

c Charts

Many tools are available for use in statistical quality control. Control charts are useful in determining if there is a change in the performance of a process. Some examples of control charts include \bar{X} and R charts which deal with variables of a product that can be measured, and control charts for product attributes such as p charts, u charts, and, the focus of this paper, c charts.

C charts, or, as they are less commonly known, count charts, deal with the number of defects in units all of uniform size and/or quantity. C charts graph the total number of nonconformities found in each piece or unit that is inspected. If the number of nonconformities for a particular piece lies above or below the upper or lower calculated control limits or if all of the points lie within the control limits but behave in a nonrandom manner, then it is likely that the process is not in control and should be adjusted to prevent the defects before continuing with production.

There are certain procedures that need to be followed in order to create a c chart. The first step is to find the average number of defects per unit, represented by \bar{c} , and the standard deviation, represented by the square root of \bar{c} , for the process. Next, plot the average number of defects on the graph. This is known as the central line. Then, determine the upper control limit, UCL, by adding three times the standard deviation to the average number of defects: $UCL = \bar{c} + 3\sqrt{\bar{c}}$. Subsequently, the lower control limit is calculated in the same manner, except instead of adding three times the standard deviation to the average, it is subtracted: $LCL = \bar{c} - 3\sqrt{\bar{c}}$. Then the upper and lower

control limits are plotted on the graph. After that, using the observed data from the process, plot the number of defects for each unit on the graph and connect them with straight line segments. The x-coordinate of the graph should represent the individual units of the process, while the y-coordinate of the graph should represent the number of defects. Finally, using the completed c chart, determine if the process is in control or not in control by checking the plotted points to see if they are within the control limits, or if there is a nonrandom pattern to the data. If either or both of these cases exist, the process should be investigated and/or corrected to prevent future defects.

C charts have many applications for quality control in manufacturing and processing. For example, in automotive production, particularly painting, the number of defects in the paint of a car can be measured and plotted on a c chart. Then it can be determined whether or not the paint job is within the control limits for the process. Other examples include any process where the number of nonconformities can be counted. The number of defects in a woven carpet, the number of defects in a shoe, and also the number of defects in a roll of aluminum foil are all processes that are applicable to c charts.

As you can see, the c chart is a very valuable tool in quality management. If the process that the c chart is being applied deals with units with defects or nonconformities that can be counted, then it is certainly advantageous to employ the use of c charts to that process. With the intensifying focus on quality and quality management, c charts are a very powerful asset to the processing and manufacturing fields.

For more information about c charts, please see *Statistical Process Control and Quality Improvement* by Gerald M. Smith. This book gives good insight into the different

applications of not only c charts, but also the other various control charts and tools available for use in quality management. Another book that is recommended for more information on the applications of statistical tools in the area of quality assurance is *Statistical Methods for SPC and TQM* by Derek Bissell. Not only does this book give examples of the utilization of statistical process control for products and processes, it also gives examples as to where these methods can be applied in general business areas.

Works Cited

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