Engineering Economics & Management

Reliability & Total Quality Management

1st Jun 16

Initial Decision Analysis

1st Jun 16

Initial Decision Analysis

- Pareto analysis ('Top-ten analysis')- to identify the most significant reliability problem areas.

- Trend analysis – to determine whether the problems are getting worse or getting better.

Pareto Analysis

- Pareto's Law of Mal-distribution that can be observed in:
  - Spares cost
  - Manpower needs
  - Outage time

- Two different forms of Pareto plots
  - Histogram
  - Cumulative plot

Example

- Example of an offshore oil and gas extraction system consisting of several identical platforms, each comprising one hundred different sub-systems.

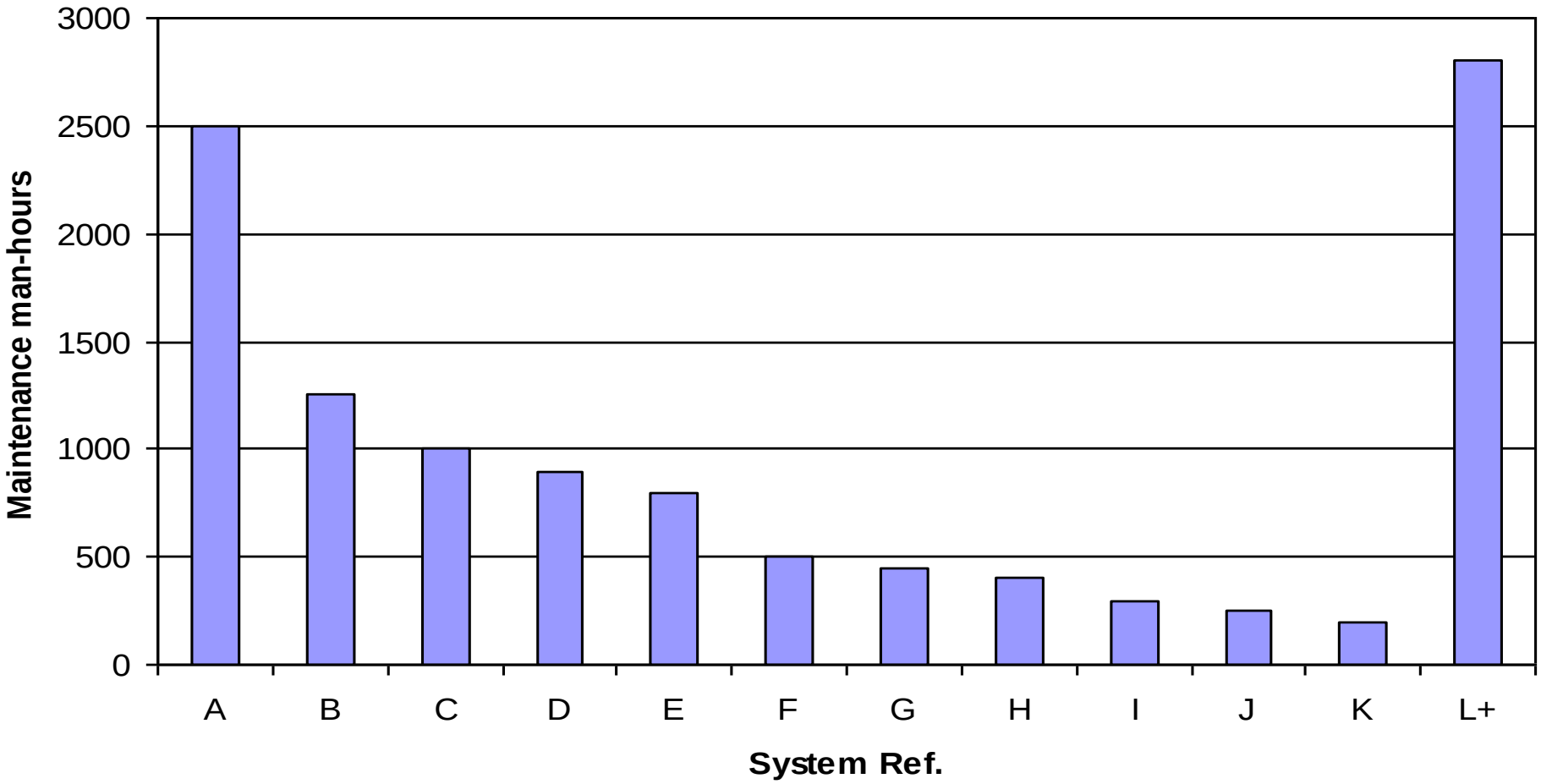
1	2	3
System	**System Ref.**	**Maintenance-Man-hours**
Lighting	A	2500
Gas Prod.	B	1250
Gas Wells	C	1000
Elec. Gen.	D	900
H2O Firefight	E	800
TEG Regen.	F	500
Separation	G	450
Compr Air	H	400
Export Pipewk	I	300
Dehydration	J	250
Fuel Gas	K	200
All Other Syst	L+	2800
	Total	11350

Example

1	2	3	4	5
System	**System Ref.**	**Maintenance-Man-hours**	**Percent of Total**	**Cum. Percent**
Lighting	A	2500	22.03	22.03
Gas Prod.	B	1250	11.01	33.04
Gas Wells	C	1000	8.81	41.85
Elec. Gen.	D	900	7.93	49.78
H2O Firefight	E	800	7.05	56.83
TEG Regen.	F	500	4.41	61.23
Separation	G	450	3.96	65.20
Compr Air	H	400	3.52	68.72
Export Pipewk	I	300	2.64	71.37
Dehydration	J	250	2.20	73.57
Fuel Gas	K	200	1.76	75.33
All Other Syst	L+	2800	24.67	100.00
	Total	11350	100.00	

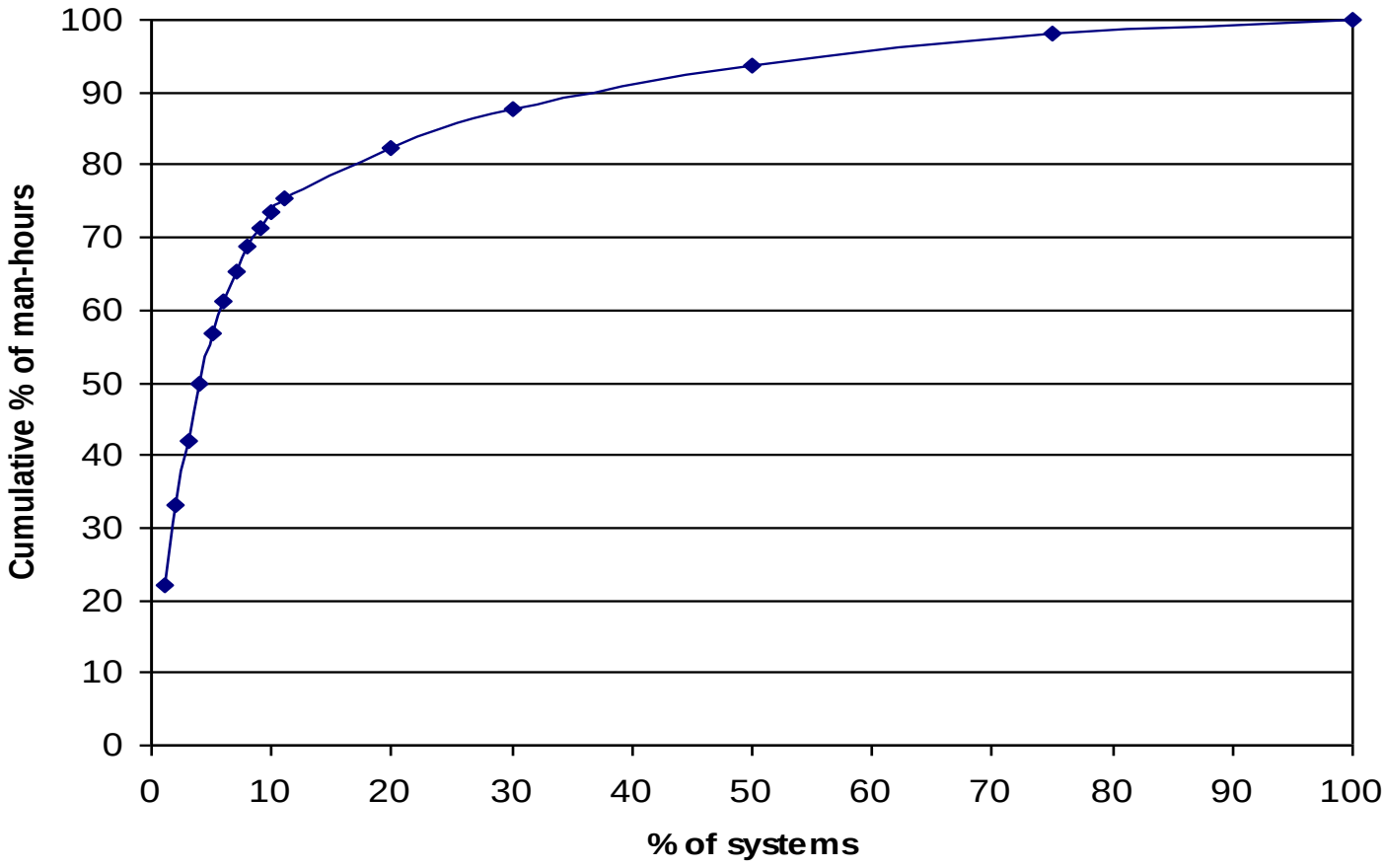
Histogram

Figure 1. Histogram of ranked manhour data



Cumulative Plot

Figure 2. Cumulative plot of percentage man-hours expended



Trend Analysis

- Conventional plot of monthly data
- Moving average
- CUSUM - Cumulative Sum of deviations

Example

- Over a fifteen month period in a processing plant, the total number of failures that occurred was recorded monthly with the results presented in chronological order as follows:

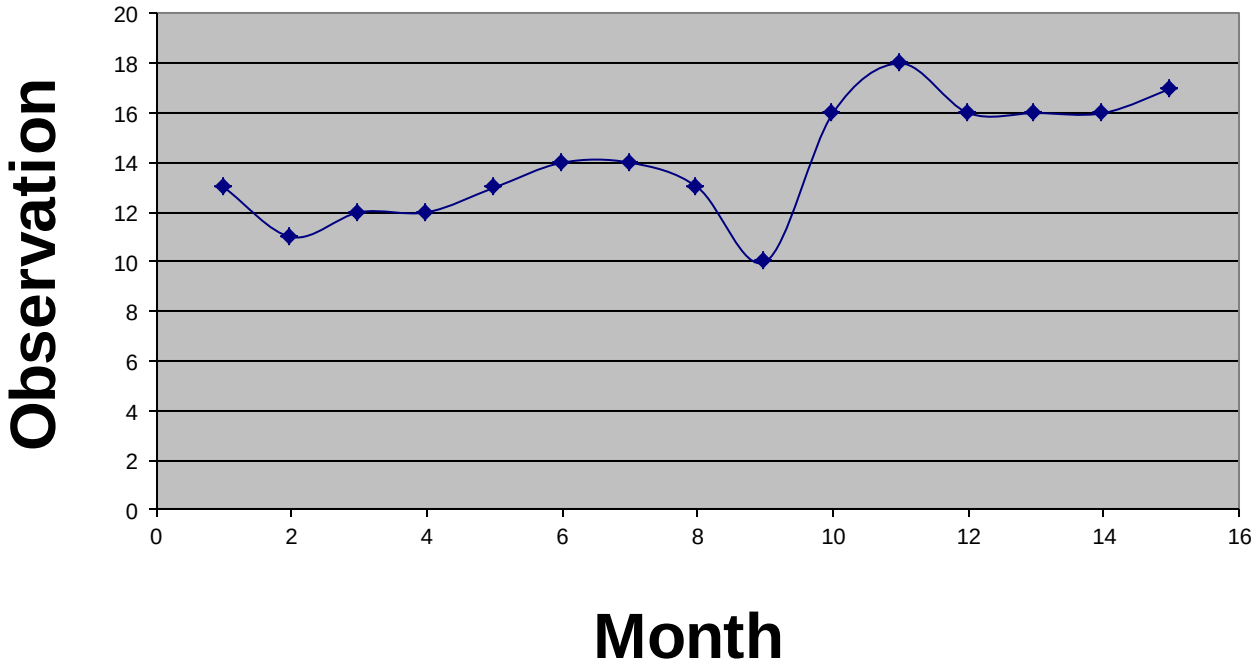
  13, 11, 12, 12, 13, 14, 14, 13, 10, 16, 18, 16, 16, 16 and 17.

  - Plot the three-monthly moving averages against time.
  - Plot the cumulative sum (relative to the monthly target of 15 failures) against time.
  - Briefly comment on any trends in the monthly incidence of failures that these two plots may reveal.

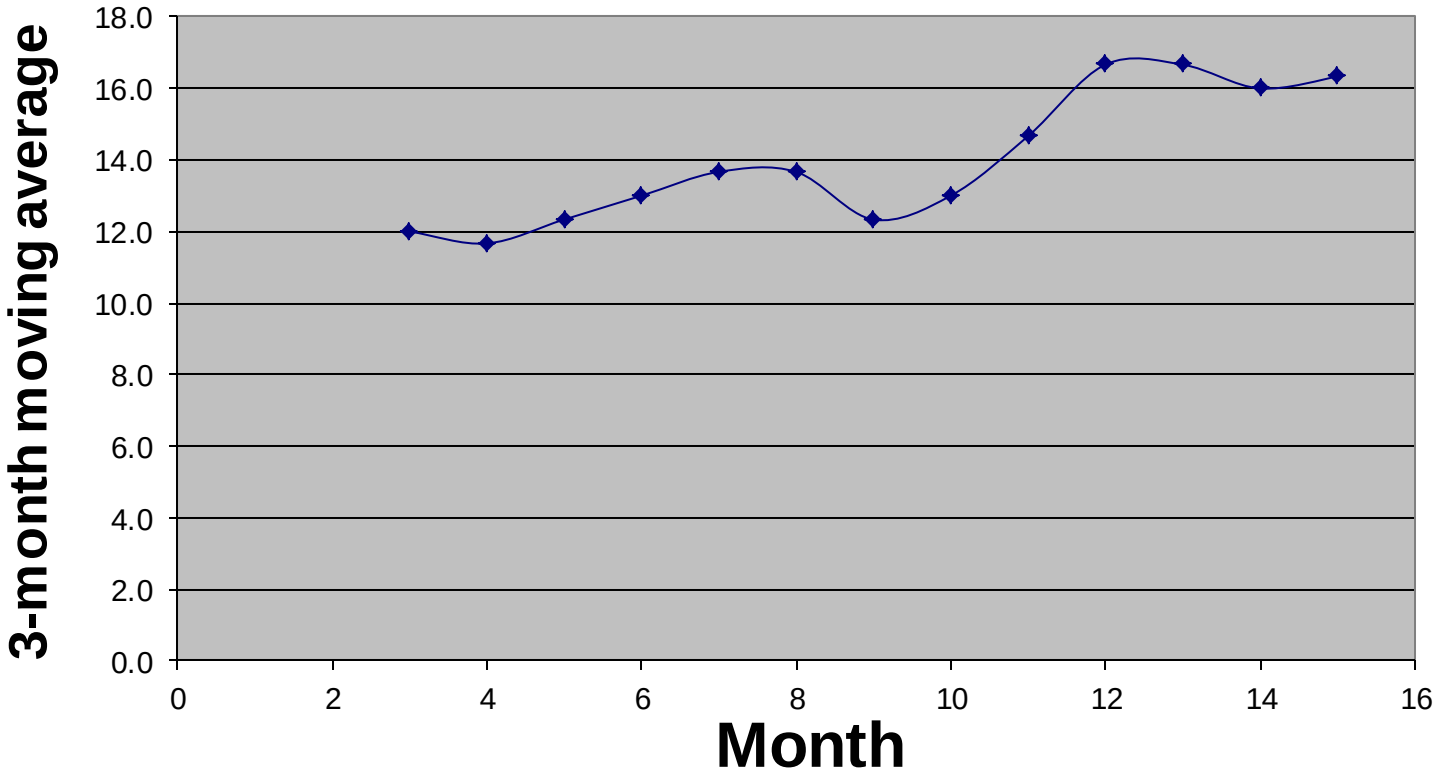
Example

Month	Failures	Three-month moving average	Deviation from target T=15	Cumulative sum of deviations
1	13		-2	-2
2	11		-4	-6
3	12	12	-3	-9
4	12	11.7	-3	-12
5	13	12.3	-2	-14
6	14	13	-1	-15
7	14	13.7	-1	-16
8	13	13.7	-2	-18
9	10	12.3	-5	-23
10	16	13	1	-22
11	18	14.7	3	-19
12	16	16.7	1	-18
13	16	16.7	1	-17
14	16	16	1	-16
15	17	16.3	2	-14

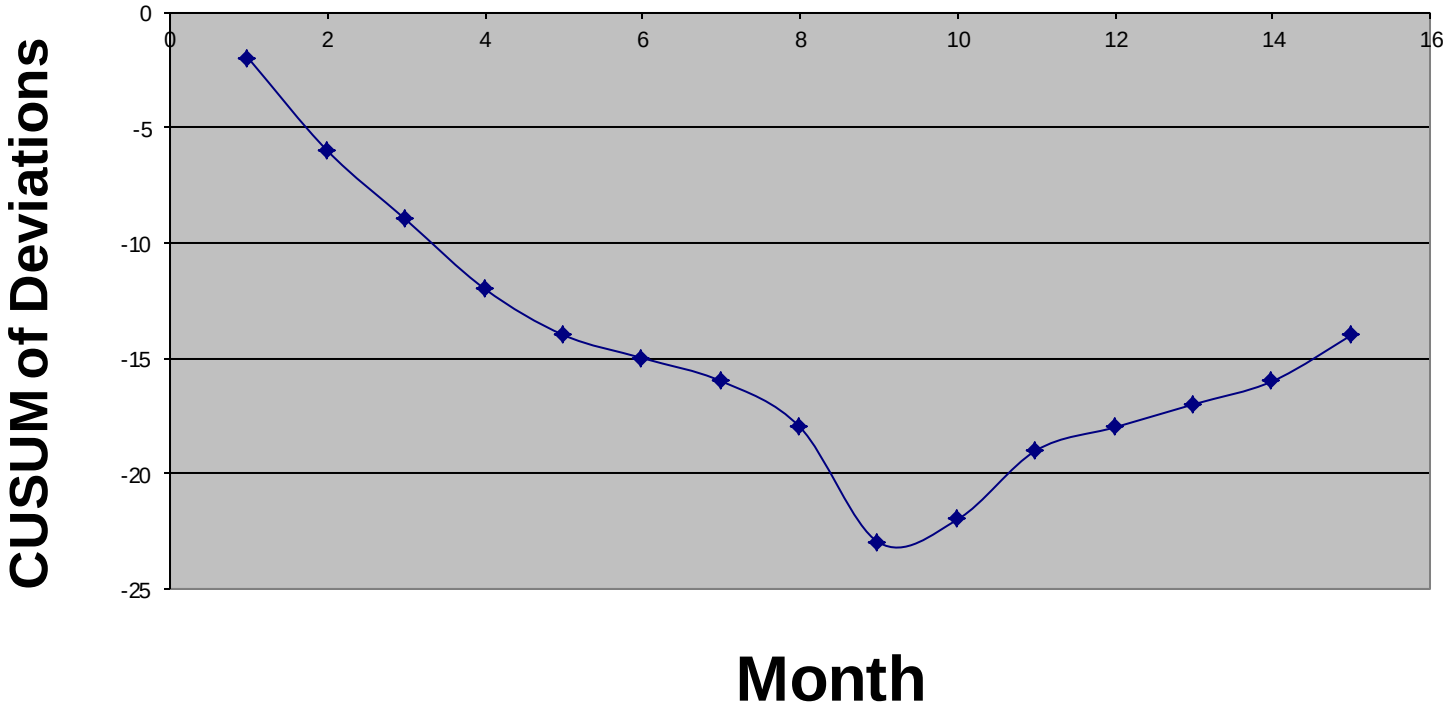
Conventional Plot



3 month moving average



Cusum



Thankyou

1st Jun 16