FAQ:

1. What are the types of Control Charts?

There are two main categories of Control Charts, those that display attribute data , and those that display variables data . They are

Attribute Data:

This category of Control Chart displays data that result from counting the number of occurrences or items in a single category of similar items or occurrences. These "count" data may be pressed as pass/fail, yes/no, or presence/absence of a defect.

Variables Data:

This category of Control Chart displays values resulting from the measurement of a continuous variable. Examples of variables data are elapsed time, temperature, and radiation dos

2. Distinguish between defects and defectives

A defective is an article that in some way fails to confirm the one or more given specifications. Each instance of the article, lack of conformity to specification is a defect. For eg., a television set is a defective one as its picture tube is not functioning or in other words non functioning picture tube is a defect in the television set. Every defective contains one or more defects. E.g. number of defects in a piece of cloth like improper colouring, improper printing etc., number of surface defects observed in a roll of coated paper etc.

3. Write the control limits for np chart

When the mean of the population (nP) from which samples are taken is unknown and P is estimated using $\bar{p} = \frac{Number\ of\ nonconfor\min g\ units\ in\ all\ the\ samples\ combined}{Number\ of\ items\ inspected\ in\ all\ the\ samples\ combined}$, the control limits are given by

$UCL = n\bar{p} + 3\sqrt{n\bar{p}(1-\bar{p})}$

$CL = n\bar{p}$

$LCL = = n\bar{p} - 3\sqrt{n\bar{p}(1-\bar{p})}$

4. Write the control limits for p chart

$UCL = \bar{p} + 3\sqrt{\bar{p}(1-\bar{p})/n_i}$

$CL = \bar{p}$

$LCL = = \bar{p} - 3\sqrt{\bar{p}(1-\bar{p})/n_i}$

Where p is estimated using the formula

$\bar{p} = \frac{Number\ of\ nonconfor\min g\ units\ in\ all\ the\ samples\ combined}{Number\ of\ items\ inspected\ in\ all\ the\ samples\ combined}$,

5. Write the control limits for c chart

UCL = $\bar{c} + 3\sqrt{\bar{c}}$

CL = $\bar{c}$

LCL = $= \bar{c} - 3\sqrt{\bar{c}}$.

Where c is estimated using the formula

$$\bar{c} = \frac{number\ of\ nonconfomities\ in\ all\ samples}{total\ number\ of\ samples} = \frac{\sum_{i=1}^{k} ci}{k}$$

6. Write the control limits for u chart

UCL = $\bar{u} + 3\sqrt{\bar{u}/n_i}$

CL = $\bar{u}$

LCL = $= \bar{u} - 3\sqrt{\bar{u}/n_i}$. where $\bar{u} = \frac{\sum_{i-1}^{k} c_i}{\sum_{i-1}^{k} n_i}$.

7. What are the Advantages of Attribute Control charts over $\overline{X} - R$ Charts:

The following are the advantages of attribute control charts over $\overline{X} - R$ **charts:**

1. Attribute control charts do not require measurements and hence, the skill and effort of measurement required to maintain $\overline{X} - R$ charts is involved.
2. By virtue of not requiring measurements attributes control charts are more economical and less demanding on inspection time.
3. An attribute control chart can be applied to a number of Quality characteristic checked at a work station; whereas, $\overline{X} - R$ charts require one chart for each characteristic.
4. Attribute control charts are less demanding on skills of the personnel collecting data and maintaining charts.
5. The chart can be easily read and understood by on-line production personnel and hence can act as self evaluation by operators.
6. Attribute control chart analysis is easier and simpler in comparison to $\overline{X} - R$ chart analysis.
7. Most often data collection effort on attribute control charts is very minimal, since data collected for other purposes can be used for the chart.
8. Attribute control chart information is also useful as quality history and is useful for management Information of Operating Efficiency, and of control of operating Efficiency.

8. A c-chart is to be implemented. From the previous study, the average number of defects per item is found to be 4.84. Find 3 sigma and 2 sigma control limits.

Three sigma limits:

UCL = $\bar{c} + 3\sqrt{\bar{c}}$ = 4.84+3√4.84 = 4.84+(3 X 2.2)=4.84+6.6=11.44

CL = $\bar{c}$ = 4.84

LCL = $\bar{c} - 3\sqrt{\bar{c}}$ = 4.84-3√4.84= 4.84-6.6 ≈ 0 (when the value is negative, LCM is taken as Zero since no.of defectives cannot be negative).

two sigma limits:

UCL = $\bar{c} + 2\sqrt{\bar{c}}$ = 4.84+2√4.84 = 4.84+(2 X 2.2)=4.84+4.4=9.24

CL = $\bar{c}$ = 4.84

LCL = $\bar{c} - 2\sqrt{\bar{c}}$ = 4.84-2√4.84= 4.84-4.4 =0.44

9. Each day a sample of 50 items was examined from a production process. The number of defectives found in each sample were as follows.

6	2	5	1	2	2	3	5	3	4	12
4	4	1	3	5	4	1	4	3	5	4
2	3	7								

Draw a suitable chart and check for control.
What control limits would you suggest for subsequent use?

Ans:
Since the subgroup size is same for all the subgroups, np chart is suitable.
Control limits:
Calculations:

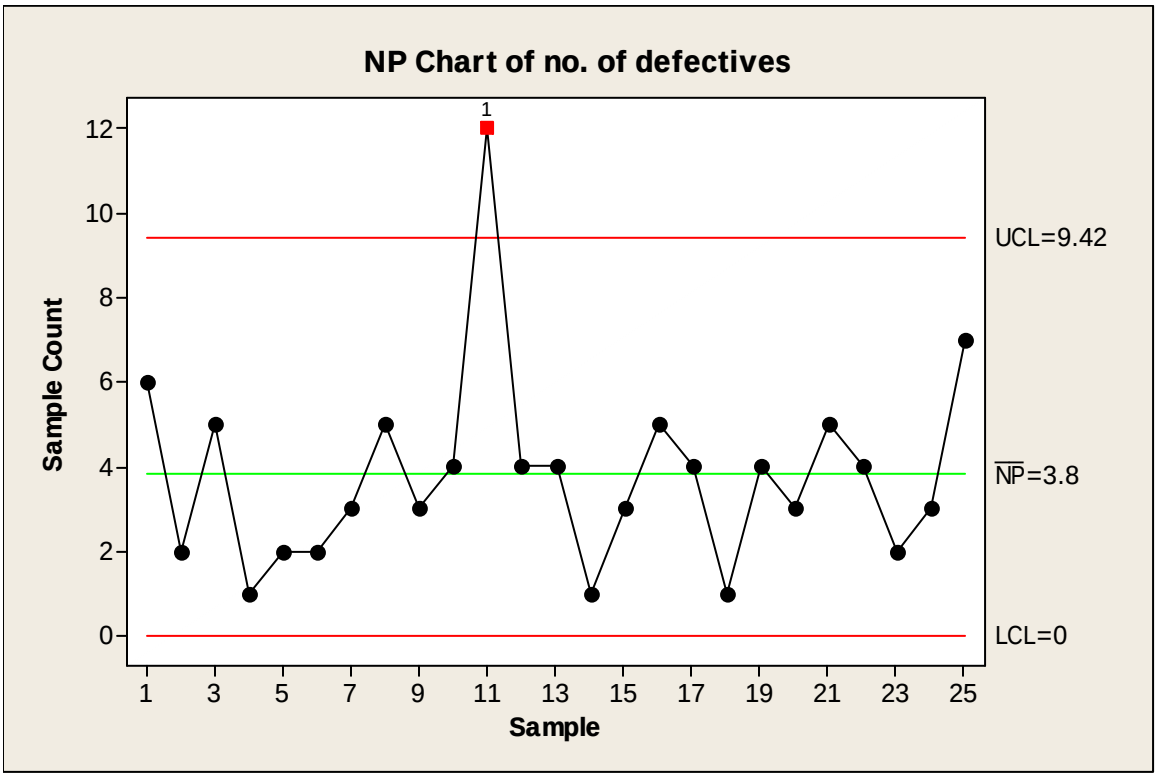
$\bar{p} = \frac{Number\ of\ nonconfor\min g\ units\ in\ all\ the\ samples\ combined}{Number\ of\ items\ inspected\ in\ all\ the\ samples\ combined}$ = 95/(50 X 25) = 0.076

UCL = n $\bar{p}$ + 3$\sqrt{n\bar{p}(1-\bar{p})}$ = 3.8+3√(50 X 0.076 X 0.924) = 3.8+3X1.8738 =3.8+5.6214 = 9.42

CL = n $\bar{p}$ = 50 X 0.076 = 3.8

LCL = = n $\bar{p}$ - 3$\sqrt{n\bar{p}(1-\bar{p})}$ = 3.8-3√(50 X 0.076 X 0.924) = 0 (as no. of defective can not be negative)

The control chart is as follows. Observe that all the values are with in the control limits and is free from assignable causes, the process is under control. These limit can be taken for subsequent use.



the revised control limits.

10. What is the difference between types of attribute control charts ?

Attribute consists of two cause
1 Defect - No of defect in a given unit. (Units still can be used)
2. Defective - No of Units which are defective in a given bunch or bulk of unit. (Unit cannot be used as it is completely defective)

Charts
Chart for Defective are
1 p Chart - It calculates the proportion of defectives in each subgroup . In p chart UCL and LCL are varying depending on the size of each subgroup.
2.np Chart - It calculates the number of defectives in each subgroup . In np chart UCL and LCL are straight lines.

Chart for Defects are
1 c Chart - It calculates charts the number of defects in each subgroup. Use C Chart when the subgroup size is constant. In c chart UCL and LCL are straight lines

2. u Chart - It calculates charts the number of defects per unit sampled in each subgroup. Use U Chart when the subgroup size varies. In u chart UCL and LCL are varying depending on the size of each subgroup.