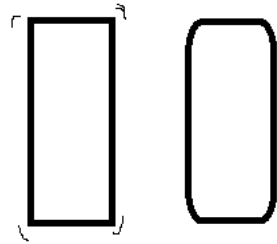
3 mins

2 seconds

Kaizen
Kai- change/modify
Zen - good / better

Lean Tool

No Cost
Low Cost
Less Time
Less Resources
Low Risk



Kai
Zen



Kai
Zen

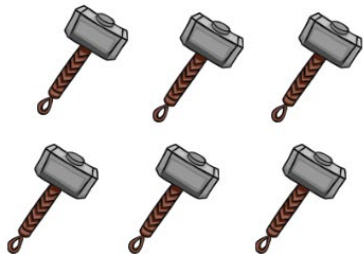


Toyota
TPS - Toyota Production System
TPS - Thinking People's Solution

Empower their people at their levels.

TT, C-team, Janitors, HK
MMT, SMT , Associates

Kaizen



lots of smaller change

Kaikaku









big change

Kakushin



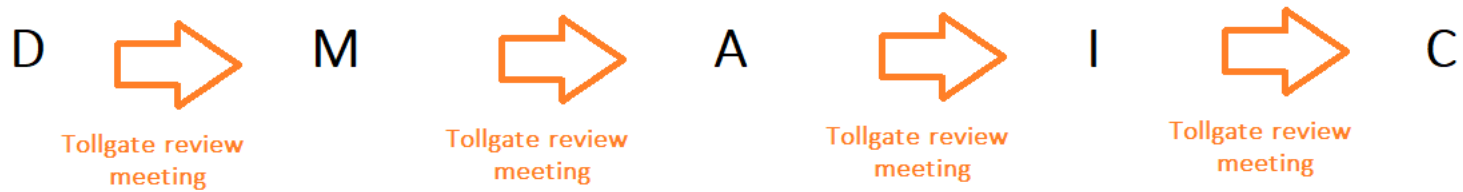
something new!!!

To do	Doing	Done
		    

Day 3:-

What you can't measure, you can't improve, You can't manage.

Toll-Gate Review



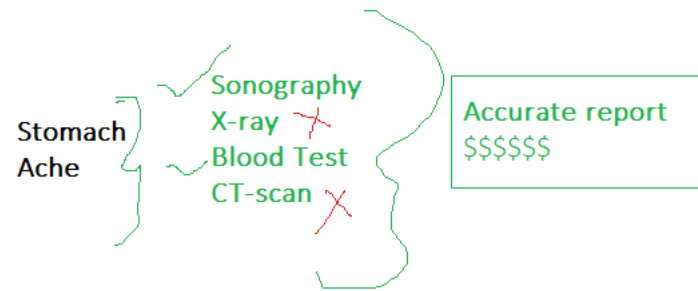
$y = f(x)$
coffee = f(brand of coffee)

$y = f(x_1, x_2, x_3, x_4, \dots)$
coffee = f(water, milk, sugar, coffee)

$y = f(x)$
sale coffee = f(taste of coffee)

$y = f(x_1, x_2, x_3, x_4, \dots)$
sale of coffee = f(taste, color, aroma, quantity, hygiene, price)

Not about measuring it right
But to measure the right things



Examples of $y=f(x_1, x_2, x_3, \dots)$

From Gabe TeBos to Everyone 03:34 PM

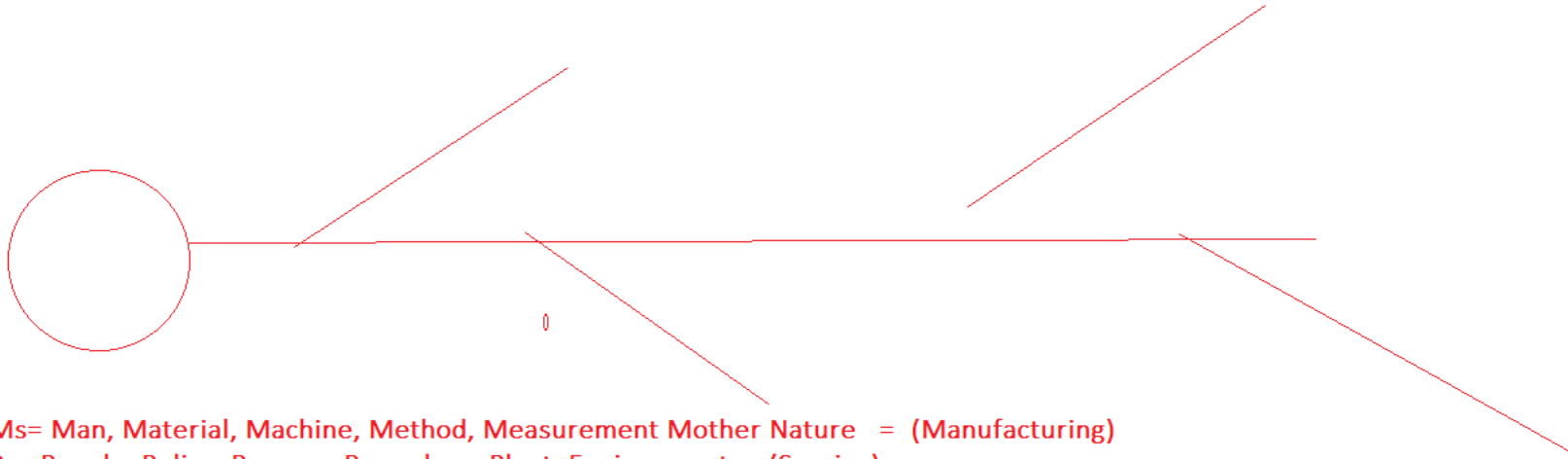
Y=Wire Delivery

Wire Delivery = $f(\text{Wire accuracy, Delivery Timeliness, Product condition})$

From Jake Koetsier to Everyone 03:35 PM

Blending = $f(\text{raw materials, formula, technicians, blenders})$

Fishbone



Ms= Man, Material, Machine, Method, Measurement Mother Nature = (Manufacturing)

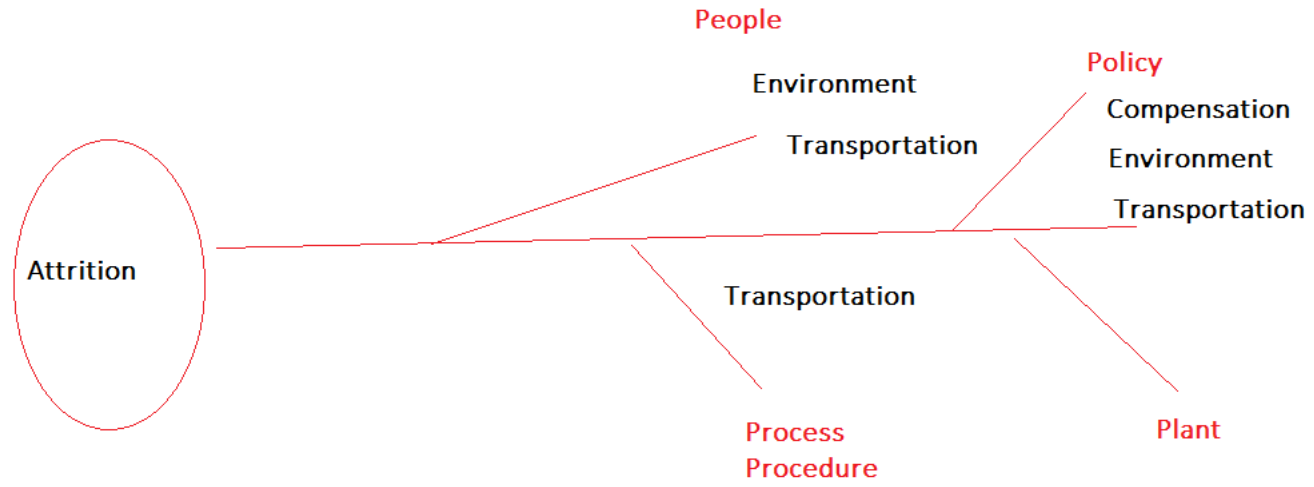
Ps= People, Policy, Process, Procedure, Plant, Environment = (Service)

Use both for any industry

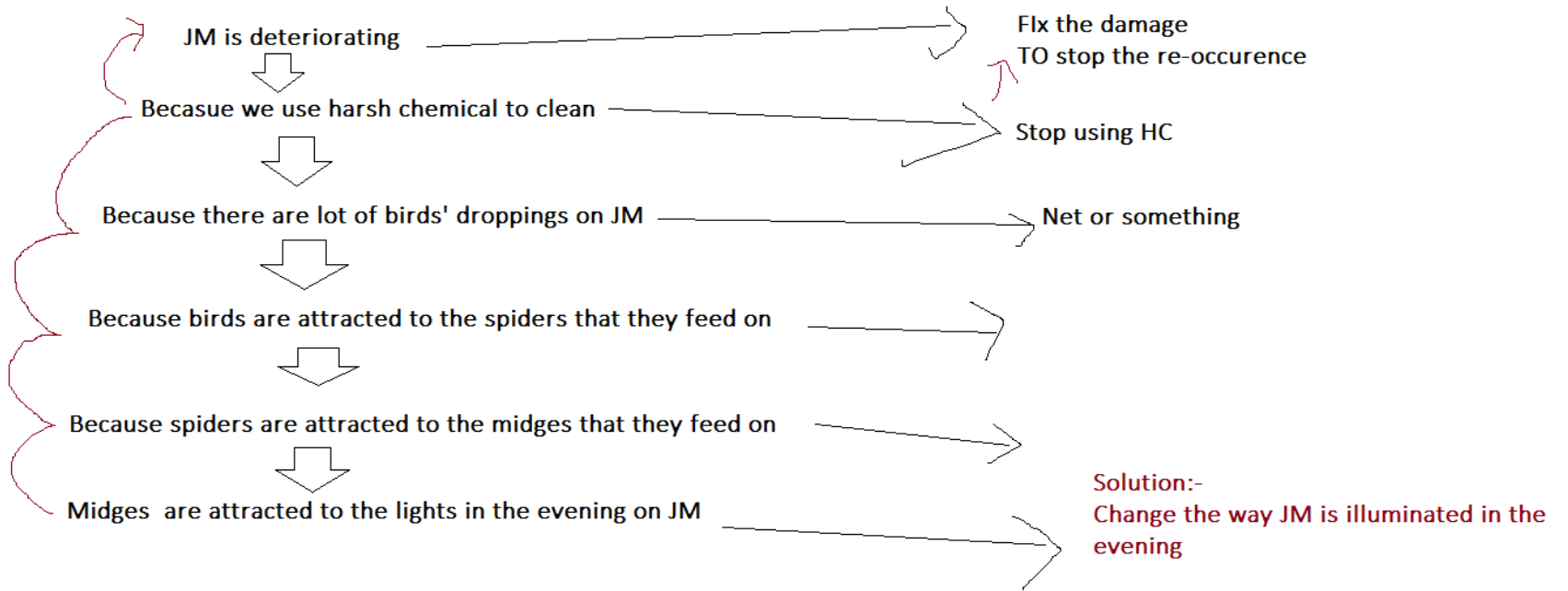
E =

S =

Fishbone - <https://www.youtube.com/watch?v=mLvizyDFLQ4F>



5 -Whys
3-7-9 Whys
Why-Why Analysis



Pareto:-

Pareto - Priortising tool

Vilfredo Pareto - Italian economist

20% land	80% land
80% poor	20% rich

- peas pods
- pod plants
- plant garden
- garden soil
- produce garden
- sales product
- profit sales
- sales customer
- complaint customer
- Issues cause

80:20 rule, pareto
pareto graph
prioritizing tool
vital few and trivial many

80:20

70:30

60:40

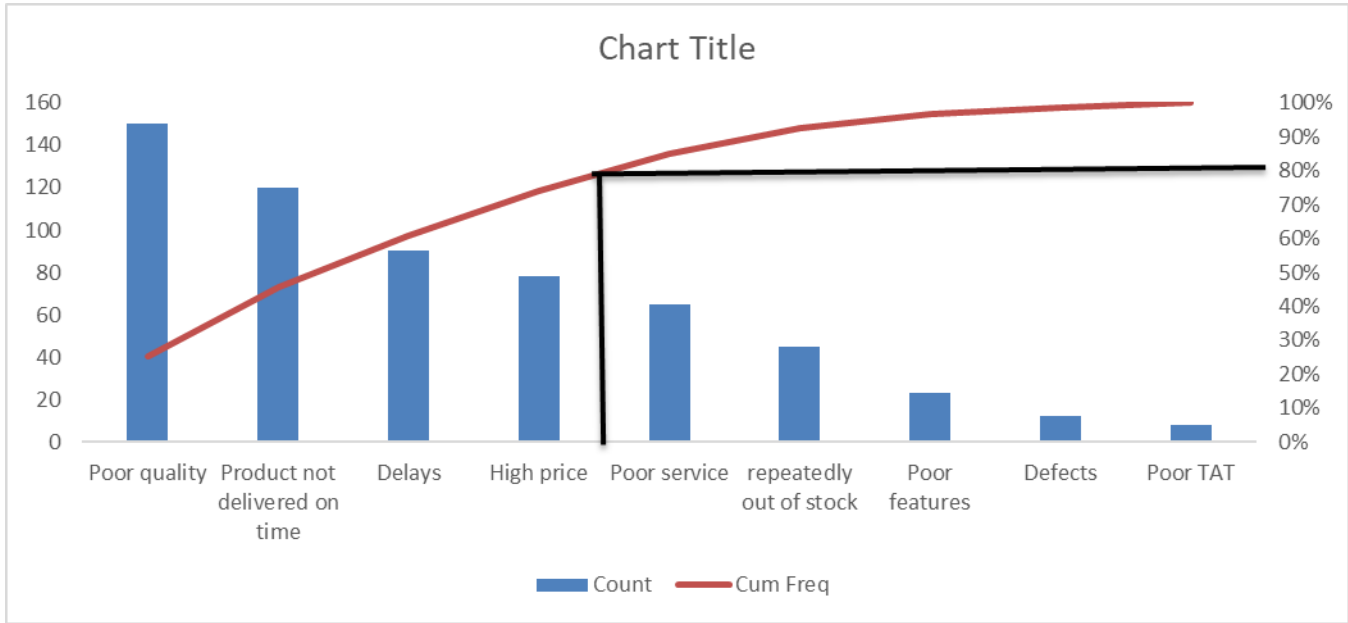
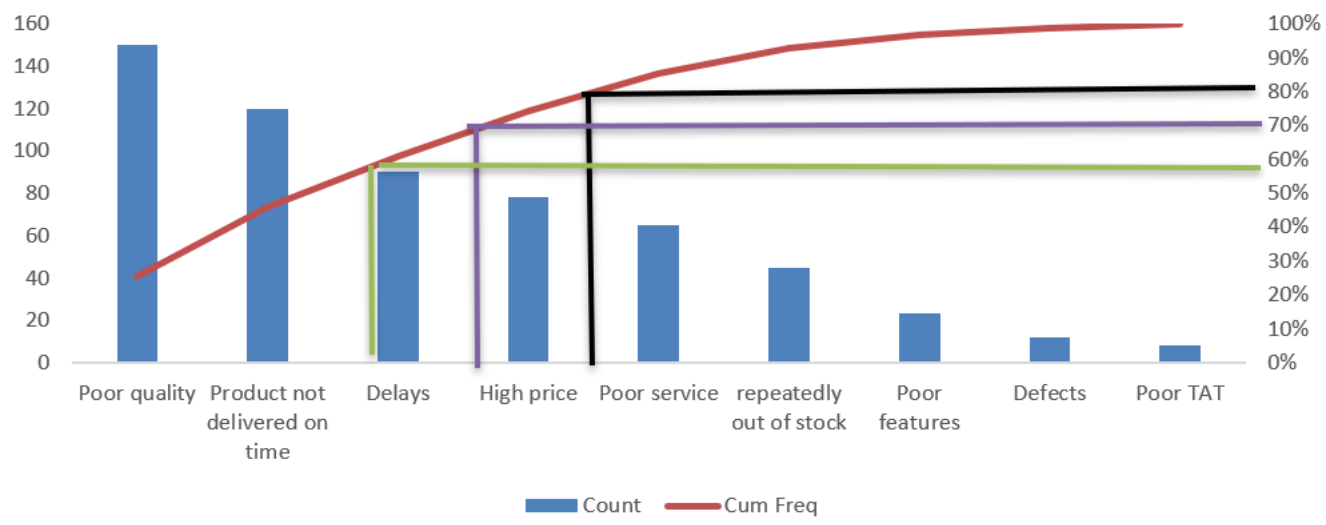
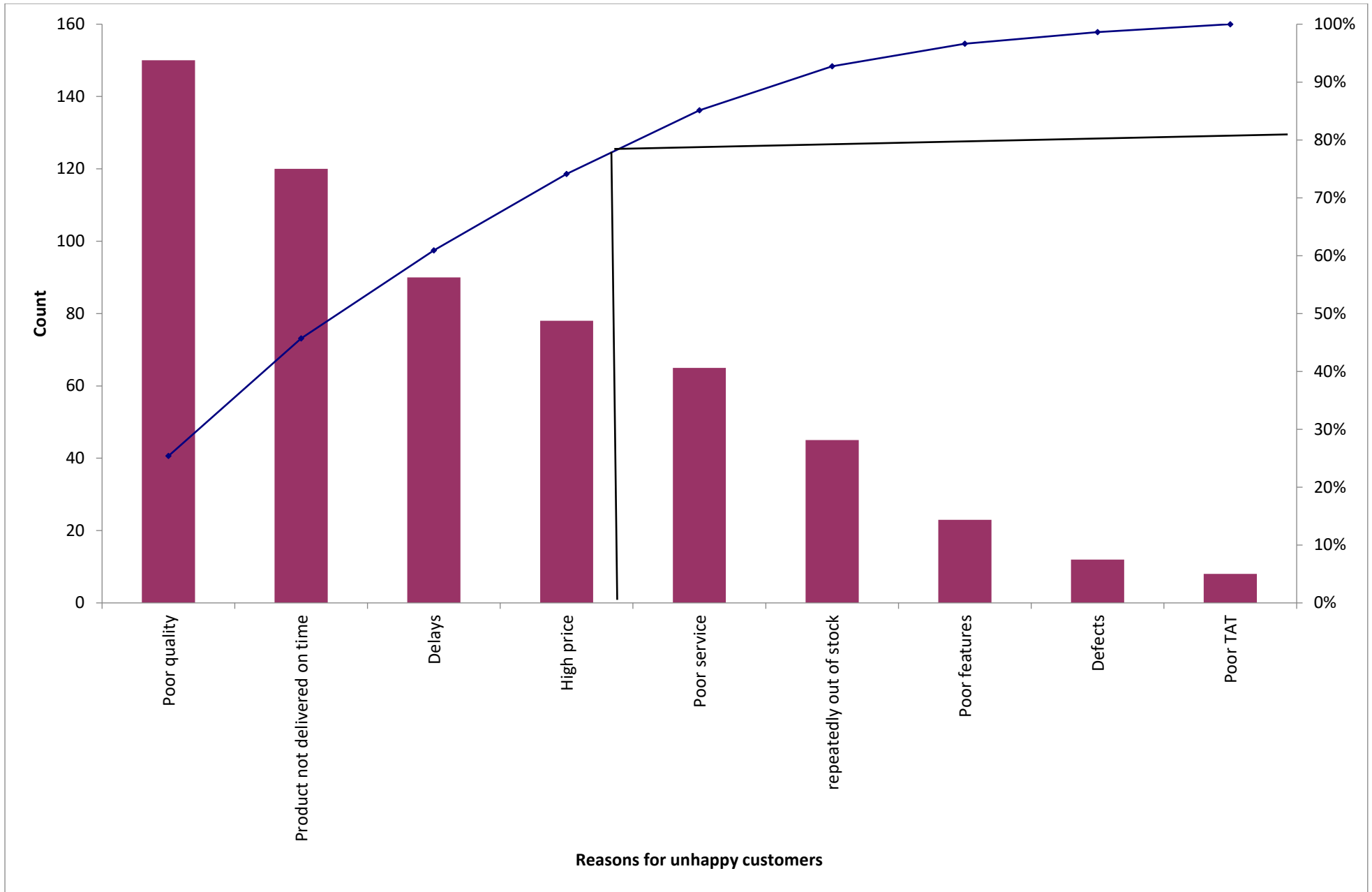
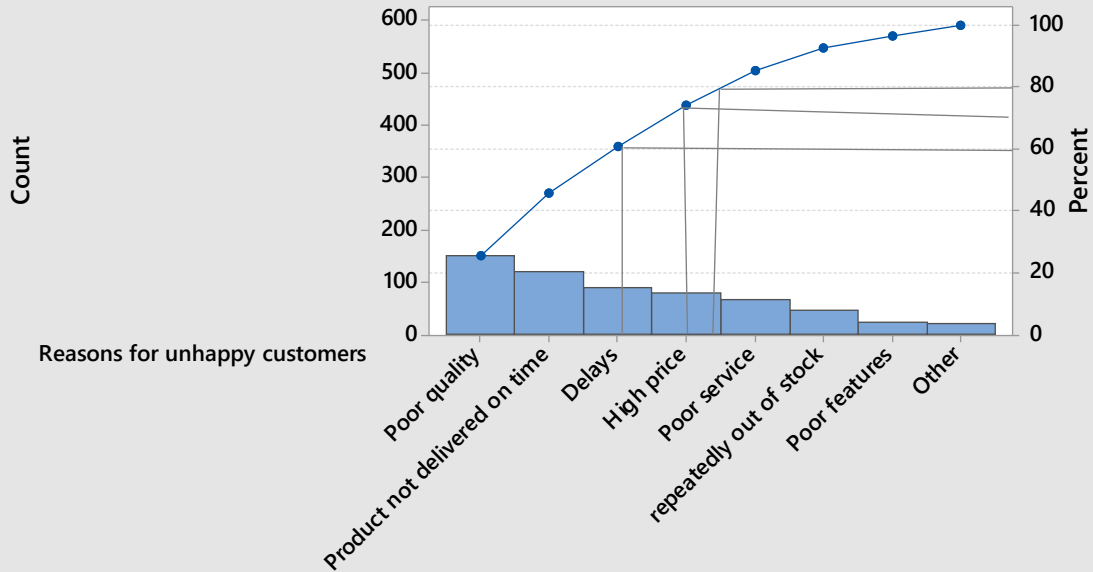


Chart Title





Pareto Chart of Reasons for unhappy customers



Reasons for unhappy customers

Count	150	120	90	78	65	45	23	20
Percent	25.4	20.3	15.2	13.2	11.0	7.6	3.9	3.4
Cum %	25.4	45.7	60.9	74.1	85.1	92.7	96.6	100.0

FMEA - Risk Assessment tool

RPN - Risk Priority Number

$$\text{RPN} = \text{S} * \text{O} * \text{D}$$

Severity 1-10
Occurrence 1-10
Detection 1-10

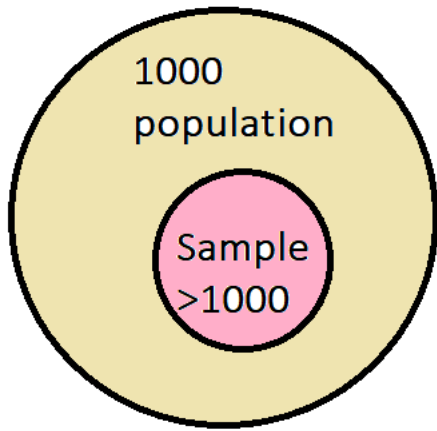
$$\text{Least RPN} = 1 * 1 * 1 = 1$$

$$\text{Max RPN} = 10 * 10 * 10 = 1000$$

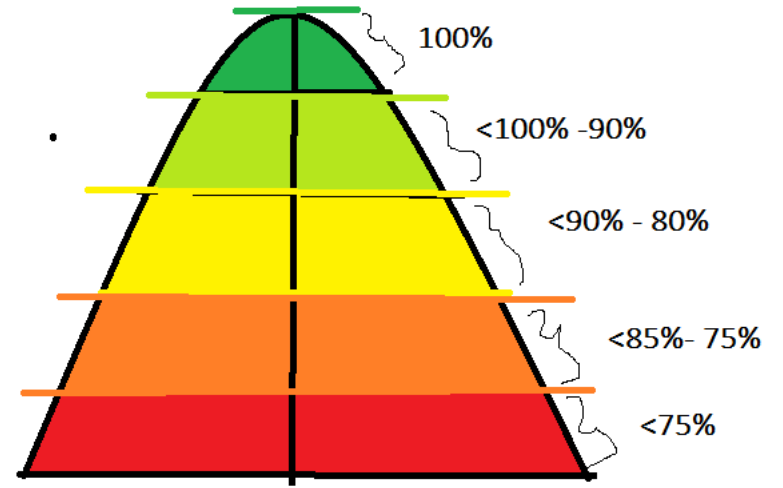
RPN range from 1 to 1000

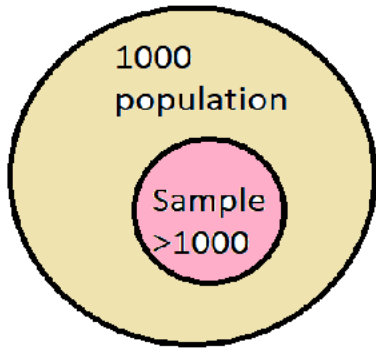
When RPN is 100 or more, we need recommendation

FMEA VIDEO <https://www.youtube.com/watch?v=rIGRd4VICw4>

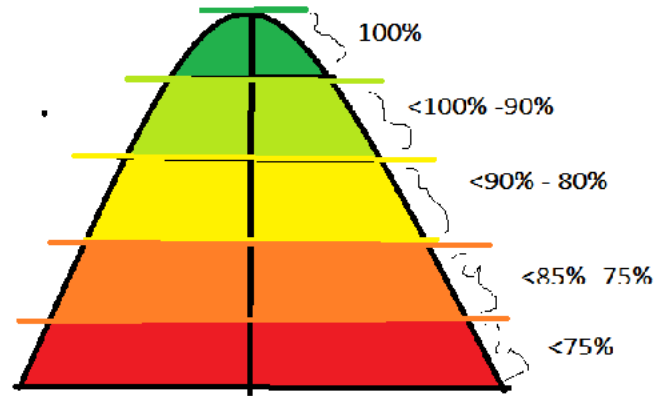


Normal Curve
Normal Distribution
Bell Curve

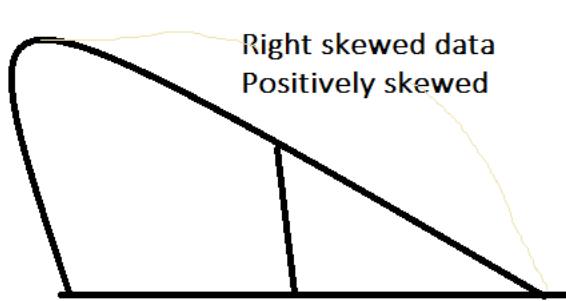




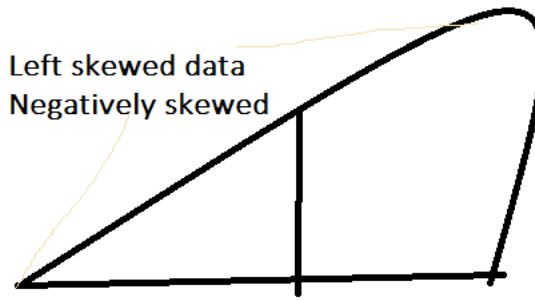
Normal Curve
Normal Distribution
Bell Curve



Non-normal curves



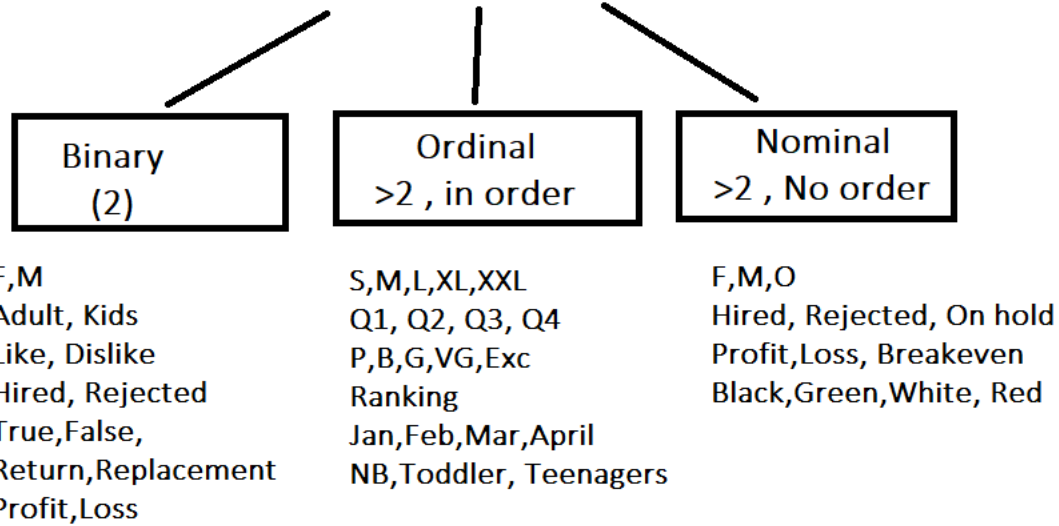
Right skewed data
Positively skewed



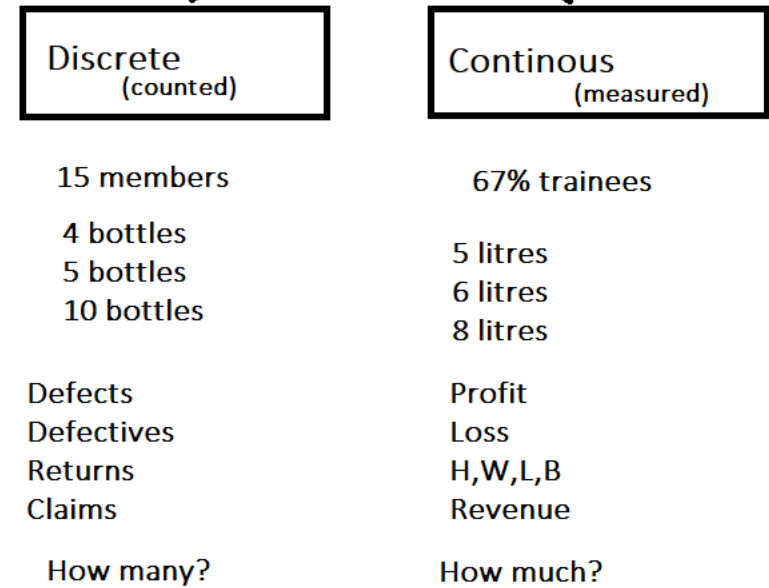
Left skewed data
Negatively skewed

Types of Data:-

Qualitative data



Quantitative data



Qualitative data

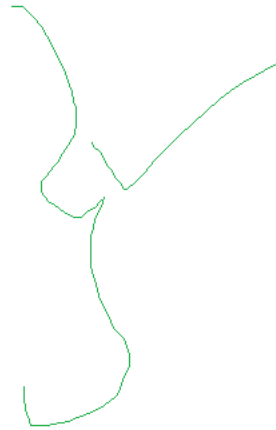
Are you over the age of 16 years?

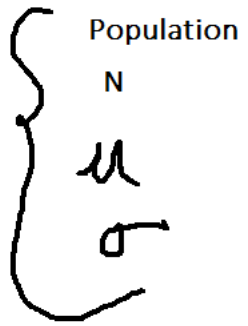
Y
Y
N
N
N
Y
Y
Y
Y
N
N
Y
N
Y

Quantitative data

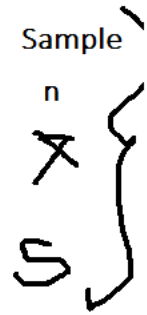
How old are you?

12
21
34.5
56
67.5
89
34
54
23
12
34
54
32
12.5
2.5

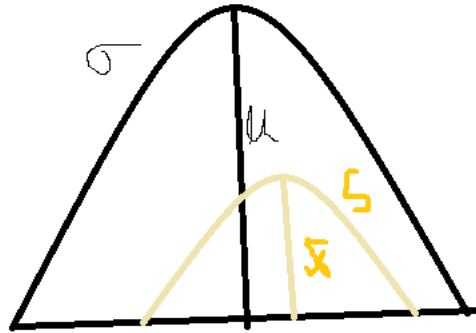
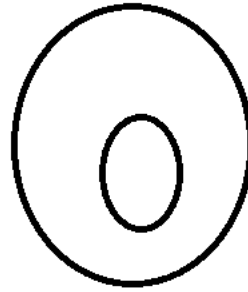


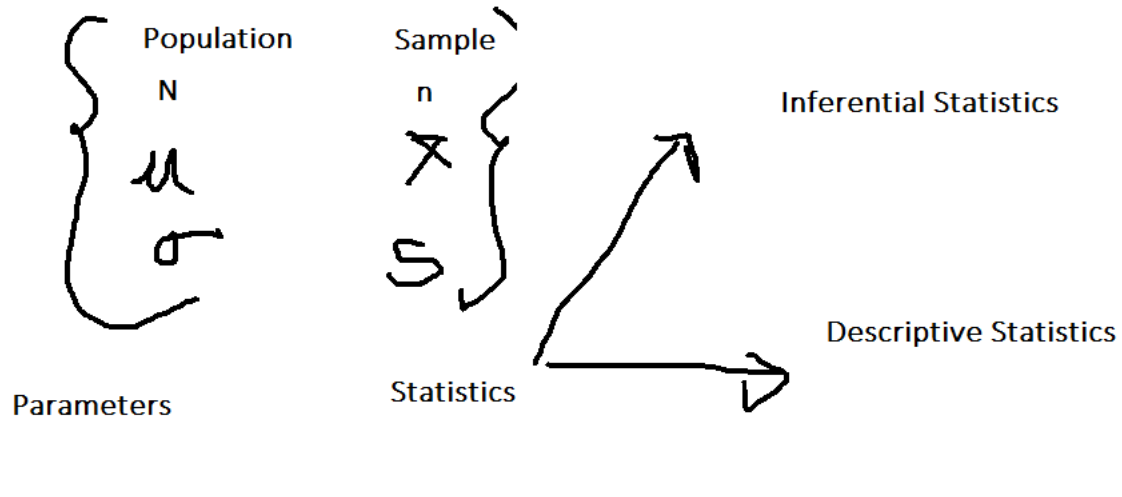


Parameters



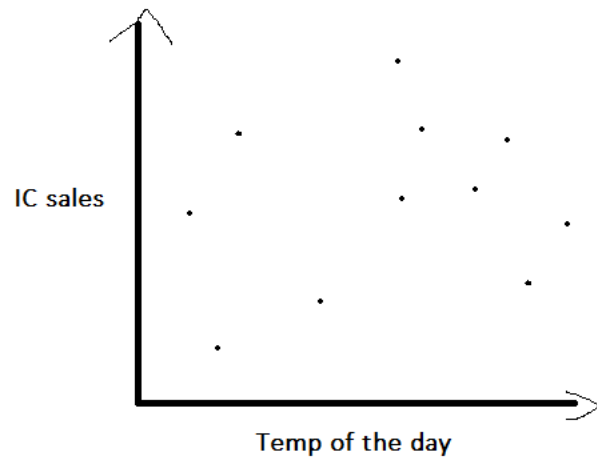
Statistics



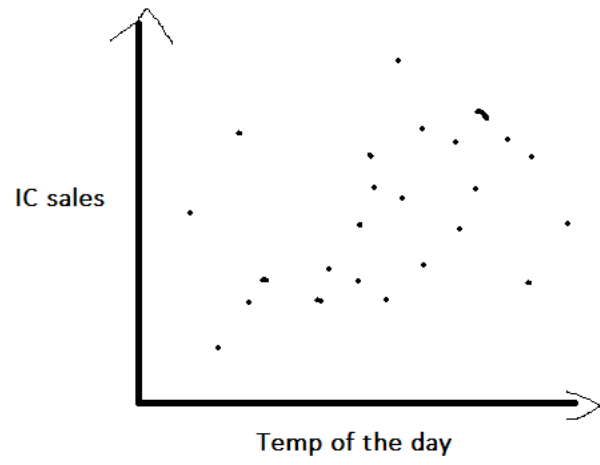


Population			Sample	
1000 shirts			100 shirts	
120	12%	Buttons	12	
50	5%	Pockets	5	
160	16%	Sleeves	16	
20	2%	color	2	

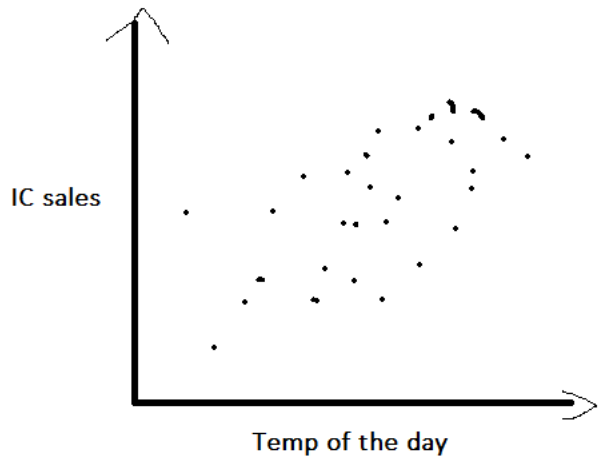
Box Plots and Multiple X Boxplots - https://www.youtube.com/watch?v=GKBBqAvH9p4&ab_channel=SigmaXLInc.



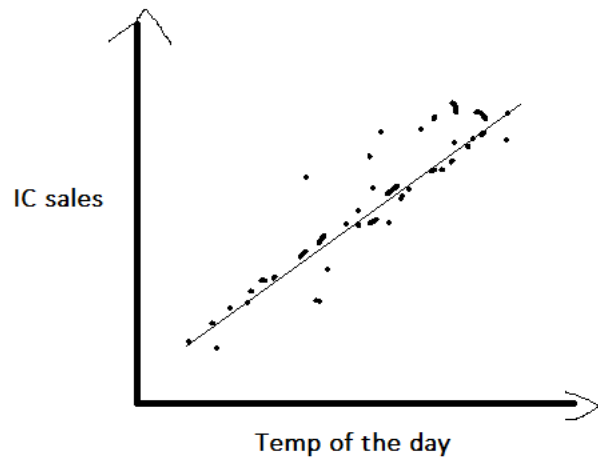
No correlation



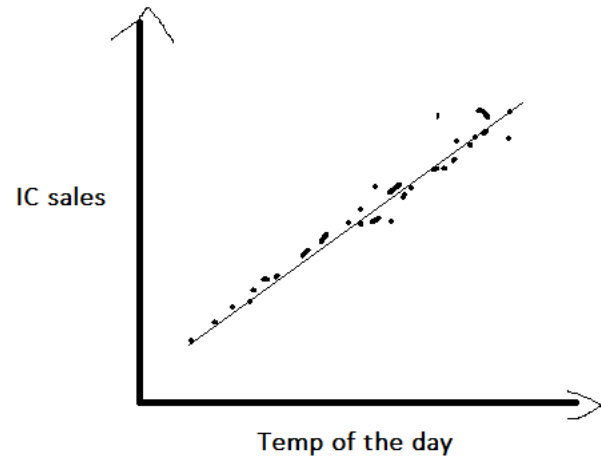
Weak



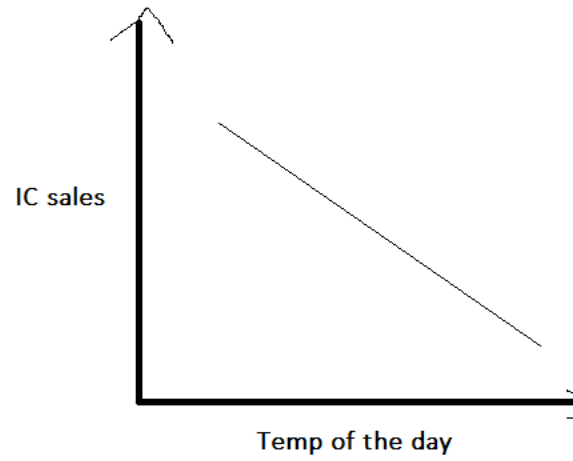
Moderate



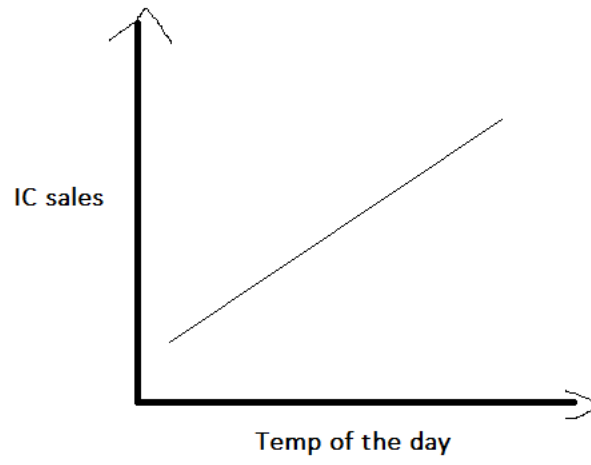
Strong



Perfect/ Strong correlation



Negative correlation



Positive correlation

Scatter Plot

r-value

Coefficient of correlation
ranges from -1 to +1

-1 = strong negative correlation

+1 = strong positive correlation

0 = No correlation

0.2 to 0.7 = Weak to moderate

0.8 and above - strong

Positive correlation

(+) (+) , (-) (-)

High temperature , More IC sales

Less defects, Less complaints

Low quality, Less Sales

More sales, More profit

More Replacement, More loss

More rework, More cost

Less waste , Less cost

Negative Correlation

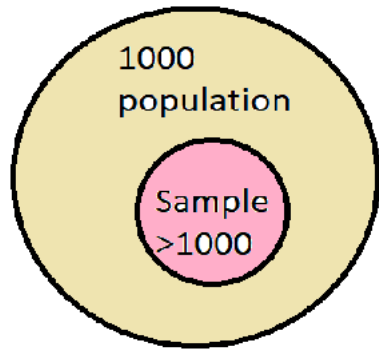
(inversely proportional) (+) (-) , (-) (+)

Low temp, high hot coffee sales

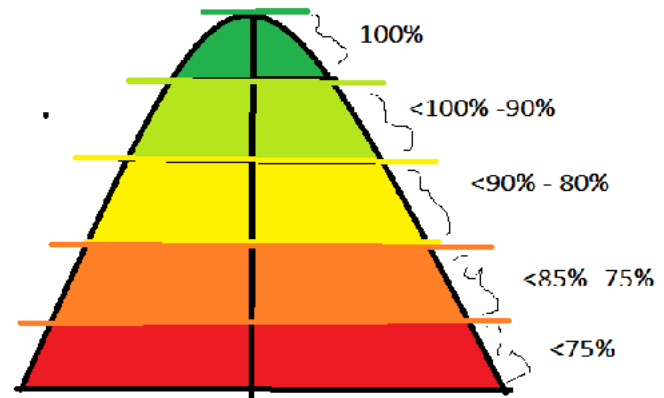
More sales, Less Over time

More production, Less waiting

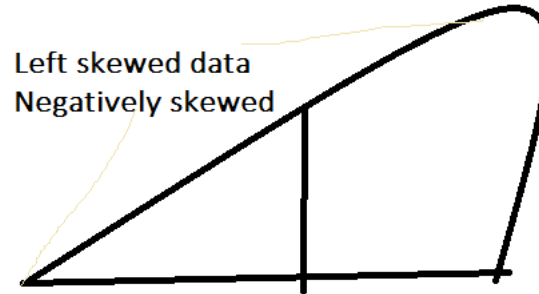
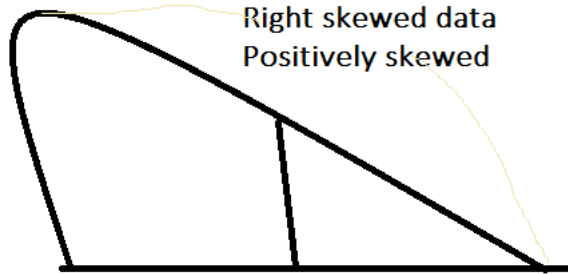
Low price, more sales

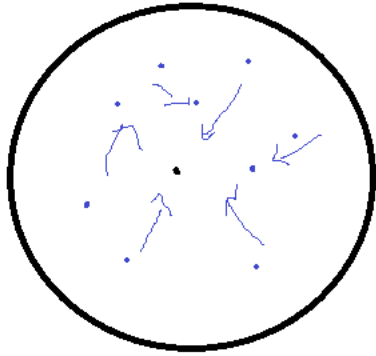


Normal Curve
Normal Distribution
Bell Curve

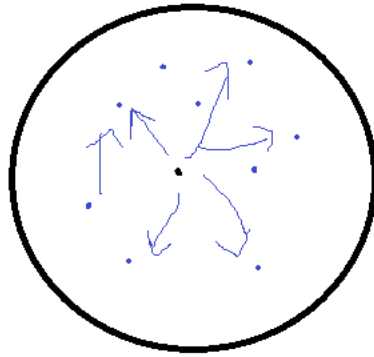


Non-normal curves





Measure of central tendency
Mean, Median, Mode



Measure of dispersion
Range, Std dev, Variance

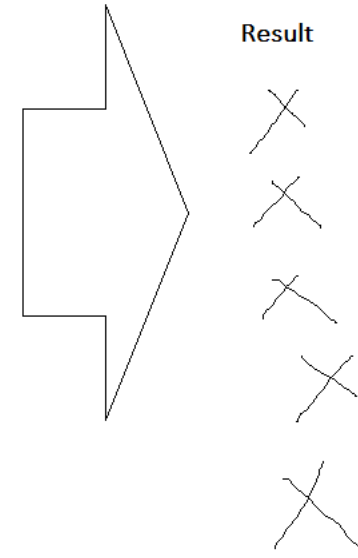
MSA

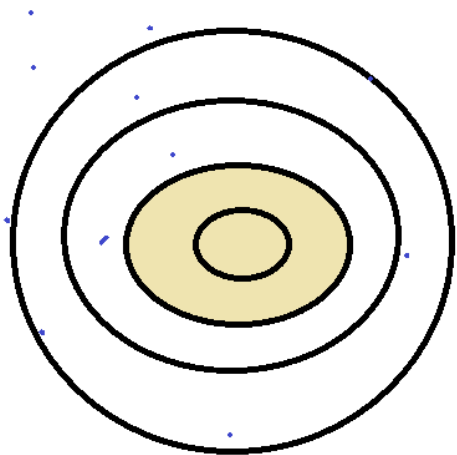
Measurement system Analysis

H -70
C-71
G- 71.5

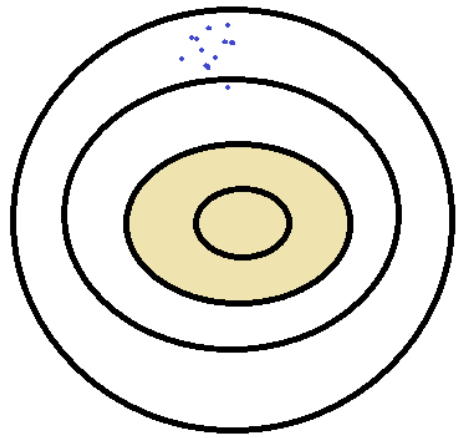
Gym-
1- 72.5
2-71
3-71.5

Measurement system					
	Nurse	Equipment	Settings	Training	Method
H -70	✓	✗			
C-71	✗	✓			
G- 71.5	✓	✓	✗		
Gym-1- 72.5	✓	✓	✓	✗	
2-71	✓	✓	✓	✓	✗
3-71.5	✓	✓	✓	✓	✗

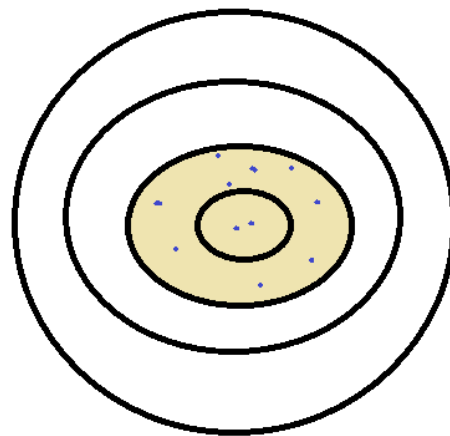




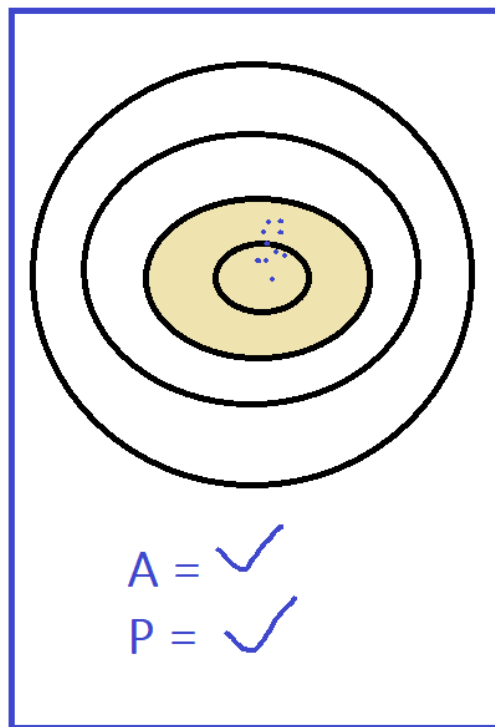
A = ✗
P = ✗



A = ✗
P = ✓

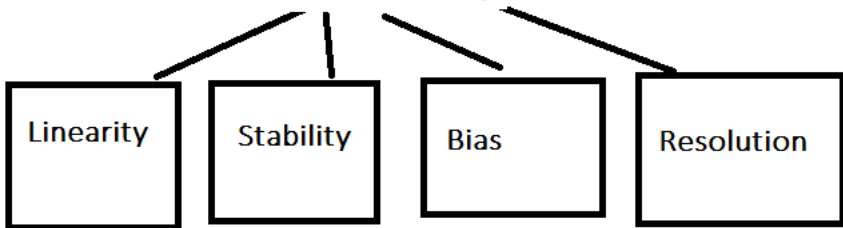


A = ✓
P = ✗



A = ✓
P = ✓

Accuracy



Precision

