IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Statistical Process Control For Attributes

Dr. Ujjvala Ajit Phatak

Associate Professor

University of Mumbai

Abstract: A process is defined as transformation of set of inputs into desirable outputs. Inputs can be materials, methods or operations whereas outputs can be services, information or finished products. For survival of any organization and its success in the corporate world, it needs to monitor and improve the quality of its product. Quality can be defined as fitness for use and meet customers' needs by possessing desired characteristics of the product. Control is the major of performance of the process so that corrective action can be taken, wherever necessary, to improve the quality. Process control aims at producing error free products. In other words, it prevents the production of defective products. Statistical Process Control (SPC) is basically a strategy for decreasing variability in products in terms of quality. SPC methods are supported by management to provide objective by means of controlling quality in any transformation process. SPC techniques may be used to measure the degree of variation of any manufactured product, services or processes. SPC tools to extract maximum information from data. In this paper we shall discuss various methods used for collecting, presenting and analyzing most of the data related to attributes.

Key words: Statistical Process Control, Attribute, Flow charts, Cause & effect, Control charts

Abstract by: Dr. (Mrs.) Ujjvala Ajit Phatak.

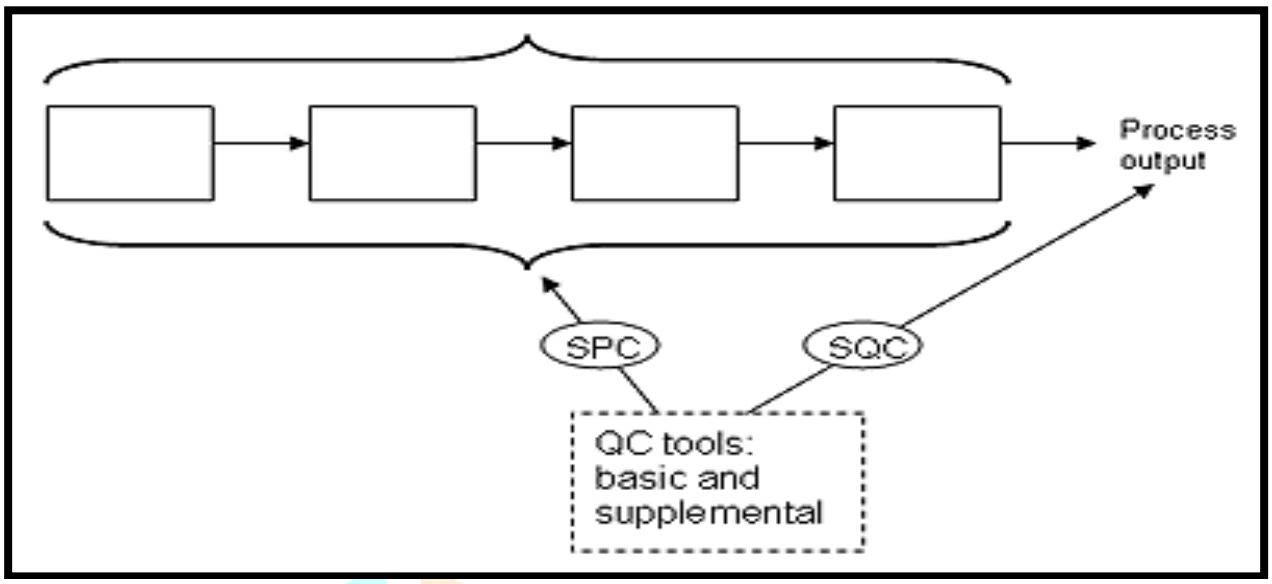
Associate Professor,

Dept. of Statistics,

Bhavan's College,

Andheri (W)

Statistical Process Control



Statistical process control (SPC) is used for production of product. **SPC** has advantages over other quality methods. It is a valuable tool for reducing cost, time etc.

HISTORY

Statistical process control was pioneered by Walter A. Shewhart in the early 1920s. W. Edwards Deming later applied SPC methods in the United States during World War II, thereby successfully improving quality in the manufacture of munitions and other strategically important products. Deming was also instrumental in introducing SPC methods to Japanese industry after the war had ended. Shewhart created the basis for the control chart and the concept of a state of statistical control by carefully designed experiments.

The following are the most commonly used tools of SPC:

- Process flow diagrams
- Check sheets/Tally sheets
- Histograms
- Pareto diagrams
- Cause-and-effect diagrams
- Scatter or correlation diagrams
- Control charts
- Run Chart

In this paper, I will explain the tools which are related to attribute data such as Process flow diagrams, Check sheets/Tally sheets and Cause-and-effect diagrams. An attribute is a non-measurable characteristic eg defects or no defects

1)Process flow diagrams or flow charts :

These are graphical representations of a process showing the sequence of different operations that make up a process. They are important tools for documenting processes and communicating information about processes. They can also be used to identify bottlenecks in a process sequence, to identify points of rework or other phenomena in a process or to define points where data or information about process performance needs to be collected.

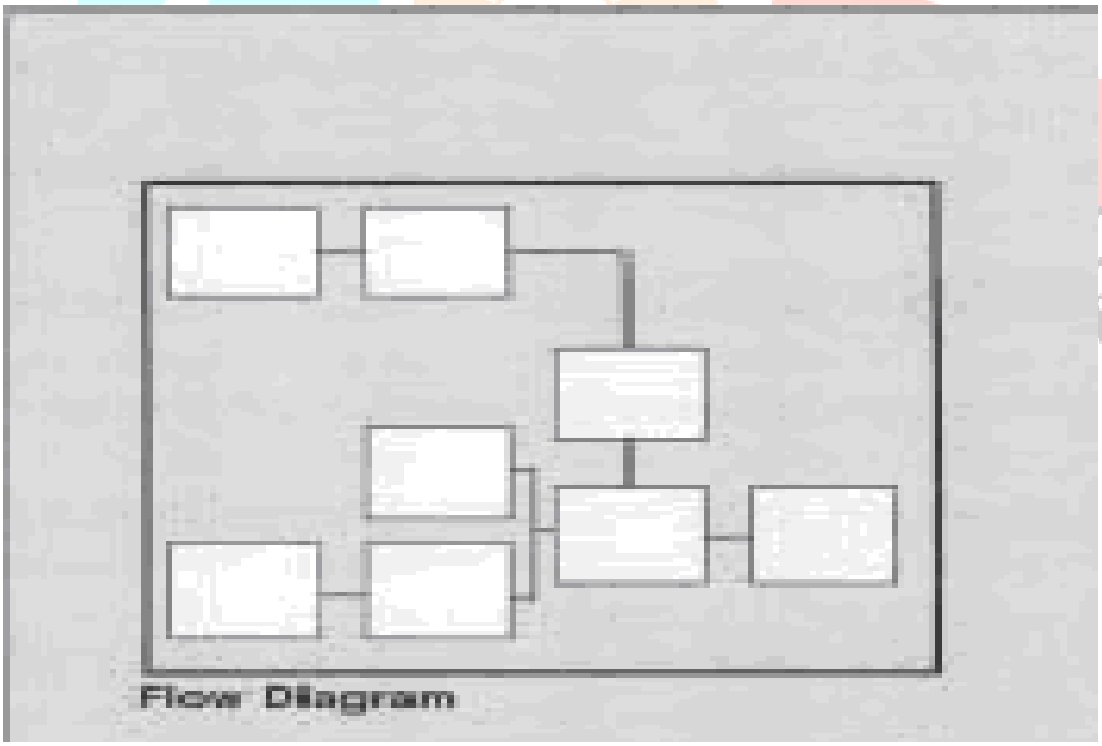
Symbols involved in a flow chart are:

- ○ Start
- □ Processing Step
- ◊ Decision Box

Only information, no processing step

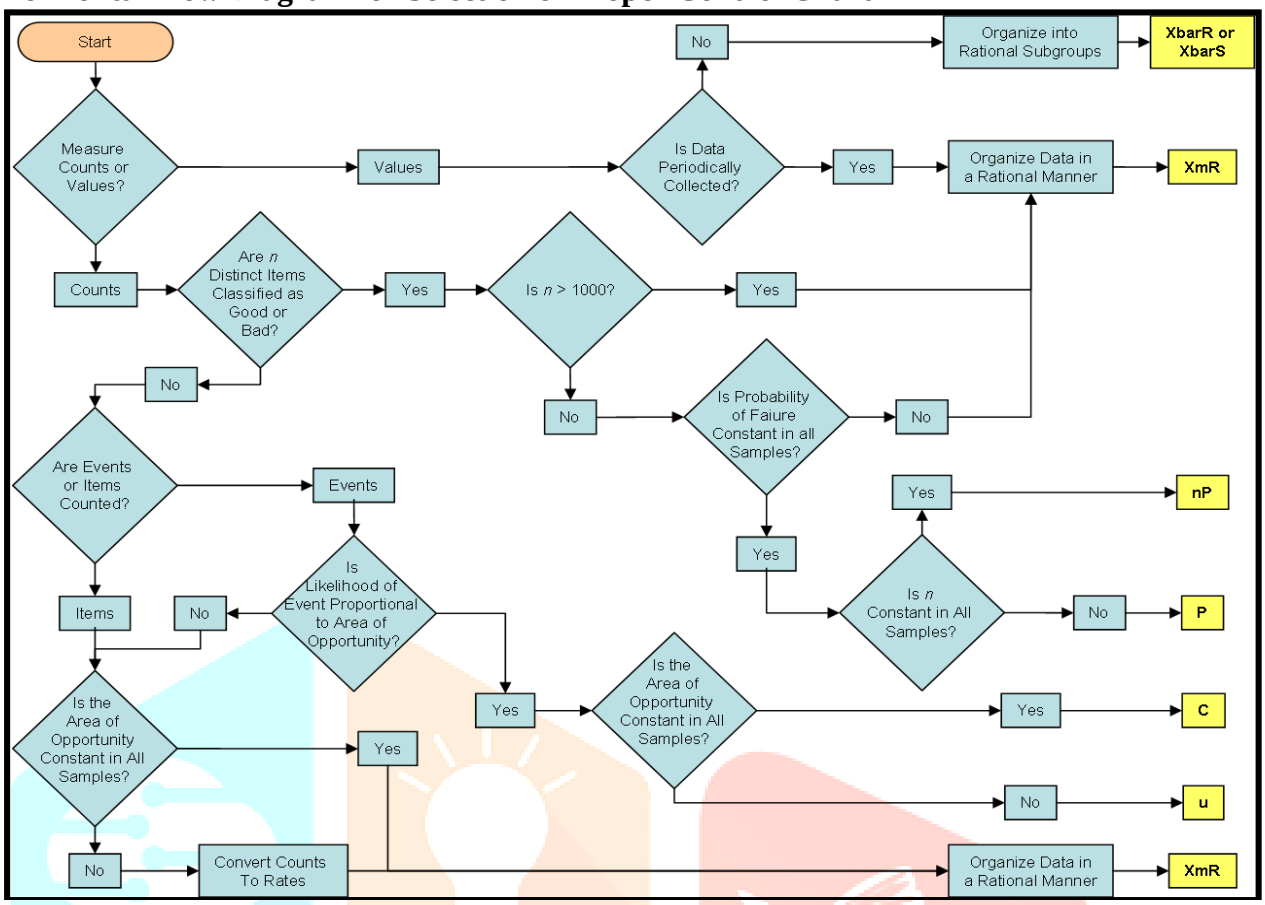
Stop/End

Outline of Flow

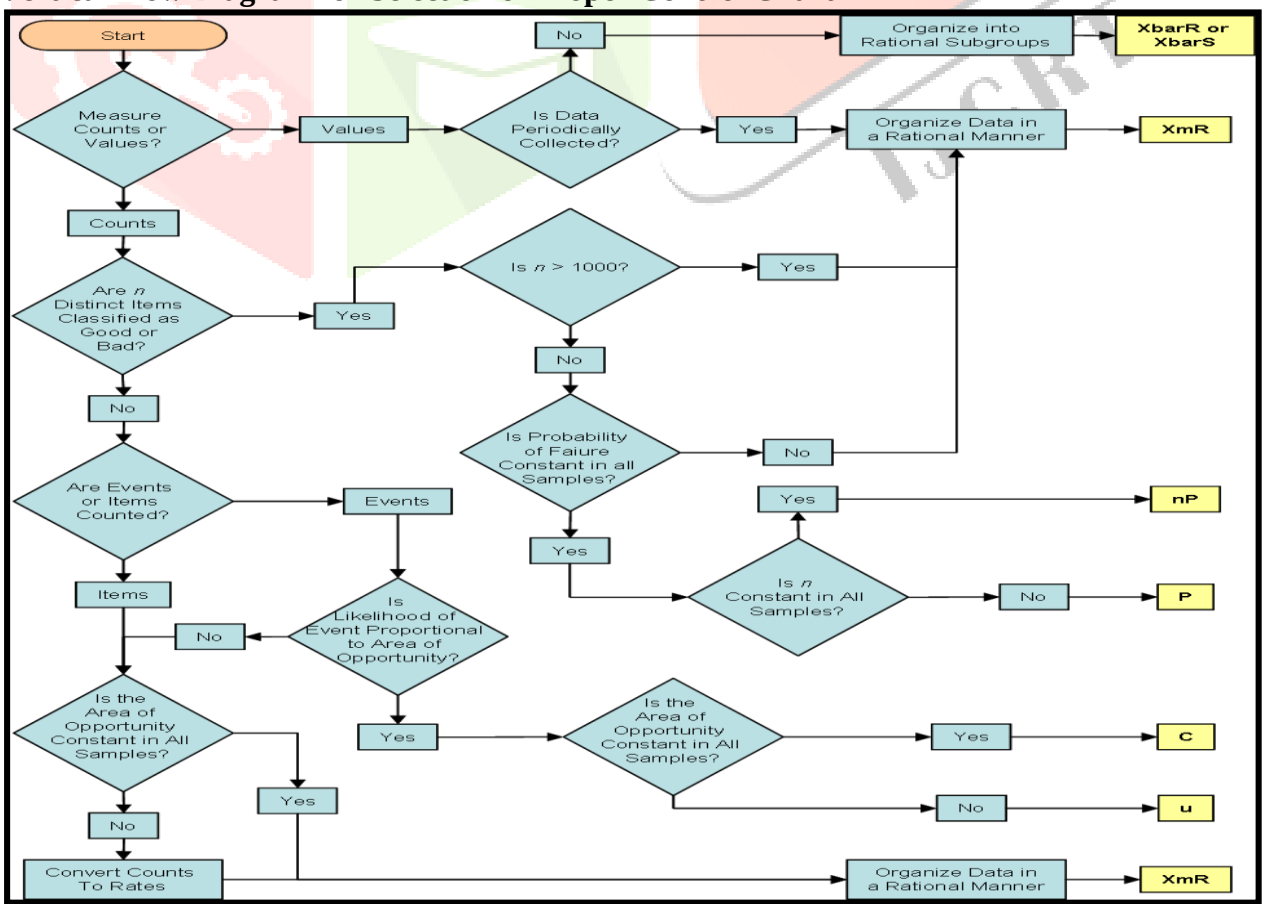


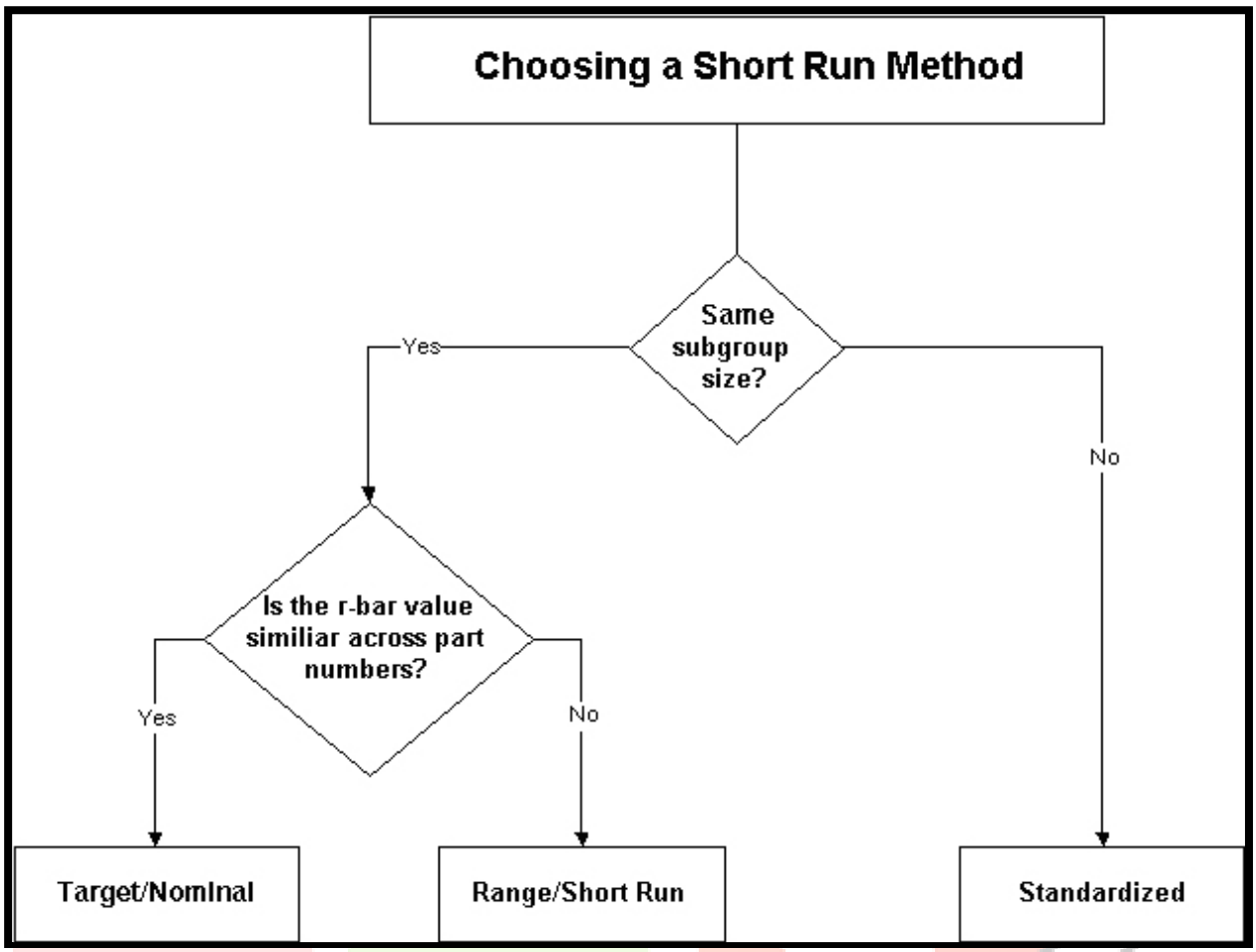
Chart

Horizontal Flow Diagram for Selection of Proper Control Chart



Vertical Flow Diagram for Selection of Proper Control Chart





Advantages:
1. This is the simplest diagrammatic method which a layman as well can understand.
2. This is the fundamental method of SPC to understand the process.
3. It gives a brief idea about the process and helps in controlling the process before hand.

Disadvantages:
1. Addition or deletion of any symbol of the diagram is a difficult task.
2. This is the optimistic approach.

2) CHECK SHEETS:

A Check Sheet is a data recording form that has been designed to readily interpret results from the form itself. It needs to be designed for the specific data it is to gather.
It is used for the collection of quantitative or qualitative repetitive data. It is adaptable to different data gathering situations. To prepare a check sheet minimal interpretation of results is required. It is easy and quick to use.
But check sheet does not provide any control for various forms of bias - exclusion, interaction, perception, operational, non-response, estimation etc.

Advantages:

1. It is a simple and quick method of SPC.
2. This diagram provides result faster than other methods regarding the control of process.
3. It gives an overview about the process control.

Disadvantages:

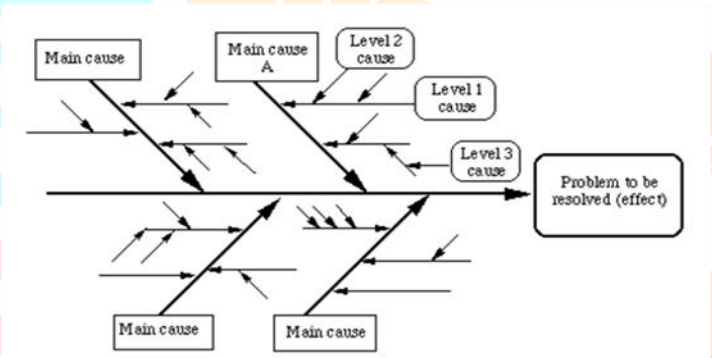
1. This type of diagram is used only to check process control through check sheet. It can not be used for the purpose of analysis.
2. It can not be used for the statistical analysis.

3) Cause-and-effect diagrams:

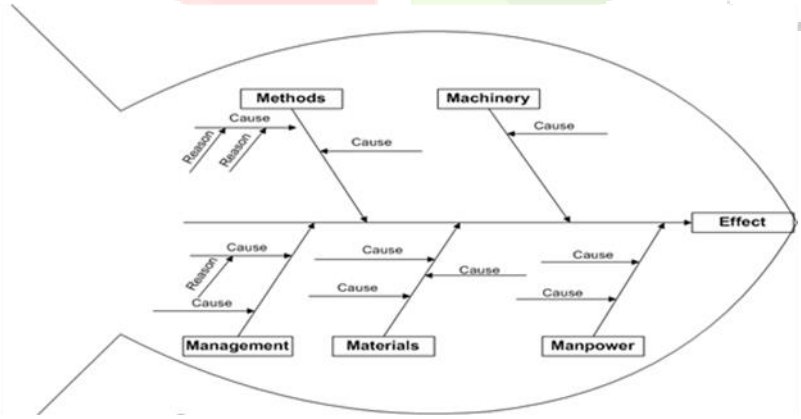
Cause-and-effect diagrams are also called Ishikawa diagrams (Dr. Kaoru Ishikawa, 1943) or fishbone diagrams.

Cause-and -effect diagrams do not have a statistical basis, but are excellent aids for problem solving and trouble-shooting

Cause-and-effect diagrams can reveal important relationships among various variables and possible causes. They can also provide additional insight into process behavior.



Ishikawa Diagram



Fishbone Diagram

Advantages:

1. This diagram explains the process in a very simple way.
2. It explains the relationship between the number of variables or factors involved in the process.
3. It explains the cause of the trouble and helps in solving the problem.

Disadvantages:

1. This diagrammatic method does not have any statistical base.
2. It can not be used for the further analysis.
3. It helps only in trouble shooting of the problem but not in statistical analysis.

4) Control Charts:

The control charts are most successful SPC tools. They were originally developed by Walter Shewhart in the early 1920s. They help you record data and let you see when an unusual event, e.g., a very high or low observation compared with "typical" process performance, occurs.

Types of Control Charts(C.C.) :

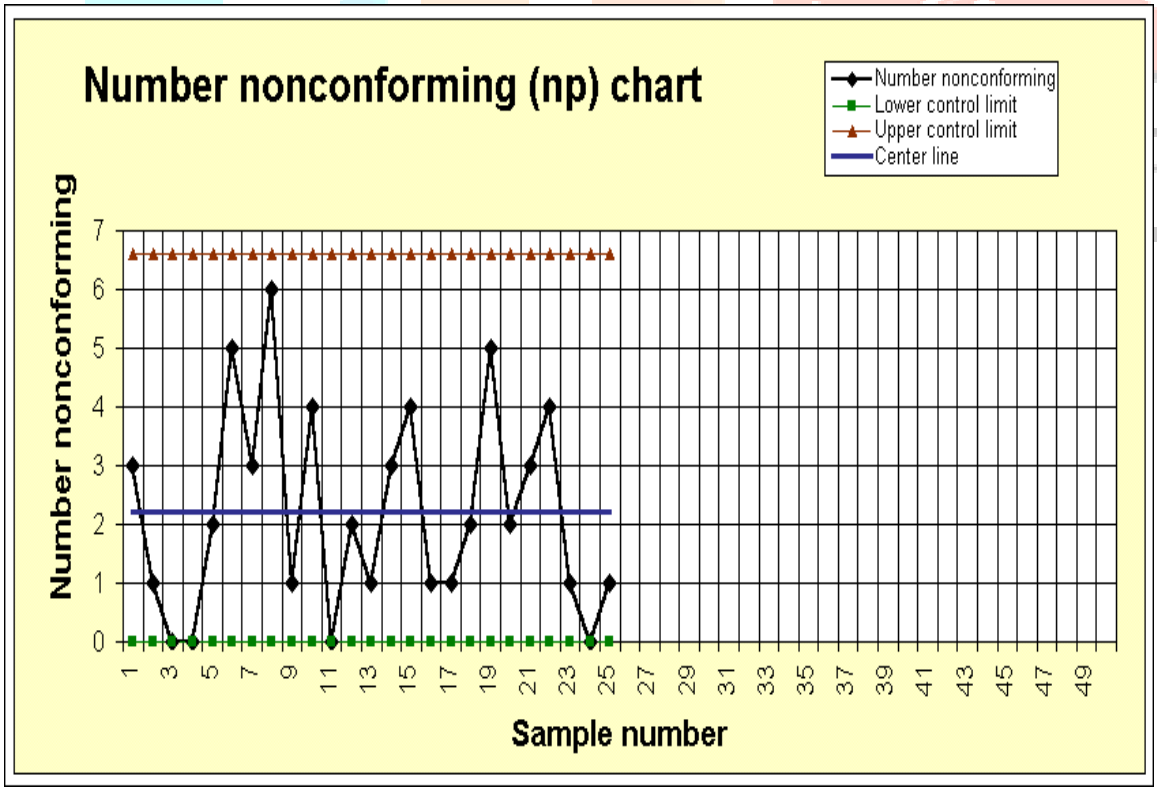
i)C.C for variables : They are used when the quality characteristic can be measured and expressed in numbers (e.g, length, time etc..)

ii)C.C for attributes : They are used for product characteristic that can be evaluated with a discrete response (e.g, pass/fail, yes/no etc..)

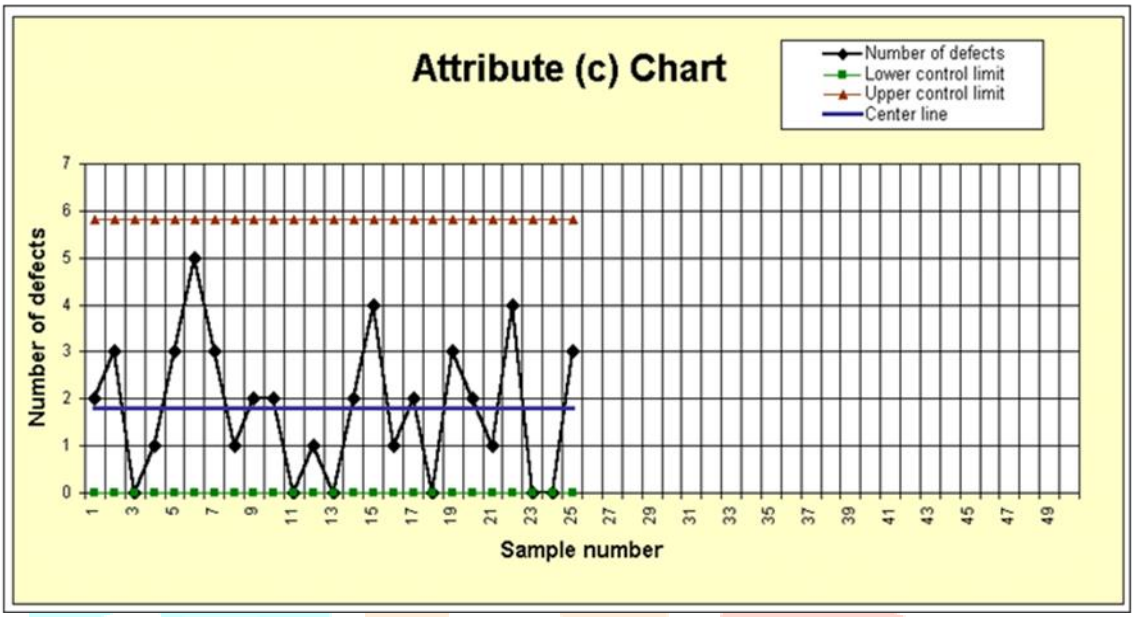
- **C.C for Attributes:**

p chart – fraction defective (fraction nonconforming)

np chart – number defective (total nonconforming)



- **c chart** – number of defects (total number of nonconformities)
- **u chart** - average number of defects (nonconformities per unit)



Advantages:

1. This method is the most useful statistical method showing all types of process control.
2. It can be used for statistical analysis as it has the strong statistical base.
3. This is the most reliable method.

BENEFITS OF STATISTICAL PROCESS CONTROL

Statistical process controls have a range of benefits:

- Reduced wastage and warranty claims
- Maximized productivity in a manufacturing unit
- Increased operational efficiency
- Reduced need for manual inspections
- Enhanced customer satisfaction
- Controlled costs
- Improved analytics and reporting

REFERENCES :

1. Gupta S.C. and Kapoor V. K.: Fundamentals of Applied Statistics 1-New Delhi: Sultan Chand & Sons, 1997
2. Gupta R.C.: Statistical Quality Control-3 New Delhi: Khanna Publishers, 1983
3. Montgomery Douglas C.: Introduction to Statistical Quality Control-1 New York: Joan Willey & Sons Inc ,1985
4. Wikipedia of SPC.