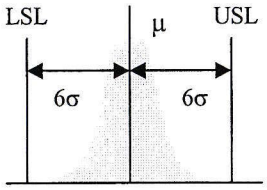

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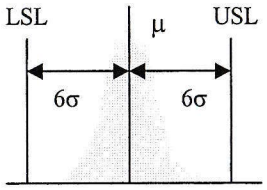
Basic Data Gathering Tools



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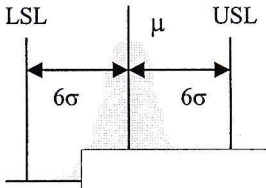
Learning Objectives

This module will teach the following basic tools:

- Check Sheet
- Pareto Diagram
- Cause-and-Effect Diagram
- Scatter Diagram
- Histogram
- Stratification
- Dot Diagram



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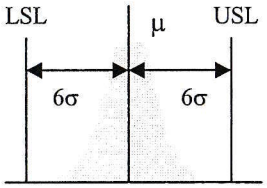
Check Sheet

- The Check Sheet is a simple & graphical method to collect defect data.
- Each mark or tally represents en event.
- Administrators can quickly tabulate defects.

Example:

Reasons for Attrition:

Defect	Count	Subtotal
Resign: Career Opportunity	X X X X X X X X X X X X X X X X	14
Resign: Dissatisfied w/ Position	X X	2
Terminated: Unethical Conduct	X	1
Terminated: Performance	X	1
Retirement	X X X X X X X X	8
Grand Total		26



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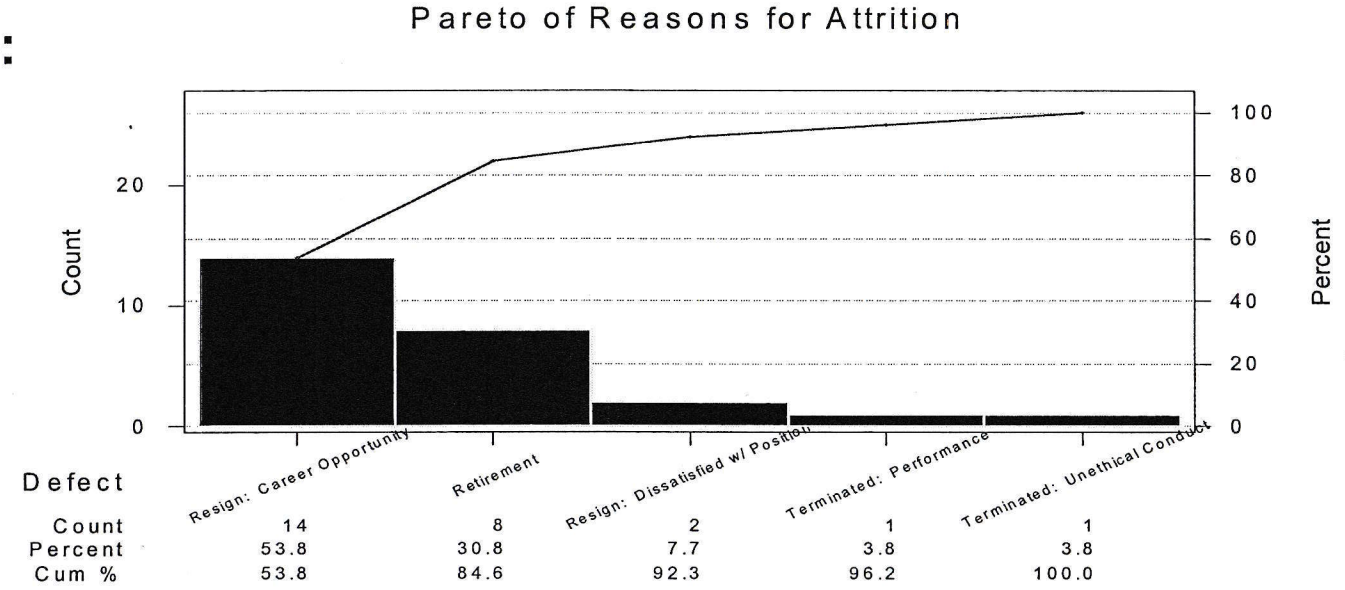
Pareto Diagram

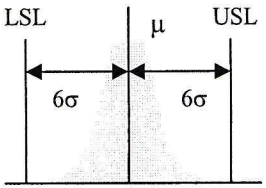
- A Pareto diagram is a bar graph with the problems or defects arranged from the largest to the smallest.

- The Pareto diagram helps the team focus on the "Vital Few" vs. the "Trivial Many" causes.

- A line is drawn showing the cumulative number of defects when moving from the largest to the smallest defect.

Example:





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Check Sheet and Pareto Exercise

Assignment:
In your teams create a Check Sheet and Pareto for the following data on causes for Customer Service Center Calls:

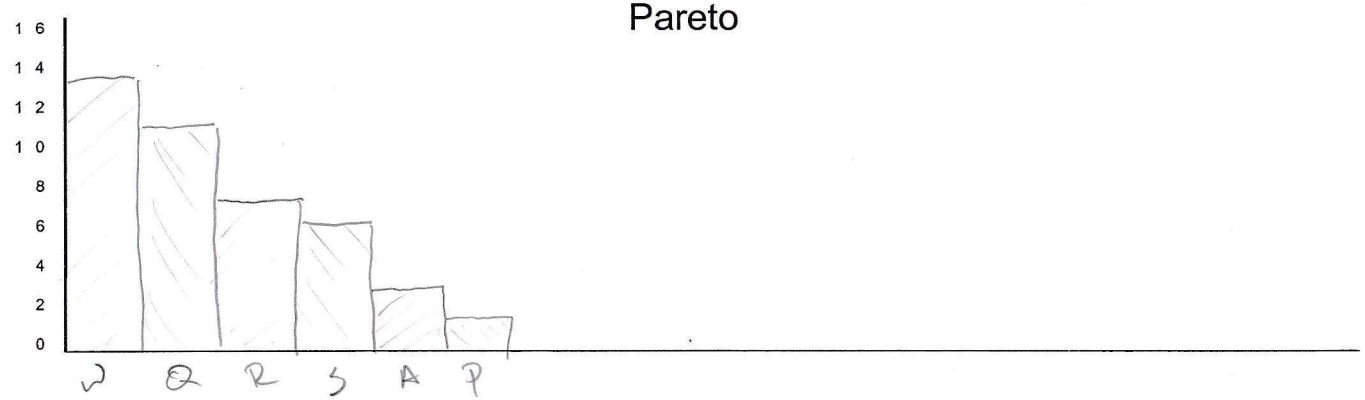
Call Categories
Warranty Issues - W
Pricing Issues - P
Quality Issues - Q
Service/Support - S
Request for Information - R

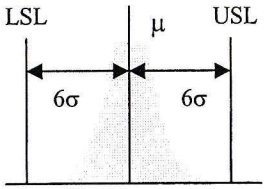
Check Sheet

Defect	Count	Subtotal
WARRANTY	XXXXXXXXXXXXXXXX	15
Pricing	X	1
Quality	XXXXXXXXXXX	11
Service	XXXXXXX	6
Requests	XXXXXXX	7
OTHER (A)	XXX	3
Grand Total		43

Data
W,S,P,W,Q,R,W,A,R,W,Q,R,R,W,Q,S,S,Q,W,W,Q,Q,A,W,W,Q,W,W,Q,
S,Q,R,R,A,R,W,Q,W,S,S,W,W,Q

Pareto





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Cause-and-Effect Diagram

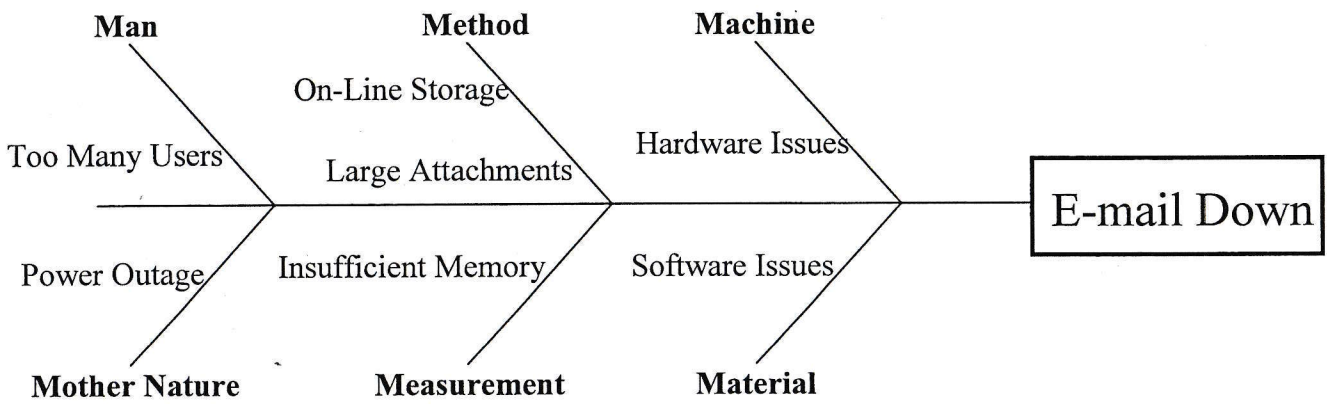
- The Cause-and-Effect Diagram or "Fishbone Chart" shows the relationship between a problem and its potential causes.

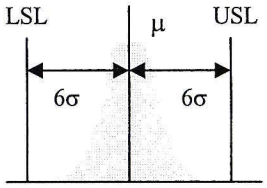
- The problem is shown on the right and the main causes of that problem are shown as branches.

- The 6M's (Man, Machine, Measurement, Material, Method & Mother Nature) are used as categories for the causes.

- The causes are broken down into subcauses and so on, down to as many levels as needed.

Cause-and-Effect Diagram





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Cause & Effect Diagram Exercise

Assignment:

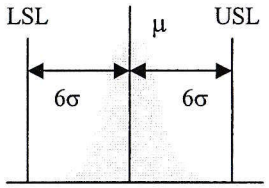
In your teams create a Cause & Effect Diagram for the problem statement provided:

Team 1 - Your spouse complains that the coffee you make is too strong.

Team 2 - Your family said they were not very hungry when you tried to feed them your special spaghetti dinner.

Team 3 – You are not getting the mileage you expect in your car..

Team 4 – Your last family BBQ was a disaster because the burgers were burned on the grill.



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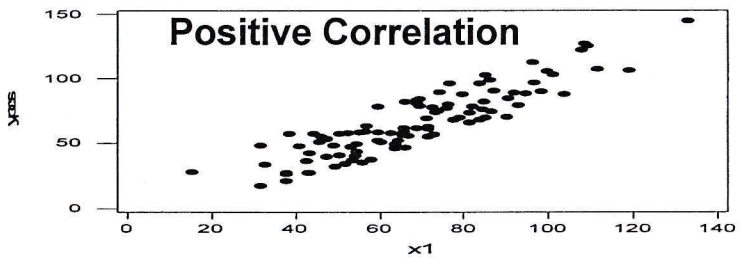
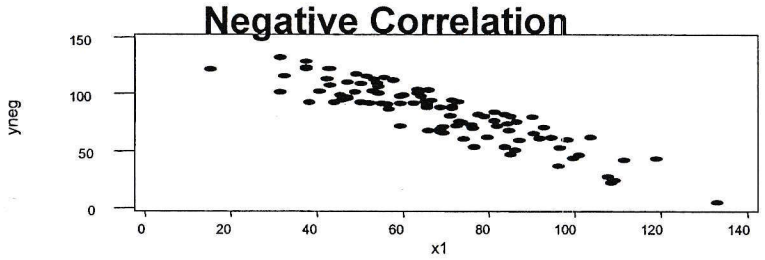
Scatter Diagram

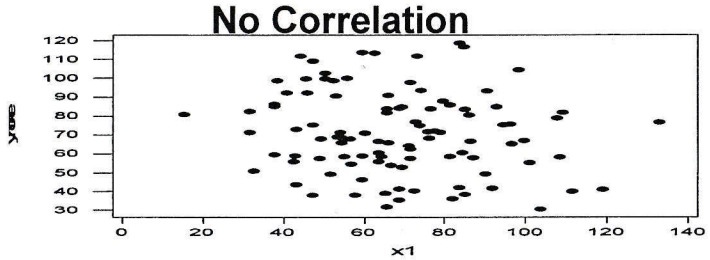
- The Scatter Diagram is used to show the relationship between Cause (x's) and Effect (y's).

- Points are plotted with the Effect or measure of quality (y) on the y-axis and the variable believed to influence quality (x) on the x-axis.

- Patterns in the Scatter Diagram indicate ***Correlation,*** meaning that there is a relationship between x and y.

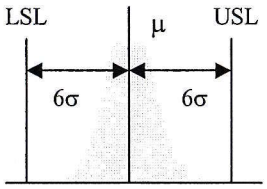






CORRELATION COEFFICIENT

- A VALUE CLOSE TO +/- 1 HAS A HIGH CORRELATION
- A VALUE CLOSE TO 0 HAS NO CORRELATION



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Scatter Diagram Exercise

It is believed that a persons height is strongly correlated to the distance between the ends of their left and right hand fingertips with hands outstretched.

1) Measure and record the fingertip to fingertip distance for each member in your team.

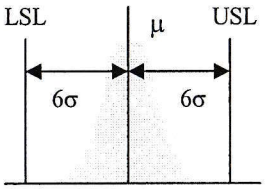
2) Measure and record the height of each person on your team.

3) Provide this data to the other teams and record their data.

4) Plot the fingertip to fingertip distance (x) vs. height (y) for all members of the Black Belt class.

5) Analyze the plot to determine if there is correlation.

(See next page for data collection sheet and plot.)



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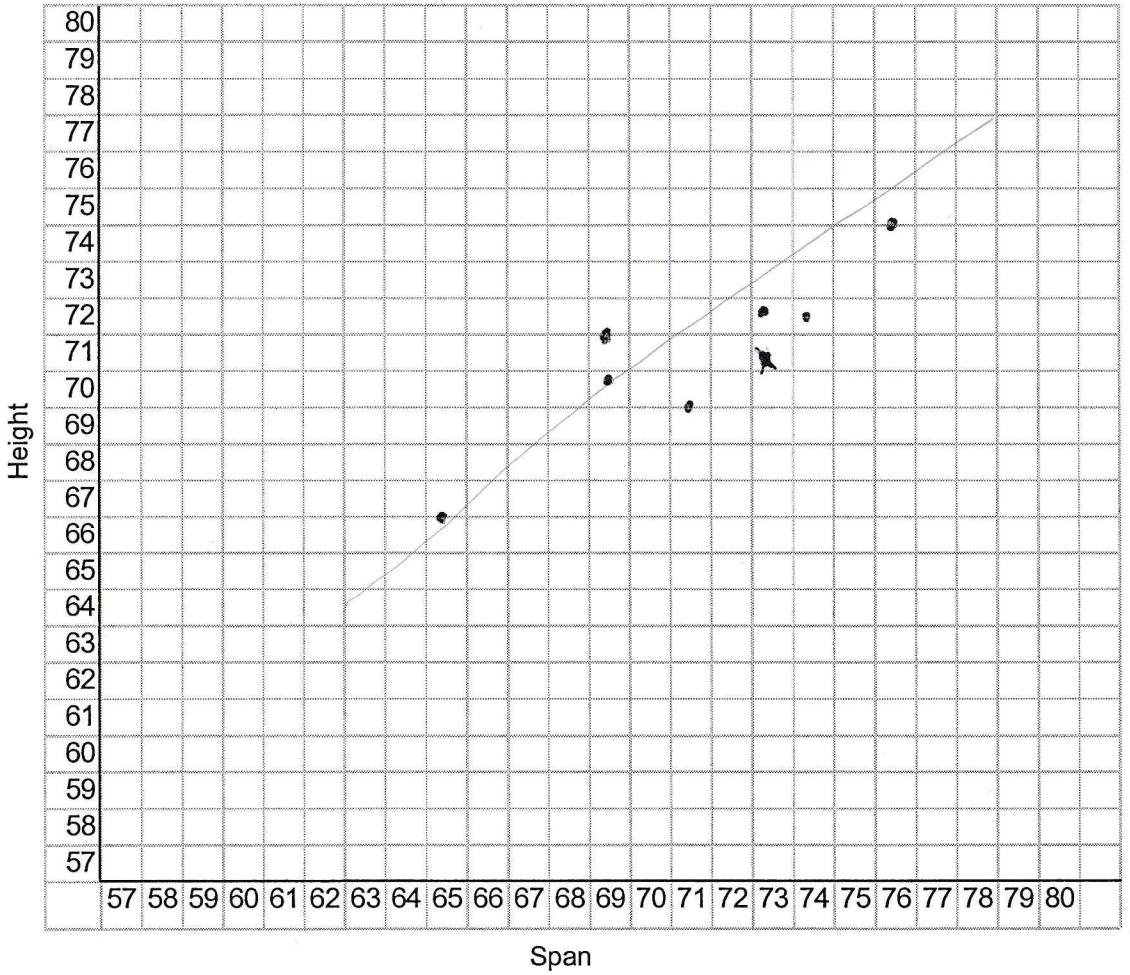
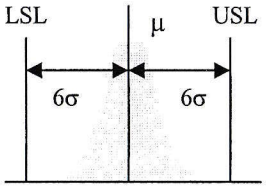
Scatter Diagram Exercise

		Span	Height
Team 1	1	64.50	66.00
	2	73.25	71.50
	3	72.25	71.75
	4	70.50	69.00
	5	68.50	69.75
	6	75.50	74.00
		72.50	71.50
Team 2	1	68.50	71.00
	2		
	3		
	4		
	5		
	6		

		Span	Height
Team 3	1		
	2		
	3		
	4		
	5		
	6		
Team 4	1		
	2		
	3		
	4		
	5		
	6		





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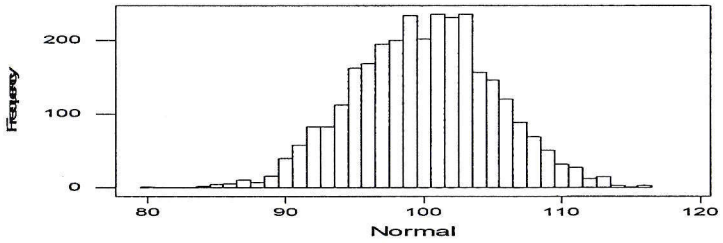
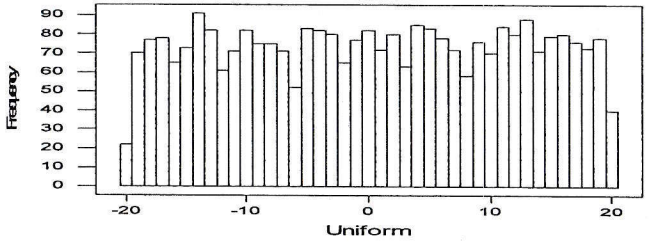
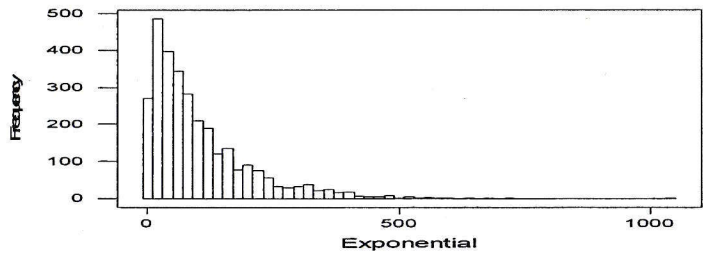
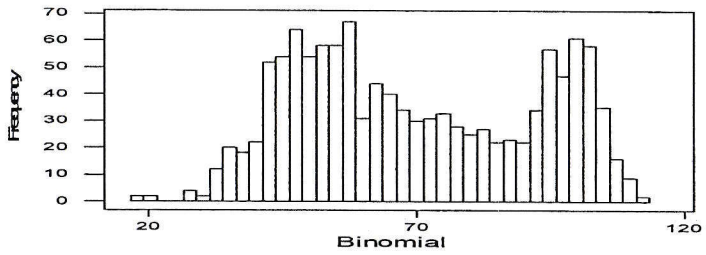
Histogram

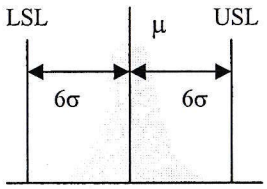
- A Histogram is a graph that shows dispersion (variation) and centering of a data set.
- Each column represents the frequency of data over equal intervals of some measure of quality.
- The Histogram is useful in understanding the shape or distribution of a data set (normal, uniform, etc.)











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Histogram Exercise

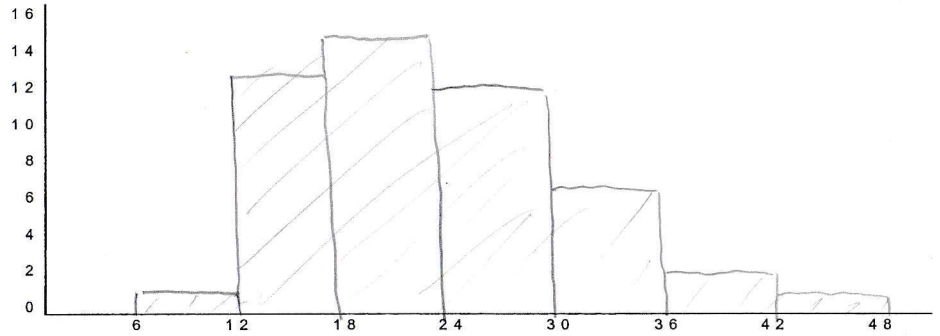
Shown below are 50 data points that represent the Quantity of Health Care Reimbursement Transactions per Day for the last 50 days.

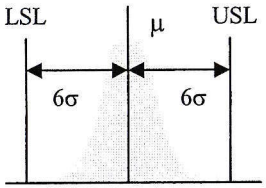
17	18	28	26	34	8	19	11	25	24
41	33	26	21	15	17	17	13	21	45
21	17	14	12	14	28	27	33	17	21
29	24	38	22	19	30	16	23	25	22
16	26	27	19	20	18	32	31	21	23

To create the Histogram, summarize the data into equally spaced classes below.

Class	Values															
6 to <12							I		I							1
12 to <18	II	II	I	I		II	I	II	I	I						13
18 to<24	I			III		II	I	II	I	II	III					15
24 to <30	I	II	III	I			I			II	I					11
30 to<36		I				I	I	I	II							6
36 to <42	I		I													2
42 to<48											I					1

Now use the data of Table 2 to create a bar graph (Histogram).





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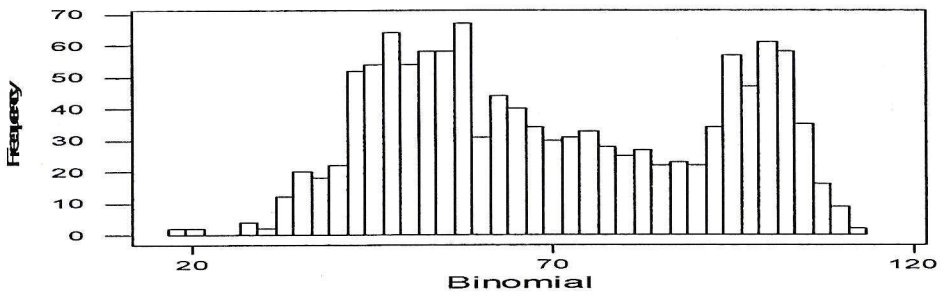
Stratification

- Stratification is used to help identify the specific causes of problems.

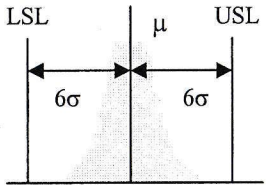
- Stratification is segregating or separating the data to help understand if there are differences in variables such as machines, shifts, operators, plants, etc.

Example:

A Black Belt is interested in understanding the causes of variation in salaries for technical specialists in their organization



The Black Belt notices an unusual pattern in the data with peaks at $50K/year and $100K/year. What might cause this? How else can the Black Belt analyze the data?



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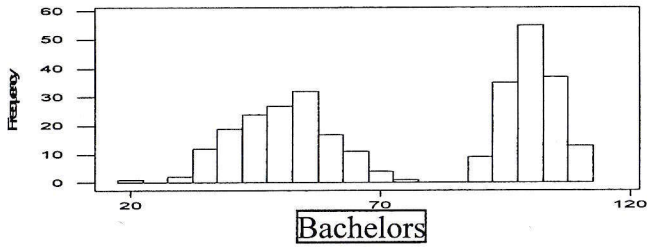
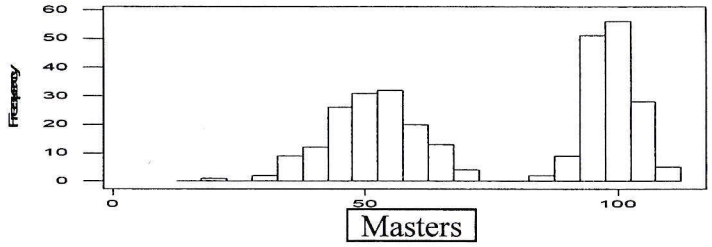
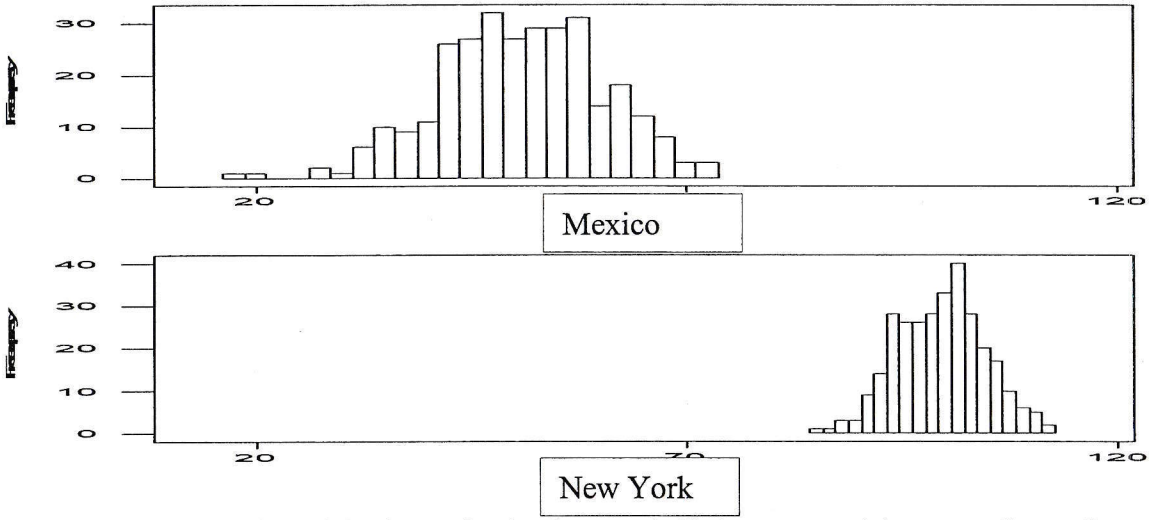
Stratification Example

The Black Belt decides to try stratifying the data by type of degree *(Bachelors vs. Masters)*.

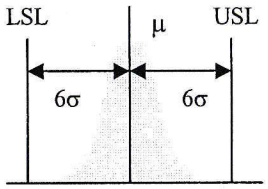




The Black Belt observes that peaks are still occurring at 50K and 100K for both types of degrees. He believes there may be another factor strongly influencing the salary. He decides to study differences by Site.



Stratifying by site shows that New York technical specialists are paid more than those in Mexico. The Black Belt can now further investigate the differences between sites.



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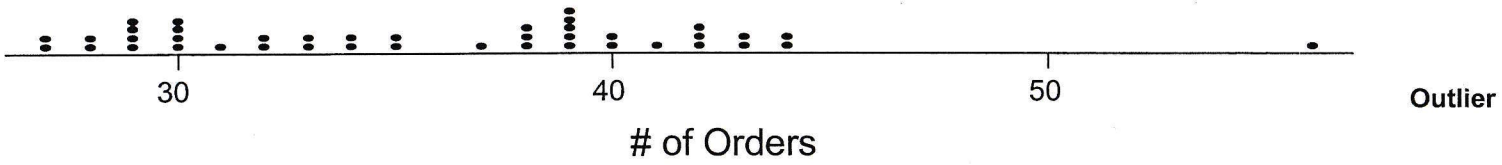
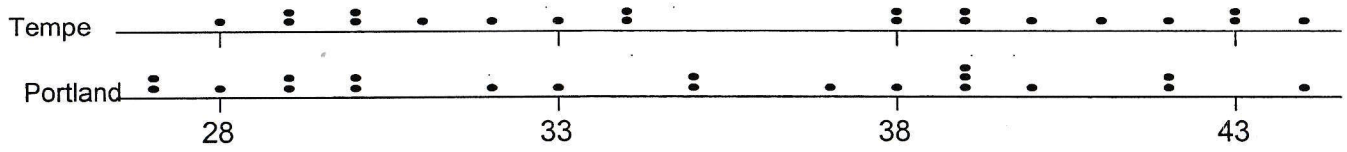
Dot Diagram

- A Dot Diagram is another tool to show the dispersion and centering of a data set.
- Each point is plotted as a single dot along a horizontal axis.
- The Dot Diagram is also an easy way to identify data points that are much different than the rest of the data. These points are called **outlier** and often occur due to special causes.

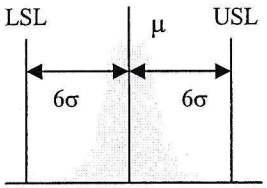


# of Orders

- Dot Diagrams are also useful for stratifying data, especially when there are not enough points to construct a histogram.



# of Orders



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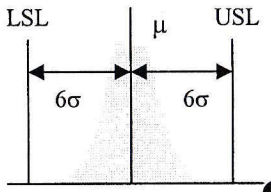
Stratification & Dot Diagram Exercise

The data shown below represent the number of orders placed for 40 products. For forecasting purposes, the team would like to determine if the number of orders placed is related to the location where the product is manufactured, the season, or the raw material supplier.

Location	Season	Supplier	# of Orders
Tempe	Summer	A	43
Tempe	Winter	A	32
Tempe	Winter	A	34
Tempe	Winter	B	31
Tempe	Summer	B	42
Portland	Winter	B	27
Tempe	Summer	A	44
Portland	Summer	A	39
Portland	Winter	A	29
Tempe	Summer	B	43
Tempe	Winter	B	33
Portland	Winter	B	30
Portland	Summer	A	44
Tempe	Summer	B	38
Portland	Summer	B	35
Portland	Winter	B	33
Portland	Winter	B	28
Tempe	Winter	B	29
Portland	Summer	B	39
Tempe	Summer	A	38

Location	Season	Supplier	# of Orders
Tempe	Winter	B	29
Portland	Winter	A	30
Tempe	Summer	A	40
Portland	Summer	A	38
Tempe	Winter	A	30
Tempe	Winter	A	34
Portland	Winter	A	32
Tempe	Winter	A	28
Portland	Summer	A	37
Portland	Winter	A	29
Portland	Summer	A	39
Portland	Summer	B	40
Portland	Winter	A	35
Tempe	Summer	A	39
Tempe	Winter	A	30
Portland	Summer	A	42
Tempe	Summer	A	41
Portland	Winter	A	27
Portland	Summer	B	42
Tempe	Summer	B	39



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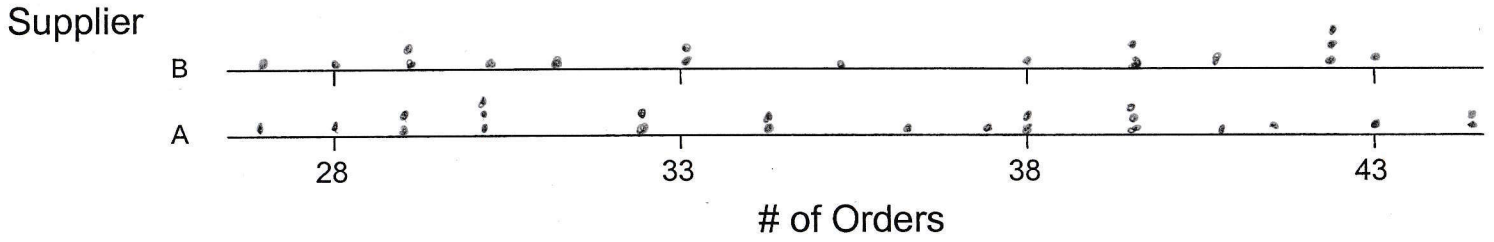
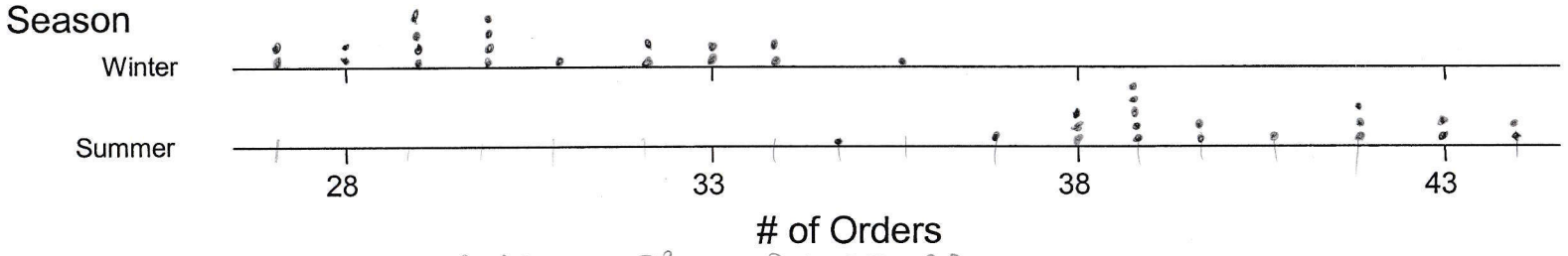
Stratification & Dot Diagram Exercise

Exercise:

Use Dot Diagrams to stratify the data and determine if season or raw material supplier effects shrinkage. (The Dot Diagram for Plant is shown on the page15)

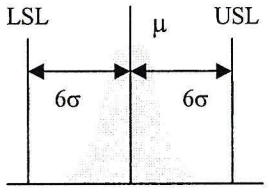
DOESN'T MATTER WHICH VENDOR





WINTER ORDERS ~ 29 R = 27-33

SUMMER ORDERS ~ 31 R = 37-42



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Summary

- You now have the ability to use the following tools
  - Check Sheet
  - Pareto Diagram
  - Cause-and-Effect Diagram
  - Scatter Diagram
  - Histogram
  - Stratification
  - Dot Diagram
- While these tools are simple they are quite powerful
- These tools allow you to answer basic questions early on
- These tools are graphical and qualitative allowing you to see an overview of your problem
- We will build on these tools and data