Level 5 – Continuous Improvement with Industry 4.0

Measure 2 – Displaying Data

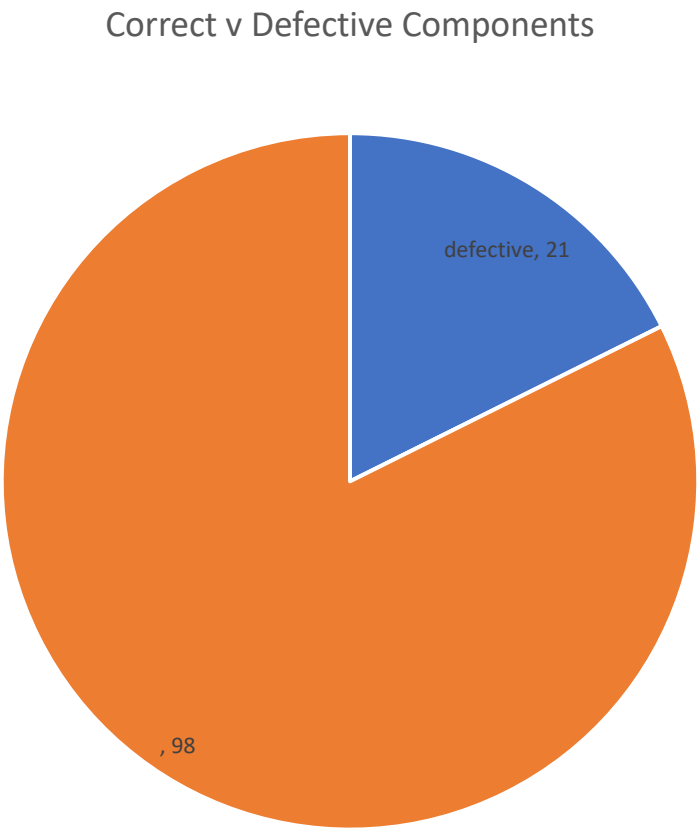
Where do we think we are?

- No data or experience – all we can offer is an opinion
- No data – we use our experience to get through
- Some data - data collected we just look at the numbers
- Grouped data - basic charts and diagrams
- Descriptive statistics - mean, median, mode, Std Dev etc
- Characterising statistics - Cp, Cpk,
- Control statistics - SPC charts
- Inferential statistics - normality, regression, DOE etc

Chart

Data that's arranged in one column or row on a worksheet can be plotted in a pie chart. Pie charts show the size of items in one data series, proportional to the sum of the items. The data points in a pie chart can also be shown as a percentage of the whole pie.

e Charts



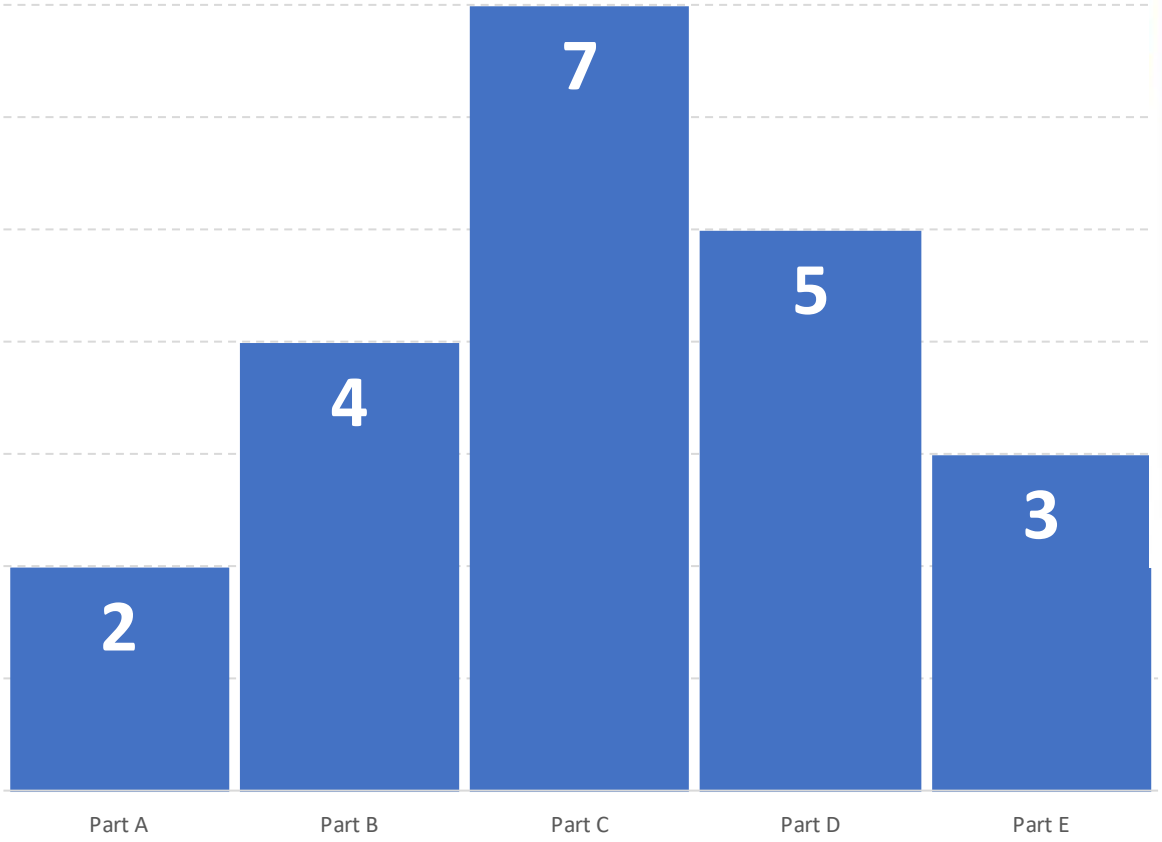
tograms

- Histograms are visual tools to examine distributions. A histogram is a bar graph that shows how frequently data fall within specific cells, that is, ranges of values.

- Histograms make it relatively simple to estimate where the process is centered and how much fluctuation there is about the center.

- We must have data to know how a process is performing. However, it is difficult to derive much information from data as presented in Table 1. The data would provide more information if they were grouped, organized, and displayed graphically. A histogram does just that.

Histograms

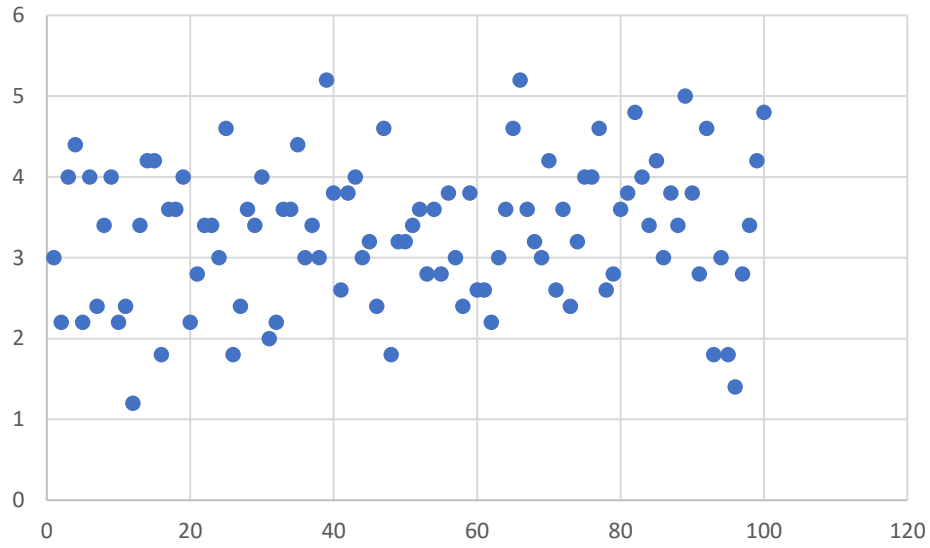


Tally Chart
Part A: 11
Part B: 1111
Part C: ~~1111~~ 11
etc,.

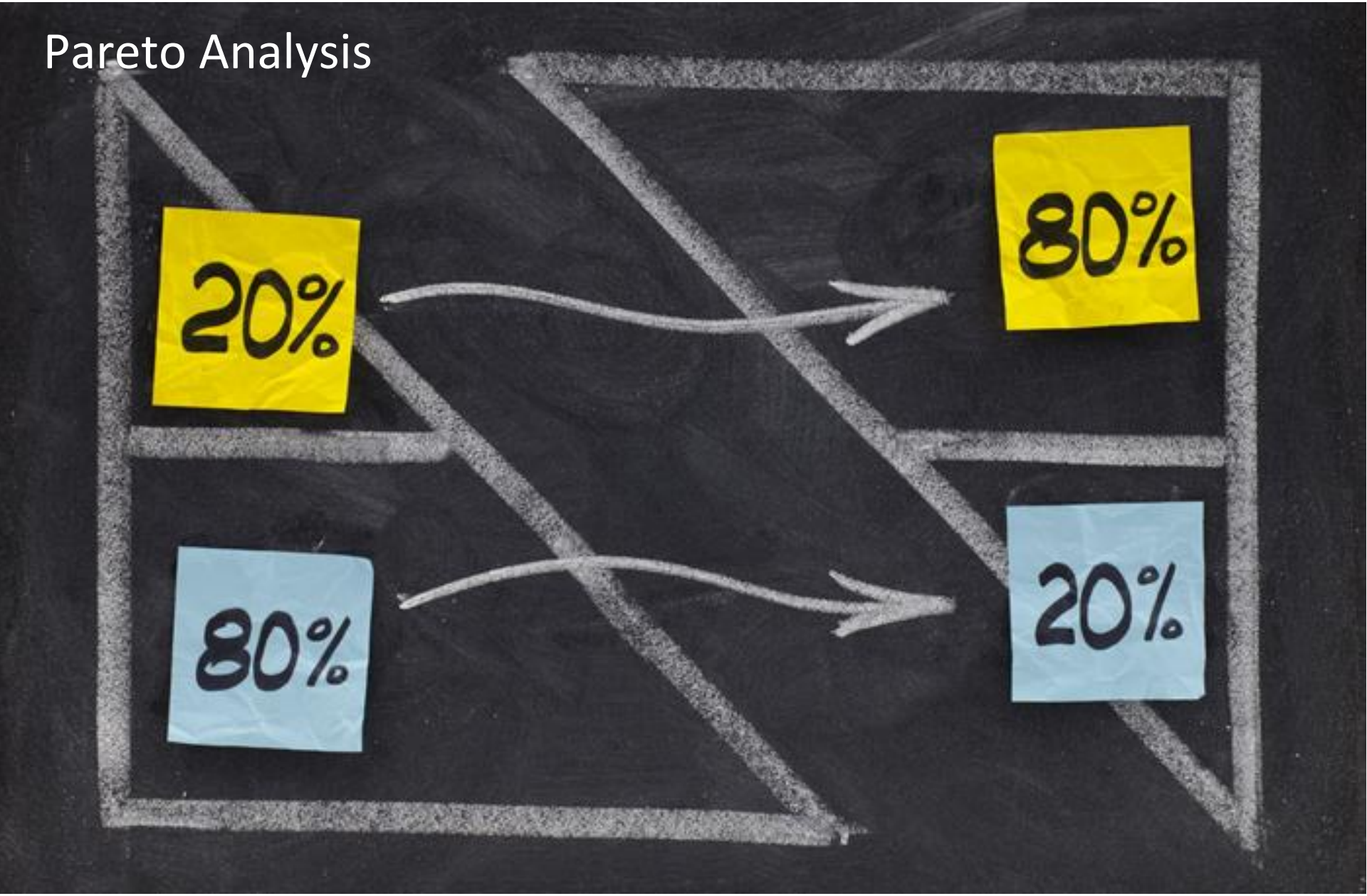
atter Plots

- Scatter plots are a pictorial way of showing distributions of two variables for a sample of data.
- The more concentrated the data along a line, the stronger the relationship – we will investigate this further within the Analyse phase.

Scatter plots



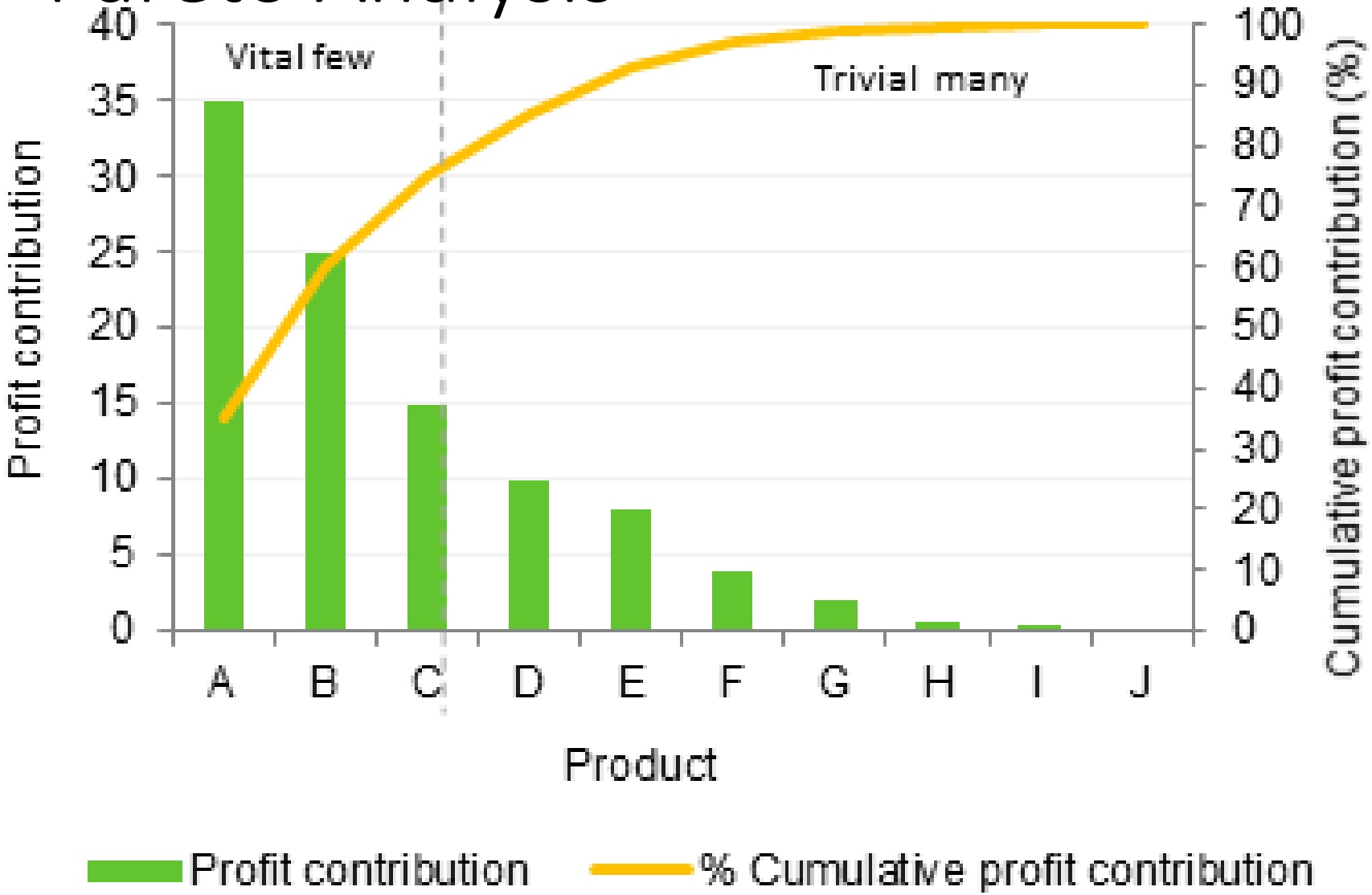
Pareto Analysis



Pareto Analysis

Vilfredo Pareto
Italian Engineer and Economist
b. 15th July 1843 d. 19th August 1923

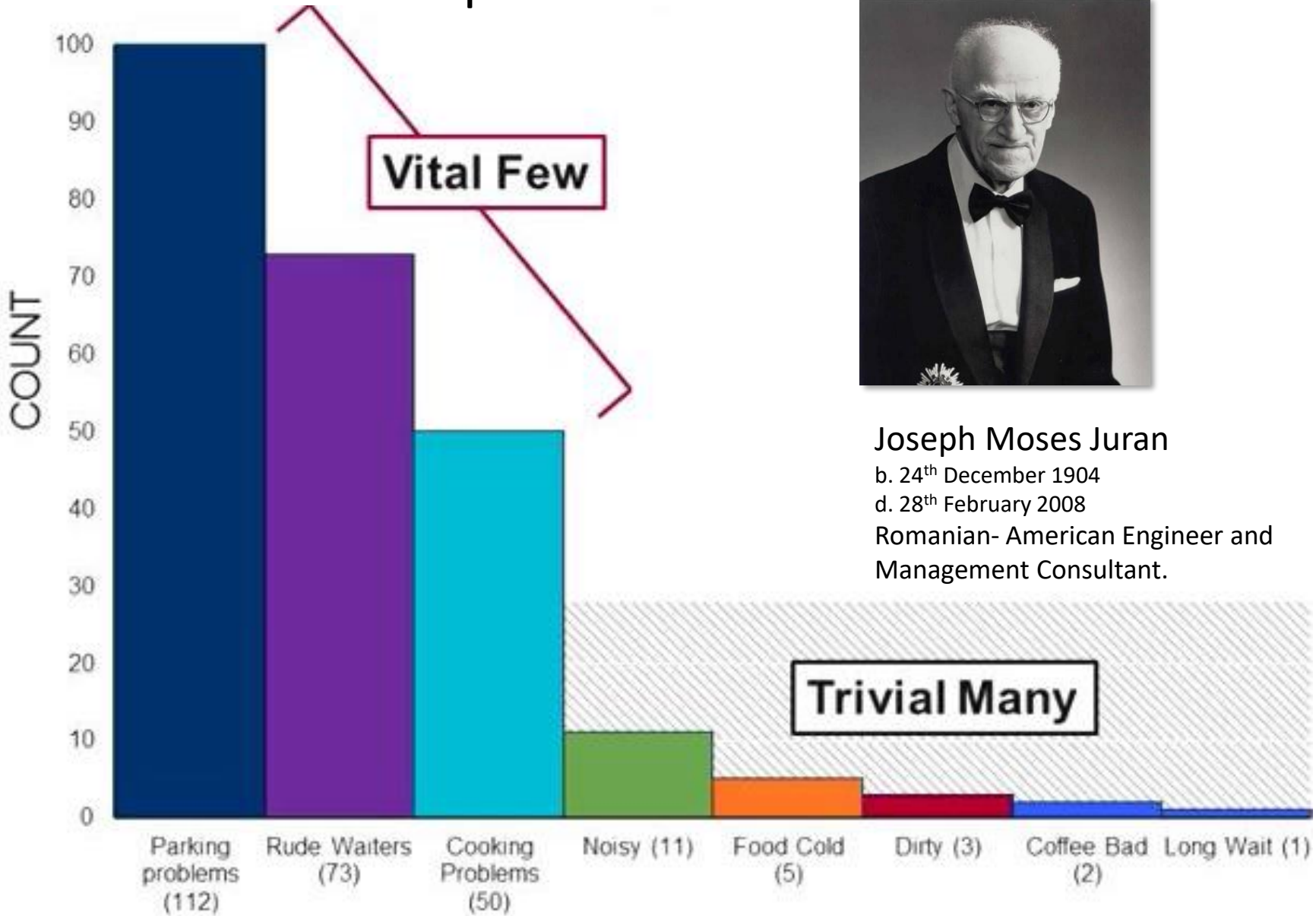
Pareto Analysis



Pareto Analysis

- 80% of the World's GDP is controlled by 20% of the population.
- 80% of your revenue comes from 20% of your products.
- 80% of your complaints are made by 20% of your customers.
- 80% of innovation comes from 20% of your team.
- 80% of your staff problems are created by 20% of your staff.

Vital few and Trivial Many – Restaurant Complaints



Joseph Moses Juran

b. 24th December 1904

d. 28th February 2008

Romanian- American Engineer and Management Consultant.

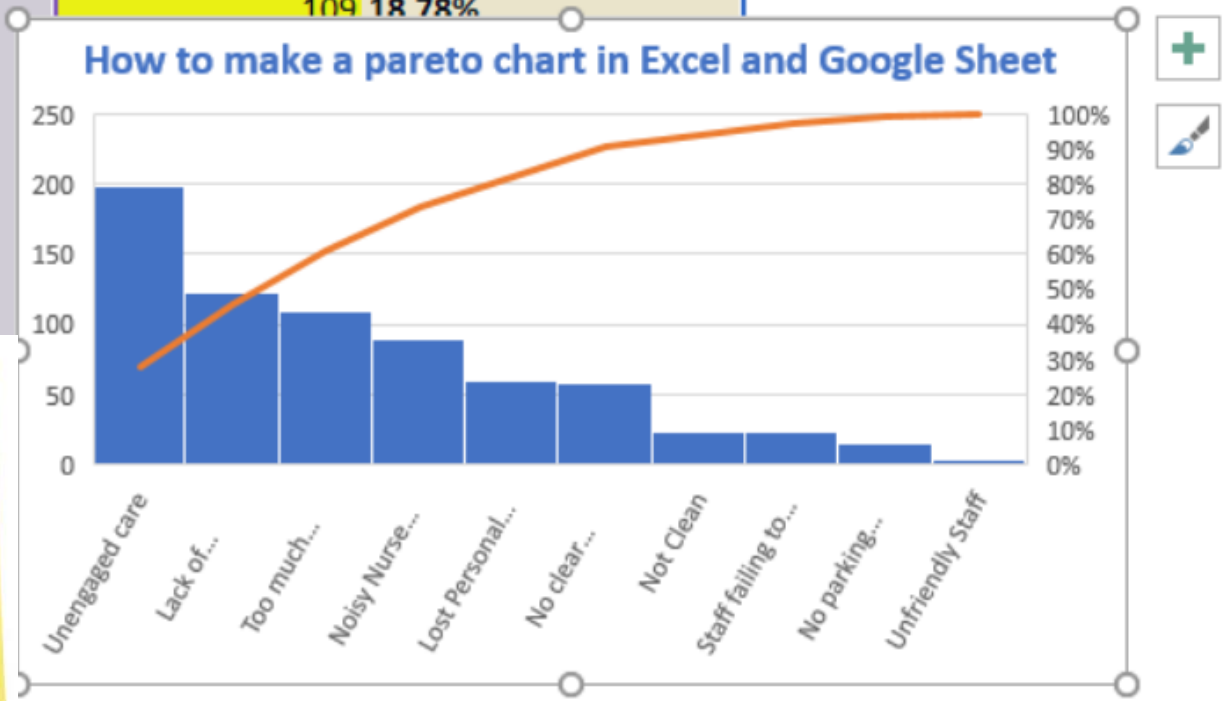
Pareto Analysis – When is it used?

- When we need to focus on the 20% that matters.
- What about the trivial many or other 80%?
- When we want to understand the potential causes to a problem their relation to the effects.
- Identify potential improvement opportunities.
- Helps groups or companies reach consensus on what should be addressed first.
- An effective tool for measuring the success of any corrective action.

Pareto Analysis – How to carry it out?

How to make a pareto chart in Excel and Google Sheet

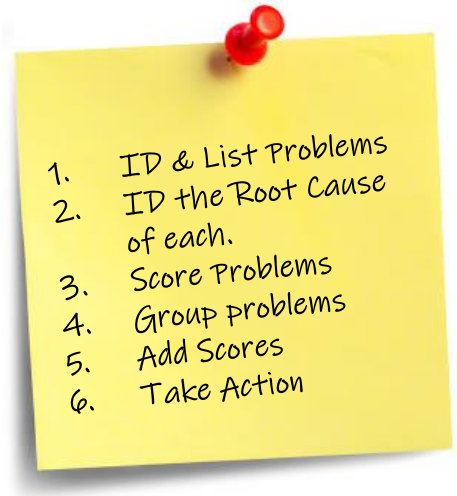
Type of Complaints	Count (frequency)	Cumulative Percentage
Not Clean	23	3.27%
Too much waiting time	109	18.78%
Unfriendly Staff		
No parking space		
Noisy Nurse Station		
Lost Personal belongings		
No clear communication		
Unengaged care		



1. Rank the data
2. Bar chart
3. Line chart cumulative %
4. ID faults to the left of 80%

Pareto Analysis – How will you collect the data?

- Incident reports.
- Interviews
- Questionnaires
- Compliant Records
- Observations – Eyewitness



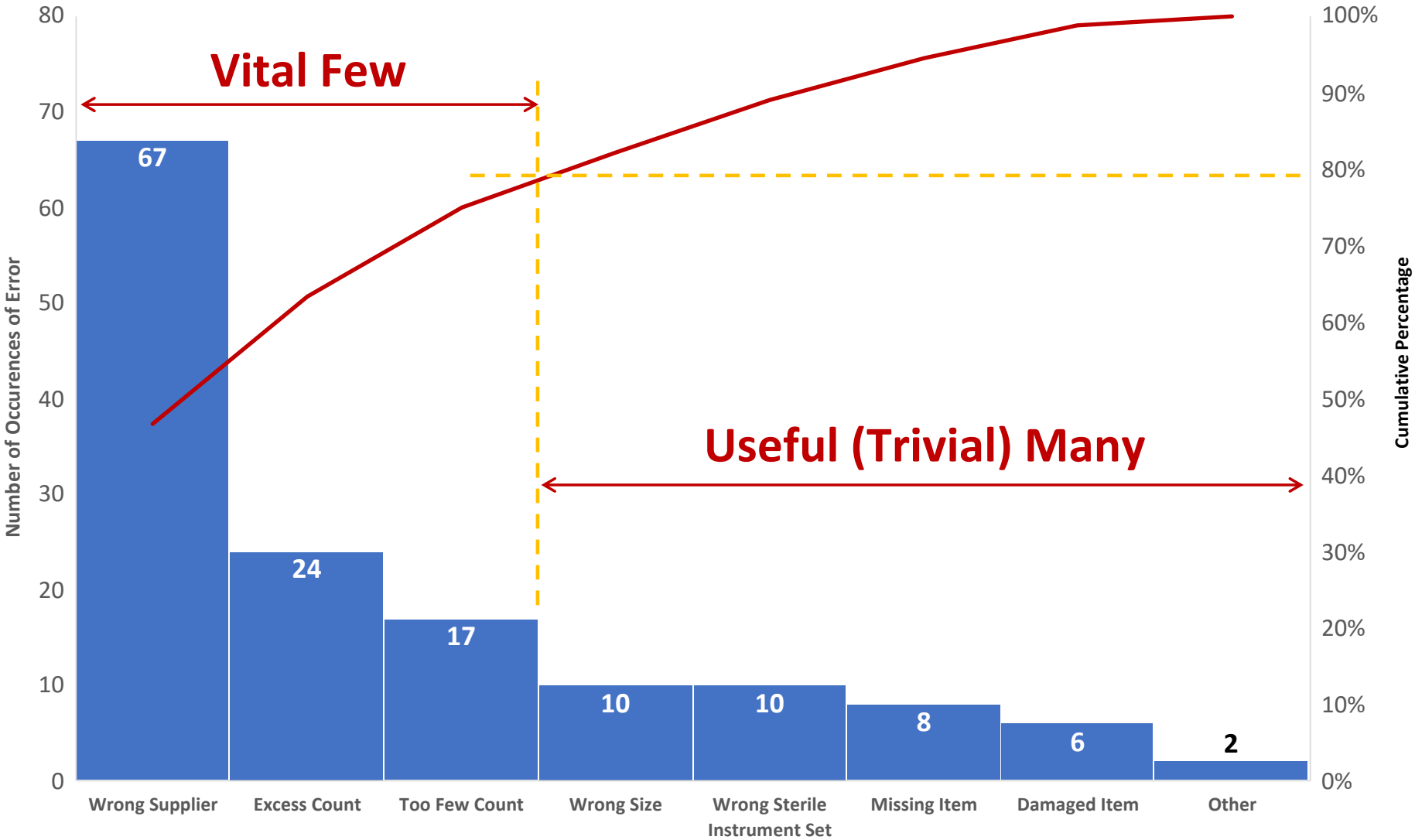
- How will you group or classify and group the data?
- Type, Size, Location and Cost?

Pareto Analysis – Surgical Set-up Example

The team identified **eight types of surgical setup errors** and collected data on the frequency of each type. When the team displayed this data in a Pareto diagram, they discovered **three types of errors accounted for 80%** of all errors.

Error Type	Freq	%	Cum %
Wrong Supplier	67	46.5	46.5
Excess Count	24	16.7	63.2
Too Few Count	17	11.8	75
Wrong Size	10	6.9	81.9
Wrong Sterile Instrument Set	10	6.9	88.8
Missing Item	8	5.6	94.4
Damaged Item	6	4.2	98.6
Other	2	1.4	100
Total	**144**	**100**	

Pareto Analysis – Surgical Set-up Example



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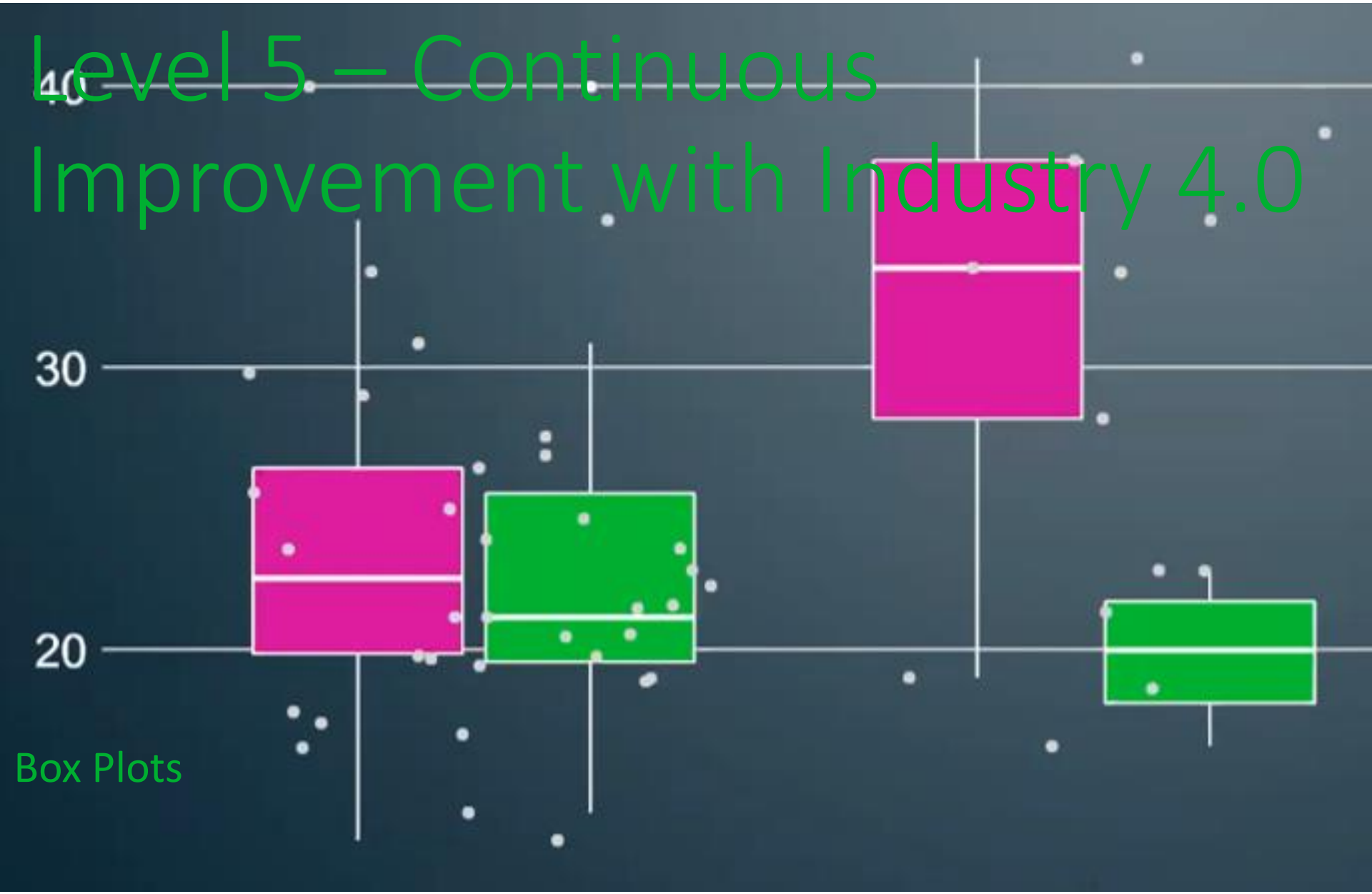
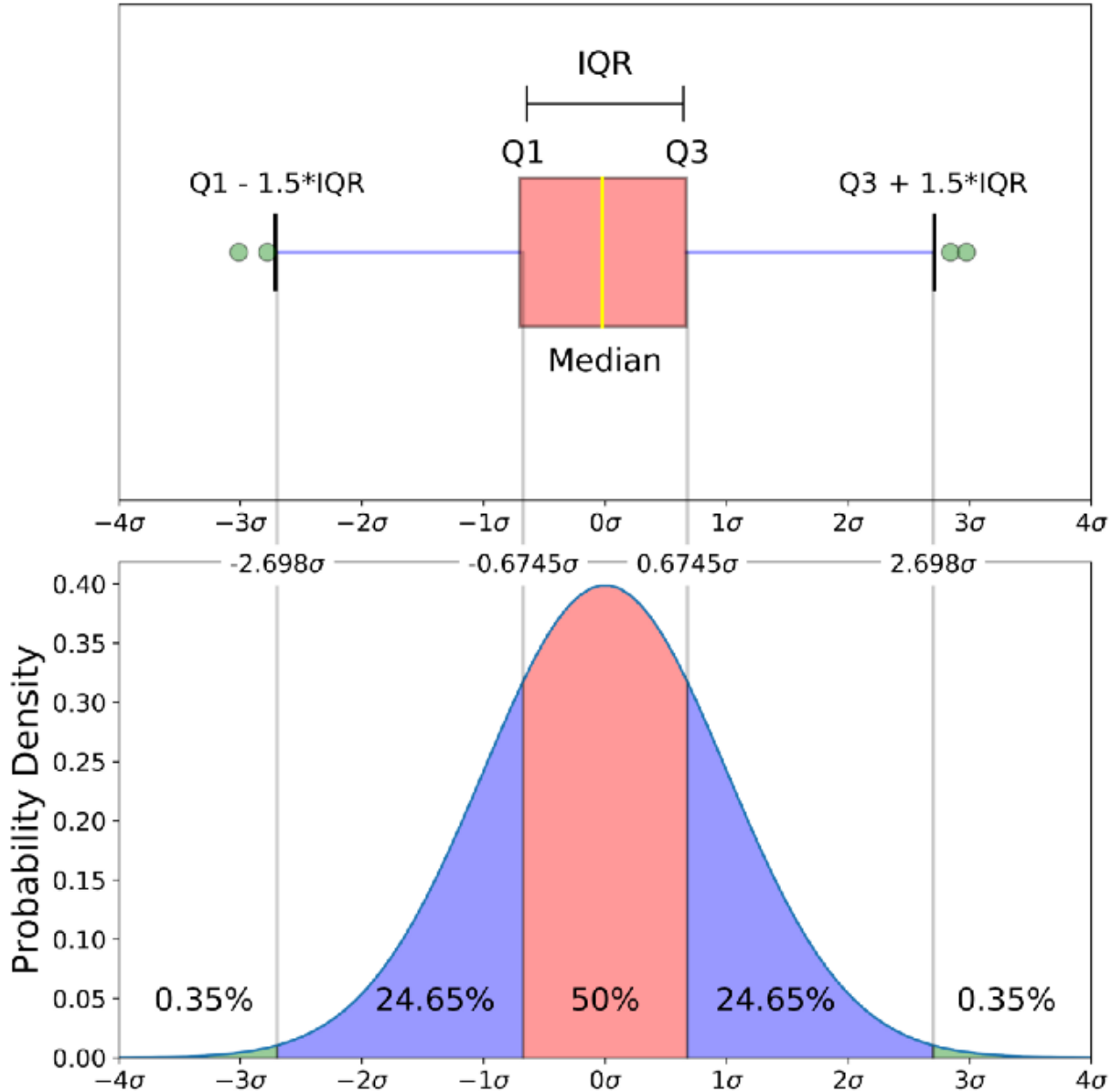


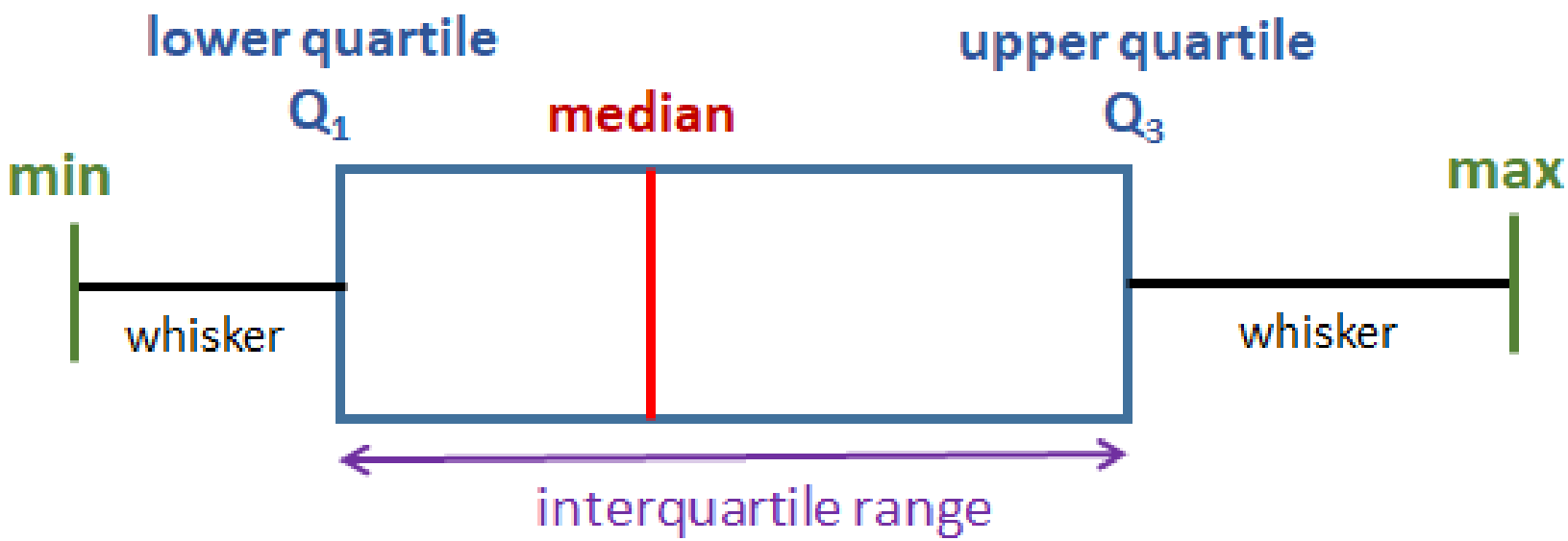
Box Plots

& Whisker Plots (aka Box Plots)

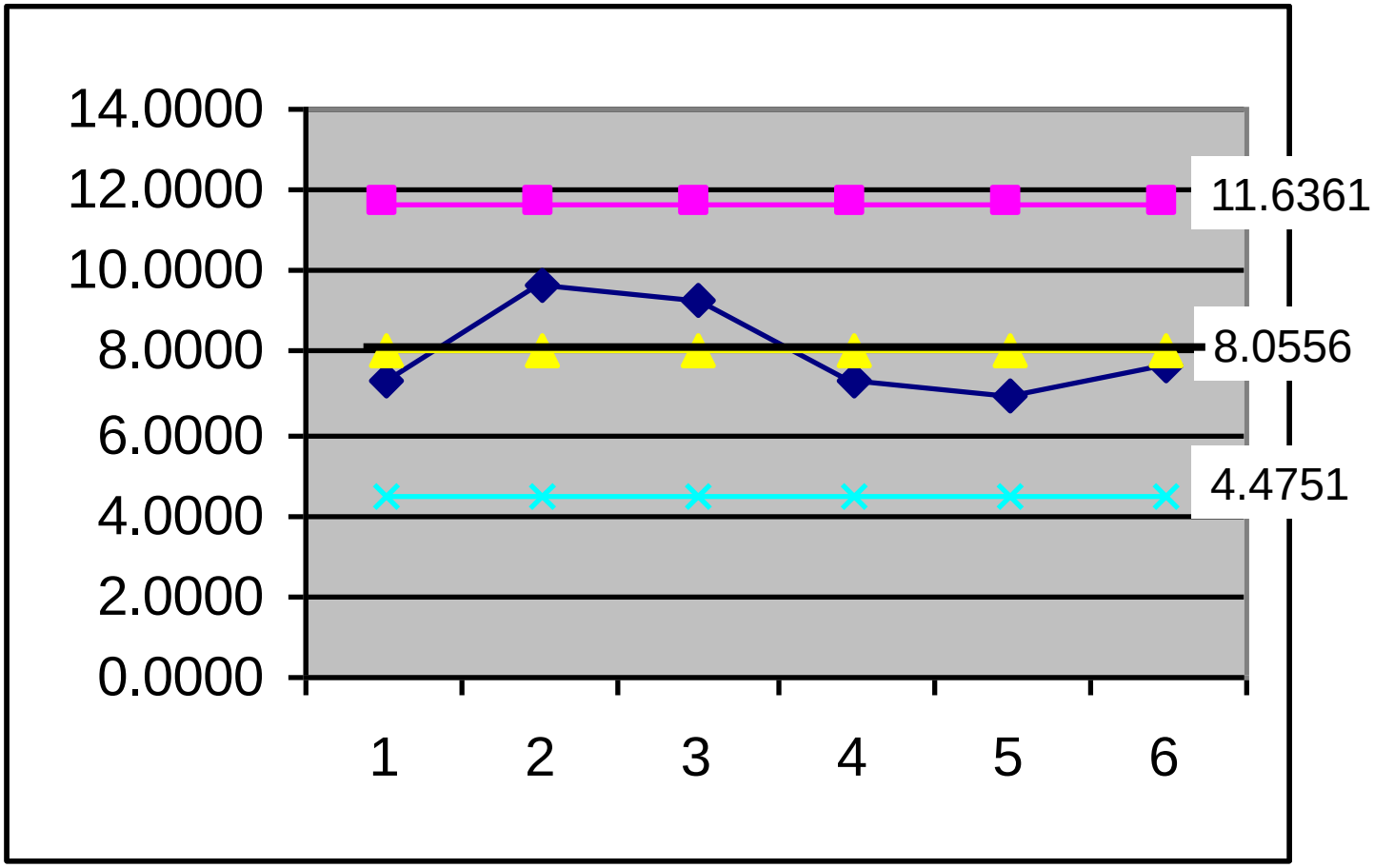


Box & Whisker Plots (aka Box Plots)

A box and whisker plot (also called a box plot) shows the five-number summary of a set of data: **minimum**, **lower quartile**, **median**, **upper quartile**, and **maximum**.



X-bar chart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1
2
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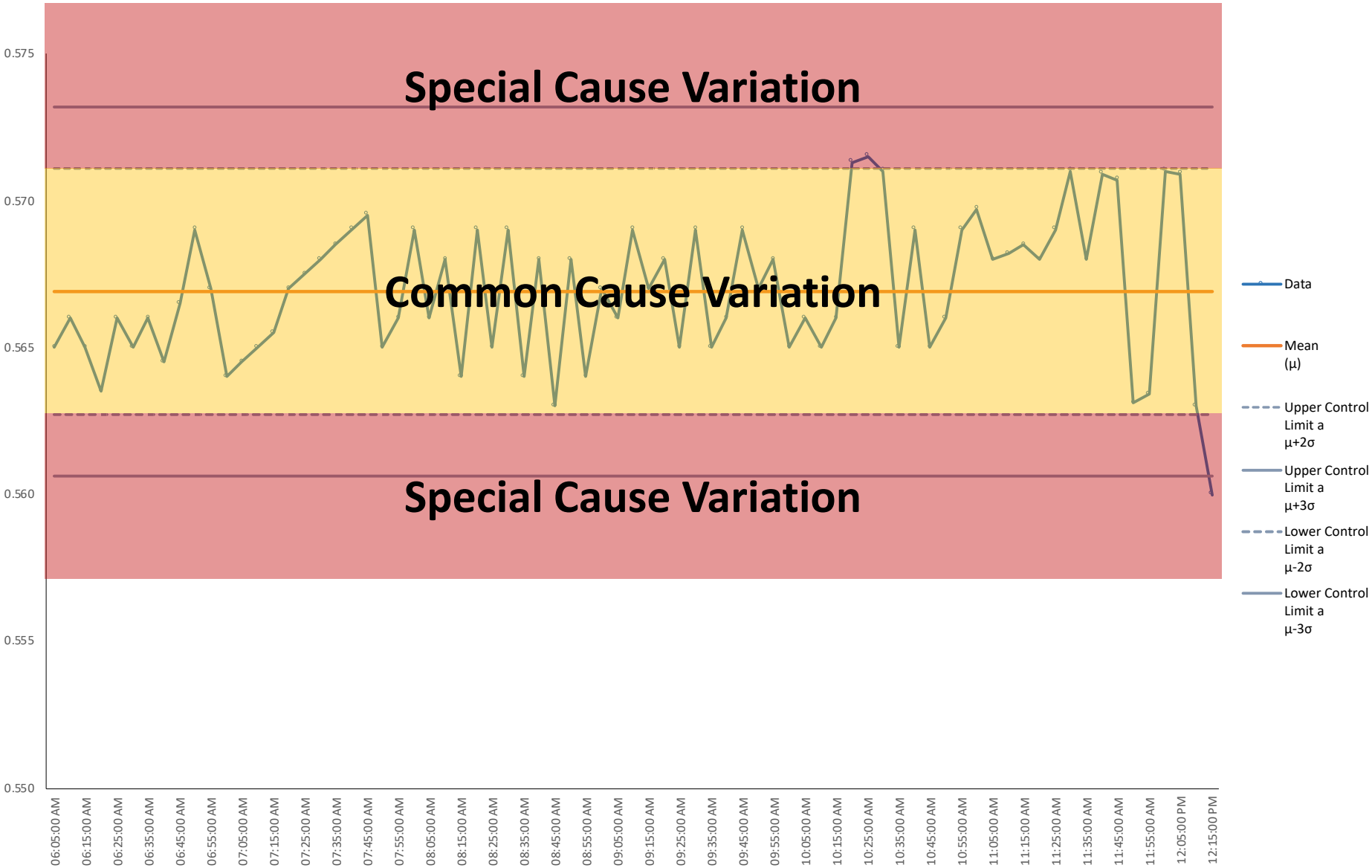
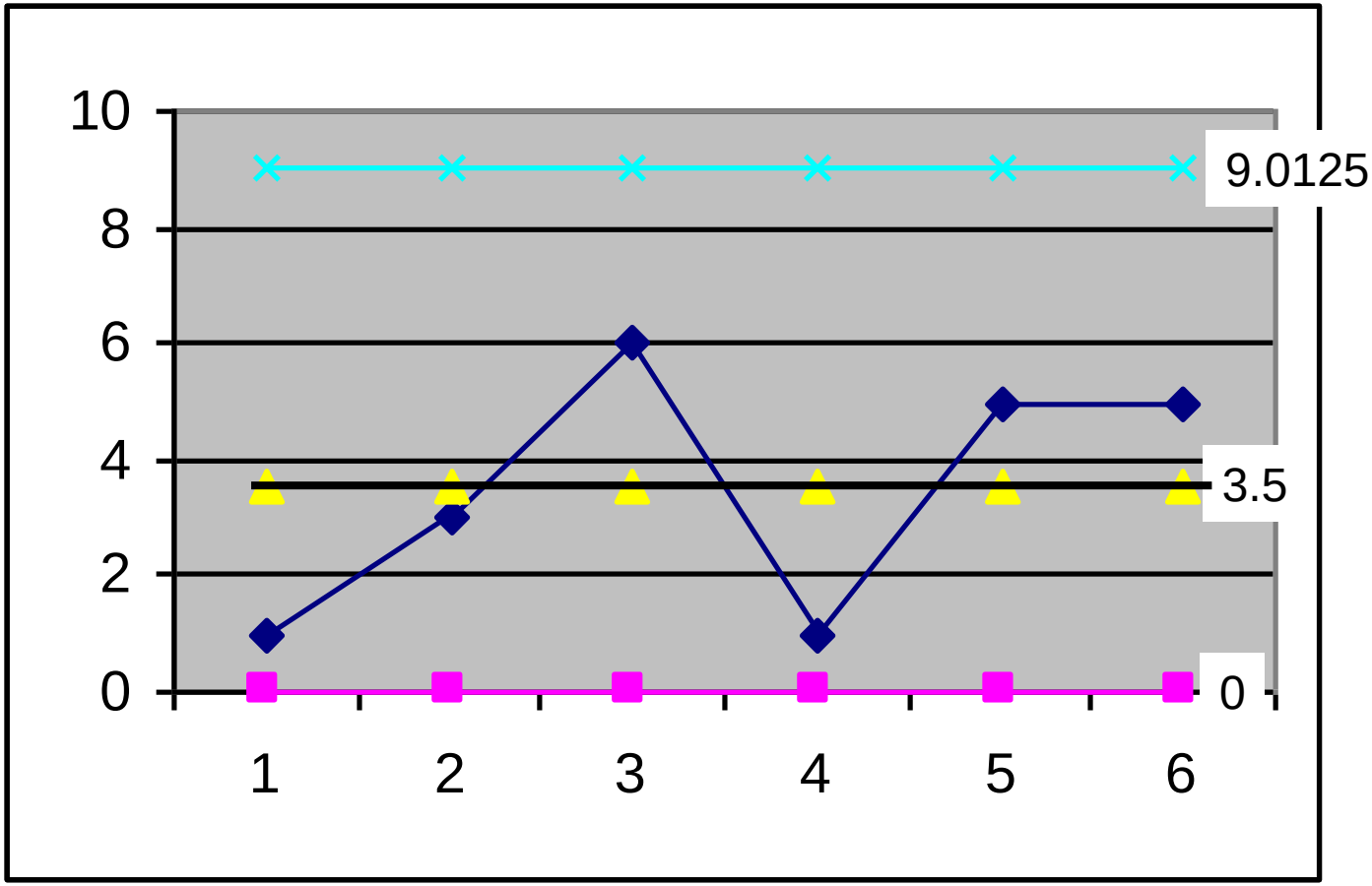
4.4751

Control Chart



R chart