CP

PURPOSE

Compute the Process capability index (C_p) for a variable.

DESCRIPTION

The process capability index measures the performance (i.e., the "capability") of an industrial process and is defined as follows:

C_p = (USL - LSL)/(6s)

where USL and LSL are the upper and lower specification limits and s is the sample standard deviation. The USL and LSL are user defined limits within which a product is considered acceptable (values outside these limits indicate that a product is defective). Values less than 1 indicate that there are still some defectives in the process. A value of 6s yields a range of plus or minus 3 standard deviations. For example, if the specification limits are symmetric about the mean of the data and the calculated C_p is exactly 1, this means that the specification limits fall at plus and minus 3 standard deviations from the mean and that the percentage of defectives will be approximately 1% (under a normality assumption). Values greater than 1 indicate the specification limits are even greater than 3 standard deviations from the mean (and so there will be less defectives) while values less than 1 indicate that the specification limits are less than 3 standard deviations from the mean (and so there will be more defectives).

SYNTAX

LET <par> = CP <y> <SUBSET/EXCEPT/FOR qualification>
where <y> is a response variable;
<par> is a parameter where the computed C_p index is stored;
and where the <SUBSET/EXCEPT/FOR qualification> is optional.

EXAMPLES

LET A = CP Y1
LET A = CP Y1 SUBSET TAG > 2

NOTE 1

Recall that Chebychev's thereom states that at least 75% of a variables observations must fall within plus or minus 2 standard deviations of the mean and that at least 88% of them must fall within plus or minus 3 standard deviations. This is for any distribution. For a normal distribution, these numbers are 95.4% and 99.7% respectively.

NOTE 2

The upper and lower specification limits must be specified by the user as follows:

LET LSL = <value>
LET USL = < value>

NOTE 3

If your specification limits are not symmetric about the mean, the CPK statistic may be a better choice than the CP statistic. It is an alternate calculation of CP that adjusts for possibly nonsymmetric specification limits.

DEFAULT

None

SYNONYMS

None

RELATED COMMANDS

CP PLOT	=	Generate a C_p versus subset plot.
CONTROL CHART	=	Generate a control chart.
CPK	=	Compute the C_{pk} index.
PERCENT DEFECTIVE	=	Compute the percentage of defectives in a sample.
EXPECTED LOSS	=	Compute the expected loss of a sample.

REFERENCE

"Guide to Quality Control," Kaoru Ishikawa, Asian Productivity Organization, 1982 (chapter 13).

APPLICATIONS

Quality Control

IMPLEMENTATION DATE

90/12

PROGRAM

```
SKIP 25
READ GEAR.DAT DIAMETER
LET LSL = 0.99
LET USL = 1.01
LET A = CP DIAMETER
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The computed C_p value is 0.53.