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## EVALUATION OF FOUR STATISTICAL QUALITY CONTROL PACKAGES

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### ABSTRACT

*Four statistical quality control software packages were evaluated for their ability to perform quality control tasks required by logging managers and supervisors. The four programs are recognised as leaders in their price category.*

### INTRODUCTION

A project to assess long term log quality levels in a logging crew confirmed high numbers of logs which did not meet specifications (Cossens, 1990). The project highlighted the value of collecting information on log quality from logging operations. A survey was conducted in 1990 to assess the use of quality control (QC) systems in logging. The results of this survey are described in more detail in Cossens (1992). It was found that most logging managers in New Zealand had not implemented Total Quality Management (TQM) systems and none used statistical quality control (SQC) packages in their management of log quality.

Murphy and Twaddle (1986) suggested that control charts could be used to monitor log making performance. Value recovery of log makers assessed using

AVIS (Geerts and Twaddle, 1984) could be charted and graphically displayed using SQC software.

QC analysis procedures are to be found in many commercially available statistics packages for personal computers. Extensive reviews of SQC packages include Juran and Gryna (1988), Montgomery (1991), Quality Progress (1988), PC Magazine (1989) and Industrial Engineering (1987).

However, not all of the packages can be purchased in New Zealand. In most cases, those wishing to obtain a package must buy direct from overseas software developers or suppliers (usually in the U.S.A.). Training and support is, therefore, also not easily available.

### SQC Tools

A preliminary review describes six tools that could be used for quality control:

- histogram
- check sheet
- Pareto chart
- cause and effect diagram
- scatter diagram
- control chart.

This review of four SQC programs looks at their ability to provide five of the above tools in addition to more sophisticated tools that are used by QC practitioners. The "check sheet" is excluded as it is primarily a data recording and reporting tool easily developed by users. QC software usually provide some of the following additional analysis tools.

### Process Capability Ratio (PCR)

It is common practice in quality analysis that a standard test for "process capability" be performed when charting histograms. Process capability is a measure of the ability of a process to conform to tolerance limits:

$$PCR = \frac{(USL - LSL)}{6\sigma}$$

where USL is the upper specification limit and LSL is the lower specification limit and  $\sigma$  is the sample standard deviation. A PCR of 1.33 is considered a minimum acceptable level.

### Control Charts

It is important to select the correct chart depending on the type of data collected. Data can be either variables or attributes. A variable is data that can be measured continuously (for example, length) while an attribute can be counted in discrete units (that is, the presence of a defect or the number of reject products). Charts for means (called "X Bar charts") are used to plot variables whilst attributes can be plotted with P, NP, U or C charts. A process is controlled by reducing its variability. This is assisted by charting measures of the process variation such as the range of data, its standard deviation or its variance. These types of charts are called R, S or  $S^2$  charts. Charts may be smoothed by the use of moving averages, moving ranges or exponential weighting. A more detailed description of these charts can be found in Montgomery (1991).

### Chart Tests

The purpose of a control chart is to detect trends in the data so that actions can be taken before critical limits are reached. Tests have been devised to identify unexpected trends such as continuous runs of increasing or decreasing points.

### Sampling Plans

Acceptance sampling is sometimes performed on batches of incoming goods to see whether the batch conforms to desired standards. Sampling schemes can be tuned to the desired level of precision.

### Design of Experiments

For some machine production systems, it may be necessary to know how the product output changes with changes in input variables. A series of experiments may need to be conducted where several variables are incrementally changed and the output response is measured. By using the "experimental design module" in SQC packages, the tests can be designed to minimise the number of runs needed whilst providing the maximum amount of valuable information.

## RESULTS

Features of the four SQC packages evaluated are summarised in Table 1. The programs cover a range of prices reflecting function and flexibility. A summary of costs and specifications is given in Table 2. No recommendations are made on which program is appropriate as each potential user will have their own requirements and budgets.

### MINITAB Release 8

MINITAB is a widely used and well-known general statistics program that has been available for many years. It is popular for its ease of data manipulation and a wide variety of data description

*Table 1 - SQC program functions*

	MINITAB	STATISTIX	SYSTAT	SAS
X mean	●	●	●	●
R range	●	●	●	●
S standard deviation	●	●	●	●
S <sup>2</sup> variance			●	
I individual obs	●	●		●
MA moving average	●			●
EW MA exponential	●	●	●	●
MR moving range	●	●		●
P count	●	●	●	●
NP count per unit	●	●	●	●
C poisson count	●	●	●	●
U poisson count/unit	●	●	●	●
T2 multivariate			●	
Box			●	●
Chart tests	●	●		●
Pareto chart	●	●	●	●
Process capability	●			●
Histogram	●	●	●	●
Scatter diagram	●	●	●	●
Cause and effect				●
Sampling plans				●
Design of experiments	●		●	●



*Table 2 - SQC program specifications*

	MINITAB	STATISTIX	SYSTAT	SAS
Cost (single user)	\$1330	\$950	\$2960	\$3650
Minimum Hardware	286	286	286	386
DOS version	> 3.0	> 2.20	> 3.0	> 3.0
Minimum RAM	1Mb	512K	640K	8Mb
Hard disk space used	5Mb	1.4Mb	6Mb	60Mb
Windows 3.1			●	●

analyses. The version tested was Release 8 which is the most recent and only version to support SQC features. MINITAB Release 8 is a DOS version but allows the use of a mouse. Commands can be recalled and run in "batch" mode. The software comes with very good manuals, one of which is an elementary statistics textbook based on MINITAB examples.

#### **STATISTIX Version 4**

Like MINITAB, the upgrade from Version 3 incorporates SQC analyses. STATISTIX V4 concentrates more on charting and produces high quality charts rapidly. It lacks some basic tools such as process capability and the more advanced SQC techniques of experimental design and sampling plans. STATISTIX V4 is easy to use but lacks any batch command capabilities.

#### **SYSTAT Version 5.1 QC STAT**

SYSTAT comes for either DOS or Windows 3.1. However, the QC module at present is only available for DOS. The soon-to-be-released Version 6 of SYSTAT should have QC STAT integrated in the main SYSTAT Windows program. The Windows version is very impressive in data handling and description. The QC application comes as a separate module that must be purchased in addition to the

main SYSTAT module. However, as a bonus the graphics package SYGRAPH is given free with the QC module to enhance the presentation of charts. Despite having some additional QC procedures, QC STAT does not have basic features such as process capability analysis, nor some of the control chart tests that are present in other programs.

#### **SAS Version 6.08 for Windows 3.1**

SAS/QC software is a supplementary group of procedures and functions for the SAS system. Versions earlier than 6.08 contain all basic QC tools except for "cause and effect" diagrams which are now in the Windows versions. The addition of the Windows graphical user interface has been a major step forward in improving the ease of use of SAS which is a comprehensive but difficult program to use. Despite its user unfriendliness, SAS is the most powerful and sophisticated statistics program available. SAS contains the widest variety of QC analyses techniques of all the packages evaluated. It is designed more for corporate and research users who require advanced data analysis techniques. SAS also has the most comprehensive data sorting and manipulation features. It is a programming language which can be used to construct QC applications and reports tailor-made to the user needs.

CHH Forests Limited, Kinleith Region, has developed specialist SAS programs for their own QC needs.

The specifications for SAS given in Table 2 are for SAS for Windows 3.1 and include Base SAS, Graphics and QC Modules. The cost given is the initial licence fee; annual fees for lease are charged thereafter.

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## SUPPLIERS

### MINITAB:

SIR Australasia Pty Ltd.,  
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### SYSTAT QC STAT:

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