

U CONTROL CHART

PURPOSE

Generates a (Poisson) proportion control chart.

DESCRIPTION

A U chart is a data analysis technique for determining if a measurement process has gone out of statistical control. The U chart is sensitive to changes in the normalized number of defective items in the measurement process. Normalized means that the number of defectives is divided by the unit area. You can also normalize to compensate for unequal sample sizes (see the NOTE below). The “U” in U chart stands for “units” as in defectives per lot. The U control chart consists of:

Vertical axis = the normalized number of defectives (number of defectives/area for sub-group = \bar{u}) for each sub-group;
Horizontal axis = sub-group designation.

A sub-group is frequently a time sequence (e.g., the number of defectives in a daily production run where each day is considered a sub-group). If the times are equally spaced, the horizontal axis variable can be generated as a sequence (e.g., LET X = SEQUENCE 1 1 N where N is the number of sub-groups).

In addition, horizontal lines are drawn at the mean number of defectives and at the upper and lower control limits. The distribution of the number of defective items is assumed to be Poisson. This assumption is the basis for the calculating the upper and lower control limits. The control limits are calculated as:

$$LCL = \bar{u} - 3\sqrt{\frac{\bar{u}}{A}} \quad (\text{EQ 2-36})$$

$$UCL = \bar{u} + 3\sqrt{\frac{\bar{u}}{A}} \quad (\text{EQ 2-37})$$

where \bar{u} is the total number of defects divided by the total area (i.e., the sum of the areas variable) and A is the area corresponding to a given sub-group. This means that the control limits can vary with the sub-group. Also, zero serves as a lower bound on the LCL value.

SYNTAX

U CHART <y1> <area> <x> <SUBSET/EXCEPT/FOR qualification>

where <y1> is a variable containing the number of defective items in each sub-group;

<area> is a variable containing the sample size or area adjustment;

<x> is a variable containing the sub-group identifier (usually 1, 2, 3, ...);

and where the <SUBSET/EXCEPT/FOR qualification> is optional.

EXAMPLES

U CHART Y SIZE X

U CHART Y AREA X SUBSET X > 5

NOTE 1

The U CONTROL CHART is similar to the C CONTROL chart. The distinction is that the C CONTROL CHART is used when the material being inspected is constant in area and the sub-groups have an equal sample size. The U CONTROL CHART is used when either of these assumptions is not valid.

If the area is constant but the sample size is unequal, simply use the sample size as the <area> variable. If the sample sizes are equal, but the areas vary, use the area without modification as the <area> variable. If both the areas and the sample size vary, then use sample size times area for the <area> variable.

NOTE 2

The attributes of the 4 traces that make up the U control chart are controlled by the standard LINES, CHARACTERS, SPIKES, and BAR commands. Trace 1 is the response variable, trace 2 is the mean line, and traces 3 and 4 are the upper and lower control limits. Some analysts prefer to draw the response variable as a character or a spike rather than a connected line. The example program demonstrates setting the line attributes (the control lines are drawn as dotted lines).

DEFAULT

None

SYNONYMS

U CHART for U CONTROL CHART

RELATED COMMANDS

C CHART	=	Generates a C control chart.
P CHART	=	Generates a P control chart.
NP CHART	=	Generates a Np control chart.
CHARACTERS	=	Sets the types for plot characters.
LINES	=	Sets the types for plot lines.

REFERENCE

“Guide to Quality Control,” Kaoru Ishikawa, Asian Productivity Organization, 1982 (Chapter 8).

APPLICATIONS

Quality Control

IMPLEMENTATION DATE

88/2

PROGRAM

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SKIP 25
READ CCU.DAT X NUMDEF SIZE
XLIMITS 0 20; XTIC OFFSET 0 1; YTIC OFFSET 1
LINES SOLID SOLID DOT DOT; TITLE AUTOMATIC
YILABEL NORMALIZED NUMBER OF DEFECTIVES; XLABEL SAMPLE ID
U CHART NUMDEF SIZE X
    
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