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COMPUTER PROGRAMS IN BASIC LANGUAGE FOR ATOMIC ABSORPTION FLAME SPECTROSCOPY

Part 2. Documentation

W. G. Boyle, Jr.

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FOREWORD

This report covers work performed by the Lawrence Livermore Laboratory for the United States Environmental Protection Agency under Interagency Agreement EPA-IAG-D7-0321.

Part 1, "Operating Instructions," of this UCRL report contains the operating instructions for the programs described in more detail here (Part 2) as well as instructions for loading and running the programs.

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ABSTRACT

There are three computer programs, written in the BASIC language, used for taking data from an atomic absorption spectrophotometer operating in the flame mode. The programs are divided into logical sections, and these have been flow-charted. The general features, the structure, the order of subroutines and functions, and the storage of data are discussed. In addition, variables are listed and defined, and a complete listing of each program with a symbol occurrence table is provided.

INTRODUCTION

These programs are updates on the flame-type Atomic Absorption (AA) Programs. The main changes are in the Least Squares Subprograms, which must be changed slightly to run on version 4.2 BASIC.* Another change is the implementation of the VAL function, which was not available previously. A few other minor changes have been made, but probably the one that is most noticeable is the re-reading of the first baseline at the beginning of a run; now a delay is used to allow time for the operator to set the baseline solution (blank) in place when not using the auto-sampler. The number of decimal places in the Final Report is no longer dependent on the concentration units (which can be anything), but is entered at Final Report time in response to a computer prompt. The method of additions using spiked samples as standards has been added.

These changes are shown on four representative programs:

(1) SMASH1.LL for single-beam instruments that require operator interaction for each measurement.

(2) RSASH1.LL for single-beam instruments that will run samples and standards automatically either in random or sequential order.

(3) SM305.LL, the double-beam counterpart of (1) above.

(4) RS305.LL, the double-beam counterpart of (2) above.

These programs were last updated on the versions delivered to the Municipal Environmental Research Laboratory of the Environmental Protection Agency, and include the features found on those programs, such as dilution factors, reagent blanks, and a standard curve difference table.

All of the above programs still chain to the same three subprograms, LSQ.AA, INT.ME, and RPT.ME.

The changes made in LSQ.AA will be detailed because these are the most significant, insofar as the operation of the programs is concerned.

On the Least Squares Subprogram (LSQ.AA) the following changes have been made:

```
Change 6013 FOR I = 0 to 25
        to 6013 FOR I = 1 to 25
Change 6085 LET T (2*J) = T (2*J) + X1
        to 6085 LET T (2*J+1) = T (2*J+1) + X1
Change 6120 LET T (2*J+1) = T (2*J+1) + X1
        to 6120 LET T (2*J+2) = T (2*J+2) + X1
Change 6150 LET F (J+1, L+1) = T (J+L)
        to 6150 LET F (J+1, L+1) = T (J+1+L)
```

These changes take care of the subscript zero restriction of version 4.2 BASIC.

Of course, the programs on the tape and listings are only representative programs. The proper program names and file names and channel numbers for analog-digital (A/D) conversion must be inserted. These should be inserted at the following locations:

*The BASIC interactive programming language used in this document is Data General's extended BASIC, operating under their Real Time Disk Operating System (RDOS).

- 17 Program name for F3S
- 35 Channel number for single-beam or double-beam instruments
- 1046 Sample I.D. file name for F2S
- 1200 Variables file name for F1S
- 6050 SAVE XXXX (put in proper main program name)*
- 9015 SAVE XXXX (here, also)*
- 6060 CHAIN XXXX (put in proper name of Least Squares Subprogram).
- 9020 CHAIN XXXX (put in proper name of Interim Report Subprogram).

In addition, the Interim Report Subprogram (referred to here as INT.ME) calls the Final Report Subprogram (referred to here as RPT.ME) at 7200:

7200 CHAIN RPT.ME.

Finally, proper file names must be added to the Final Report Subprogram at 3040, 3045, 3050,

*An important change because the programs automatically save themselves when chaining.

3055, 3060, 3065, 3070, and 3075. Some of the programs may have been delivered with a REM at 8018 REM GO TO 8025 FOR ON-LINE DATA, so that data can be typed into the programs for familiarity. By placing GO TO 8025 here, the on-line call is implemented.

An input READY?, X\$ message at 8015 can be added to the RS type programs. This addition will allow time for the operator to run samples by hand if he does not want to use the auto-sampler.

RPT.ME may be called separately as a stand-alone program for writing reports from the file records produced from the four representative programs listed previously.

The two versions of the Bracket Program have not been changed significantly. A beam corrector algorithm has been added to the double-beam version. The following locations should be changed for file names:

- 27 for the Interim Report file
- 9605 for the Final Report file
- 37 for single- or double-beam channel number
- 36 for double-beam channel number

The Bracket Program does not chain to other programs. A summary of program names and file names is as follows:

<u>Program</u>	<u>Function</u>	<u>Files</u>
SMASH1.LL	Single-beam flame AA Semiautomatic	VASH1.SM IDASH1.SM
RSASH1.LL	Single beam flame AA Automatic, with random or sequential sampling	VASH1.RS IDASH1.RS
SM305.LL	Double-beam flame AA Semiautomatic	V305.SM ID305.SM
RS305.LL	Double-beam flame AA Automatic, with random or sequential sampling	V305.RS ID305.RS
BRASH1.LL	Single-beam flame AA Automatically brackets samples for interpolation	INASH1.BR FNASH1.BR
BR305.LL	Double-beam flame AA Automatically brackets samples for interpolation	IN305.BR FN305.BR
INT.ME	Writes Interim Reports	
RPT.ME	Writes Final Reports	
LSQ.AA	Does least squares calculations	

SEMI-AUTOMATIC PROGRAM

General Features

The program may be started by typing LOAD XXXX where XXXX is the current name of the program as saved on the disk. To run the program, type RUN, which starts the program with the initialization and dialogue. Alternatively, RUN XXXX will begin the initialization and dialogue directly. The general features of the program are shown in Fig. 1.

Initialization and Starting Dialogue

The operator enters the initial dialogue by answering the questions asked by the computer at the start of the program. The questions pertain to information the operator may use in his Final Report and to the standards and sample information. The first question is OPERATOR'S NAME, AND INSTRUMENT to which almost anything may be typed except commas (commas are delimiters and will give an error message). A return will terminate (or bypass) this section and most of the "title" type information. Next comes the question ELEMENT AND SAMPLE SOURCE; then MAXIMUM I.D. LENGTH of the sample identifier is given (log number or source, etc.), and then the number of samples being run. A carriage return is used to indicate that messages have been answered and should be stored.

Next, the sample code for each unknown is entered in response to questions numbered from 1 to N1 where N1 is the number of unknowns. This code determines the numerical order of the unknowns. Check standards, duplicate unknowns, and spiked samples are entered here and their I.D. must begin with CS, DU, or SP. A reagent blank may also be entered. It must have an R in the last blank space allowed for I.D. An opportunity to correct these entries comes next, and then come questions about instrument conditions and baseline limit. The instrument condition prompt is for general information. The limiting value of the baseline is then entered. This value is usually a large number around 12,000 for single-beam instruments and guards against the baseline drifting off to saturate the A/D converter (16,383). For double-beam instruments, it is the maximum baseline that will be tolerated in optical absorbance units; i.e., 1% is 0.0044 AU.

Units are simply for information, and anything can be entered here, but usually PPM, PPB, or UG/ML are used.

The integration time in seconds would be entered next. This is converted internally to the number of points to be taken and returned to the operator. A point is taken every 2/15th of a second. The integration time is the length of time the program actually integrates a reading. The pause time in seconds follows; this is the time that elapses before integration begins. It allows the signal to become steady as aspiration carries the sample through the burner and allows time for operator interaction if automatic sampling is not being used.

After asking for the number of standards, the program asks for the concentrations of standards. They must be entered in increasing order, followed by spike values, if any.

For single-beam instruments a dark current must be measured. Therefore, at the message, COVER SLIT RETURN WHEN READY, the operator must cover the entrance slit of the instrument and obtain a dark current reading. This reading is displayed on the terminal and should be slightly above zero. A carriage return initiates integration.

Dialogue for Main Body of Program

After initialization and selection of variables the program automatically reads a baseline. At this point the operator may select the next solution to be measured: baseline or blank, standard, or sample (unknown).

After an appropriate delay, which has been previously entered, the computer integrates the signal from the AA instrument for a known length of time, calculates the absorbance, and subtracts or allows for the absorbance of the blank (see Appendix A). The percent optical absorption, the optical absorbance, the position of the sampler (whether or not it is used), and the reading of the last baseline are returned for the operator's information. Unless averaging has been requested, it is this baseline that has been used in the calculation.

The operator may average baselines or blanks by signaling the computer before it reads a sample or standard. In this situation a baseline must also be taken after the sample or standard has been read, and the average of this new baseline and the last previous baseline is used in the calculations. The value of the baseline returned to the operator will now be the new baseline and not the average. This new baseline is used in subsequent measurements.

Fig. 1. General features of Semiautomatic Program.

This procedure is continued until all samples and standards have been read. Readings may be repeated, in which case the former value is replaced with the new value. When the operator is satisfied with the values obtained for all the samples and standards, he can select a method of calculation: (1) first degree, second degree, or third degree least squares fit of the standards, (2) interpolation between the two nearest standards, or (3) method of additions. In the case of least squares fitting, the coefficients of the equation, the coefficient of determination, and the differences from the standard curve are returned. In the case of interpolation, the word INTERPOLATION is returned. In the case of method of additions, the program uses the standards section to record the values of the spiked unknown. The first concentration should be zero. The first sample must also be this unknown and subsequent samples should have similar matrices.

At this point new values may be taken and results recalculated or an Interim Report requested. When a report is requested, the following information is displayed: the number of the run,^{*} the sample number and identification, the value of the unknowns from this run, the average value of the unknowns, the standard deviation and the relative standard deviation from previous runs and the current one, and quality control values (percent recoveries) for that run.

After this information has been displayed, the operator can ask for a copy from the printer. He can also choose to recalculate the results by a different method and to accept or to reject the results. If the results are rejected, the values of this set of data are removed from the running statistical parameters, and the run counter is decremented.

During the first run if a standard is missed, a warning message is issued. During subsequent runs the operator has the option of not running new standards. Warnings of missing standards are available only during the first run.

Syntax errors are given throughout the running of the samples and standards. If an extra unknown is run, however, no error message is given, but the results are not available in the normal routine of the program. The program cannot distinguish a standard or an unknown run with a label different from that established during the initialization phase of the program.

When the operator decides he does not want to make another run, a Final Report is written as a

hard copy after dilution factors (if any) are entered. The Final Report gives the last statistical values for the unknowns, the title of the analysis, information as to the date, operator's name and instrument, the number of runs, the number of standards, concentration of the standards, source of the standards, and parameters of least squares fit (or the word INTERPOLATION), and instrument conditions.

The Final Report also (1) returns percent recovery of check standards, duplicate unknowns, and spiked samples that are used for quality control, (2) displays a reagent blank value, and (3) affords the opportunity of subtracting that value if desired.

Structure

The main program is divided into sections as follows: Section 1 to 50 is for initialization and for calling subroutines that allow for analysis input information. Also, these subroutines set up parameters for an initial baseline reading. Section 100 directs the program to the proper subroutine upon receiving information from the Command String Interpreter (CSI). Section 950 is a subroutine for analysis input information. Subroutine 2000 is the CSI. Section 5000 positions the sampler (if it is being used), takes the signal reading from the instrument, checks to see whether the baseline is to be averaged and if it is, repositions the wheel and automatically takes a second baseline reading, and finally calculates an absorbance. Section 5000 does this by calling a number of subroutines: Subroutine 8500, to position the wheel. Subroutine 8000 to take a reading, Subroutine 7000 to read a baseline.

Section 6000 sets up the files for the Least Squares Subprogram and chains to it. Finally, Section 9000 sets up the files for the Interim Report Subprogram and chains to it. This subprogram calculates running statistics, prints an Interim Report, and allows options for recalculating, accepting, or rejecting results and chaining to a Final Report Subprogram.

Subroutine Order and Functions

Subroutine 950 is called to ask the operator for information about the analysis and to receive information on standards and unknowns. Subroutine 200 sets up constants for an automatic baseline reading at the beginning of each run. Line 140 calls various subroutines depending on instructions from the CSI. Subroutine 175 gives a BAD SYNTAX

*A run is defined as a complete set of data obtained from standards and samples and used to calculate unknown concentrations.

warning message. Subroutine 5000 controls the type of reading taken. Subroutine 6000 calls the Least Squares standardization Subprogram, 7000 reads the baseline, and 9000 calls the program that does the calculations, writes the Interim Reports, and calls the Final Report Subprogram. Subroutine 2000 is the (CSI) and determines what subroutine will be selected at line 140.

Some of these subroutines call others in turn. For instance, subroutine 5000 reads standards and samples and then calls subroutine 8500 which positions the wheel, which in turn calls subroutine 8000, which reads the signal and may call subroutine 7000 to read a baseline if baseline averaging is requested. Similarly, subroutine 7000, which reads a baseline, also calls subroutines 8500 and 8000 (see Fig. 2).

Data Storage and Arrays

The program is set up to run 10 standards and 50 samples a maximum of 10 times each. The concentrations of the standards are stored in the array C(10). The optical absorbance or final signal used to calculate concentration are stored in the array S(60). The first part of the array, up to a maximum of 10, contains standard absorbances, and the rest contains unknown absorbances. These values are overwritten at the beginning of each new run so that the old values are lost.

The concentrations of the unknowns are stored in the two-dimensional array A(10,50). The first value is the run number, and the second value is the concentration of that numbered unknown. For instance, A(3,10) would contain the value of unknown number 10 found during run number 3. Thus, the concentration for each run is always available until cleared by reinitializing the program for a new analysis.

The running average is stored in the array D(50) and the variance in V(50). Arrays B(50) and O(50) store the same values, respectively, for the previous run, so that, if the latest run data are rejected, valid statistical parameters are maintained.

The array L(50) provides 50 extra variables, which can be called upon when needed. About 20 of these have been used in these programs.

Most of the remaining arrays are used in the Least Squares Subprogram.

The variables containing literal information are marked with a dollar sign (\$). Thus Z\$3 contains the information typed in response to the question (prompt) ELEMENT AND SAMPLE SOURCE? In general, 72 characters have been allowed for each category of literal information.

The scratch variable X\$ contains the information typed in response to the question SAMPLE I.D. CODE? This information is successively written to the I.D. sample file as each sample is identified. At report time this file is read and formatted according to the maximum length of the I.D. code (entered in the program and stored in N3). The scratch variable X\$ allows a maximum of 15 locations for each identifier.

Some Details of the Program

As mentioned previously, the program calls various subroutines in response to the operator's request. The operator's request is decoded by the CSI, which looks at each character and then assigns values to the variables MO and K, and looks for further numbers or letters before directing the program to go to the proper subroutine. The program direction is controlled by an ON MO + 1 THEN GOSUB command.

Legal commands to the CSI are S1 to S(NO), which directs the program to read a standard; U1 to U(N1), which reads an unknown, B, which reads a baseline, S1!B, or U3!B, for example, which reads the designated standard or unknown and then a baseline, and averages the latest baselines before calculating an absorbance; C1, C1, C2, C3, or CA, which direct calculations by interpolation, first-, second-, or third-degree least squares fit or method of additions, and R which requests an interim report.

In order to find the proper number the CSI must evaluate the typed expression and convert the expression to an actual number. The BASIC function VAL is used. This is found at subroutine 2150, which incorporates some error routines for meaningless characters (see Fig. 3).

Data-Taking Routine

Subroutine 5000 calls several subroutines, which position the sampler, read the analog-to-digital (A/D) converter, and read an extra baseline if necessary. This subroutine also calculates absorbances. Because it is common to all programs, this calculation is covered in Appendixes A and B.

Sample Wheel Position and A/D Reading

Subroutines 8500 and 8000 use BASIC calls to position the sampler and read the A/D, respectively (see Appendix C).

Fig. 2. Subroutine flow, Semiautomatic Program.

Least Squares Subprogram

This routine is common to all programs and is covered in Appendix D.

Report Writing

Subroutine 9060 calls the program that produces reports. The reports themselves are self-explanatory, but certain calculations are embedded in these programs; namely, the method of interpolation and the running statistics (see Appendixes E and F).

Files

Two files are used in the course of the program: a sample I.D. file and a file for the storage of

variables. These files are opened as random access files (Mode 0), and information is stored according to record number. This information is used by the Least Squares, the Interim Report, and the Final Report Subprograms. Provision is made to change the names of these two files at final report time if a permanent disk record is desired. Otherwise, the files are overwritten by the next set of data from a new analysis. Appendix G shows the structure of these files.

Program Listings

Appendix H gives Definitions of Variables, and Appendix I gives Listings of Programs.

RANDOM PROGRAM

General Features

The initialization phase of this program is similar to the previously described program; however, the operator must choose between a sequential or random mode of operation. He must also choose how often the baseline is to be read. If he chooses to average the baseline, then a reading is taken after every sample or unknown.

If sequential operation is selected, the computer determines a baseline and then reads the standards and unknowns as they were entered into the program. If random operation is selected, the computer determines a baseline and then randomly selects the next position to be read. The computer does this until all samples and standards have been read once. These selections are interrupted to reread the baseline at the appropriate intervals.

At the end of the first run the computer stops its run and allows the operator to choose a method of calculation as the operator has done in the previously described program. This method of calculation is then used during each subsequent run. The computer stops at the end of each run to give the operator the same ending options as previously described except for the method of calculations. However, because the selection of standards and samples is under computer control, the standards are redetermined during each run.

Structure

The Random Program is structured similar to the Semiautomatic Program. Only the differences will be discussed here. Because there is no detailed CSI, line 40 directs the program to Subroutine 109, which determines the mode of baseline reading. The program then goes to Subroutine 200, which determines whether the sampling will be sequential or random. The program then proceeds to Section 3000 (random) or Section 3500 (sequential). These sections select the sample, standard, or baseline to be read, call the appropriate subroutines to position the sampler (if used), take a reading, or calculate results and write reports. These subroutines are virtually the same as previously described.

Subroutine 2000 contains an interpreter to determine the method of calculation from the input C1, C1, C2, C3, or CA. These inputs have the same meaning as before.

Subroutine Order and Functions

The chief difference in the order of the subroutines and functions is that they are called from Subroutine 3000 or 3500 instead of by the operator input and the CSI. As mentioned previously, the method of calculation is chosen at the first run, and subsequent runs use this method with no option for changes.

Data Storage and Arrays

The data storage is the same as previously described. There is an additional array set up to check a random number selection as a duplicate; E(1).

Files

Two files are again used in this program. The file structure is the same as previously described, and the three programs that are called by chaining are exactly the same as in the Semiautomatic Program.

Some Details of the Program

The random number generator is the unique portion of this program. Currently we use the standard

technique of generating a random number from one to the total numbers of samples and standards by using an expression involving the RND function. Each time a number is generated a table is entered. When a duplicate number is generated the table will indicate this. A RANDOMIZE statement makes the order of selection unpredictable.

The scheme works well for numbers up to 50 and seldom requires more than 100 generations to select 50 positions. However, beyond this the time increases rapidly, and 100 positions would take an extremely long time (hours) to generate the last few unfilled numbers because of the many duplications being generated. Other random selection schemes are available if more than 50 samples must be run in a random manner (see Fig. 4).

BRACKET PROGRAM

General Features

The initialization and starting dialogue is again similar to that of the other two programs. The exception is that a relative standard deviation must be entered after the UNITS have been declared. The baseline frequency or averaging is determined by the appropriate response to the question in Subroutine 100, similar to the Random Program.

This program is considerably different from the first two programs. It is a routine that first reads all of the standards. It then reads the first unknown and locates the two standards that bracket it, reads the two standards in order, and calculates a concentration by interpolation. It then rereads the lower standard, the sample, and the higher standard, and calculates a new concentration with cumulative statistics. It will repeat this last step once more for a total of three determinations, called runs. (The number of repeats is stored in variable L(30) set at 3 at line 20.)

The precision is tested for acceptance against a relative standard deviation figure previously entered by the operator. If rejected the entire bracketing procedure is repeated with three more runs averaged. If this procedure is rejected three times (called trials), the operator is alerted. Otherwise the system continues on with the next sample. (The number of rejects before the operator is alerted is stored in L(33) set at 3 at line 21.)

A continuous status report is displayed and printed on an ASCII disk file. This report contains

information about the number of the run, the number of the unknown, the concentration, the average concentration, the relative standard deviation, and the number of the trial.

In case the unknown is not bracketed, a message is given that says UNKNOWN NO. X LAST STANDARD TOO LOW (or FIRST STANDARD TOO HIGH) with the approximate concentration calculated from the last two (or first two) standards.

In case the relative standard deviation is higher than the set limits, the message UNK NO. X TRIED THREE TIMES AND RSD IS YYY WHICH IS > ZZZ is given.

The Final Report is written on the disk and is different from the previous reports because it is a complete ASCII file in itself. The number of trials is recorded; failures to meet the relative standard deviation are recorded and nonbracketed unknowns are included with the approximate concentration (see Fig. 5).

Structure and Subroutine Flow

After initialization and input have been completed, the program is directed to Section 3500 where the main program differences occur. This routine reads the standards in sequence while maintaining the baseline as directed in the input information.

Fig. 4. Random number selection.

Fig. 5. General features of Bracket Program.

Section 4000 begins the routine that reads unknowns, finds bracketing standards, reads them, and develops the statistics. This section uses Subroutine 4200 to read the standards and unknowns and to keep track of baselines. After comparing the unknown to the standard, the program goes to Subroutine 4800 to warn about the last standard being

too low, or Subroutine 4830 to warn about the first standard being too high, or Subroutine 4400, which runs the unknown and the bracketing standards three times. This subroutine in turn calls Subroutine 4200 to take readings (see above), and Subroutine 4600, which calculates concentrations by interpolation and running statistics (and prints the results) in

the same way as the previous programs do these calculations. Subroutines 5000, 7000, 8000, and 8500 are the same as previously explained. Section 9000 writes the Final Report, which does not chain to other programs.

There are no options for calculations of concentrations. They are done only by interpolation (see Fig. 6).

Files

There are two ASCII files that are saved on the disk until overwritten: INASH1.BR and FNASH1.BR for single-beam, and IN305.BR and FN305.BR for double-beam.

Some Details of the Program

As mentioned previously the number of runs can be changed by changing the value of the variable L(30) at line 20. The number of attempts at meeting the relative standard deviation criteria can be

changed by changing the value of the variable L(33) at line 21.

When an unknown is very close to a first or last standard but is just bracketed by standards, it will, of course, be run three times. The number three is stored in L(30). At this point if the Relative Standard Deviation test fails, the next attempt at three runs is accomplished by treating the unknown as a new sample; i.e., the unknown is read and compared to the standards again. This time it might not be bracketed, and thus it will be rejected.

The original standards table is not updated by the further reading of the standards as bracketing is done, because this updating can cause an uneven and confusing standards table at any one time.

Data-Taking Routines

These are the same as those previously described.

Reports

Section 9000 prints a Final Report. No major calculations are completed here, however, and this section prints final results as read.

Fig. 6. Subroutine flow, Bracket Program.

APPENDIX A

DEFINITION OF ABSORBANCE

Absorbance is calculated as the logarithm to the base 10 of the ratio of 100% transmission to the percent transmission. For double-beam instruments the percent transmission is developed directly from the BASIC call that reads the raw data. This percent transmission is then converted to optical absorbance by calculating the common logarithm. Baselines are also calculated as absorbances and subtracted directly from the absorbance of interest.

Single-beam instruments use a dark current measurement that establishes the total range of readings when used with the baseline measurements. The percent transmission is then calculated using this range; the absorbance is calculated as before.

APPENDIX B **SUBROUTINE 5000***

*Call sampler, get data, calculate absorbance.

APPENDIX C

SUMMARY OF THE BASIC CALLS USED

Subroutines 8000 and 8500 use BASIC calls that are summarized here (see Fig. C1).

Delay

CALL 1, T2

where T2 is the number of 1/60-sec periods of delay. T2 is actually entered as seconds of pause time and transformed to periods of delay in the BASIC program. T2 must be a variable.

Read

Single beam

CALL 6, L(4), L(6), L(1)

where L(4) is the channel number of the A/D converter, L(6) is the number of points entered as integration time and transformed to number of points by BASIC as one point every 2/15th sec, and L(1) is the integrated signal contained in the A/D converter.

Double beam

CALL 11, L(4), L(6), L(8), L(5), L(7)

where L(4) is the channel number of the A/D converter for the reference beam, L(6) is the number of points again at 2/15th sec, L(8) is the integrated signal from the reference beam, L(5) is the channel number of the A/D converter for the sample beam, and L(7) is the integrated signal from the sample beam.

Stepping Motor

CALL 21, D, (Function)

CALL 22, D, (Position)

These calls initialize and position the stepping motor, which controls the sampling arm; D refers to a device code and is set to an integer, depending on which sampler is used (it must not be zero). When the Function or Position is equal to zero, the current position of the wheel is initialized to 1.

When (Function) = 1-arm is raised
 = 2-arm is lowered
 = 3-a solenoid valve is on
 = 4-a solenoid valve is off

Functions 1 and 2 are performed within the assembly language calls also, so that their use here is not mandatory. Functions 3 and 4 are not used but may be incorporated into some valve-driven device in the future. There are also provisions for adding two extra functions to this call (5 and 6).

The position call goes from 1 to 40 when the operator inserts the number in the (Position) variables. The assembly language routine picks the shortest route to the next position.

Fig. C1. Subroutines 8500 and 8000 (position sample and take data).

APPENDIX D

LEAST SQUARES SUBPROGRAM

Equations for calculating the concentration of unknowns from the experimentally determined absorbances are derived by fitting a least squares polynomial to a set of data points obtained from a set of calibration standards. The polynomial is:

$$y = a_1 + a_2X + a_3X^2 + \dots + a_{M1}X^{M1-1},$$

where y is the concentration and X is the absorbance.

A polynomial of M1 terms (degree M1-1) may be fitted to an array of M2 data points by solving the following matrix equations:

$$[F] = \begin{bmatrix} M2 & \Sigma X & X^2 & \cdot \\ \Sigma X & \Sigma X^2 & \Sigma X^3 & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \Sigma X^{(M1-1)} & \Sigma X^{2(M1-1)} & \cdot & \cdot \end{bmatrix}$$

$$[H] = \begin{bmatrix} \Sigma Y \\ \Sigma X \cdot Y \\ \Sigma X^2 \cdot Y \\ \cdot \\ \cdot \\ \cdot \\ \Sigma X^{M1-1} Y \end{bmatrix} \quad \text{and} \quad [W] = \begin{bmatrix} a_1 \\ a_2 \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ a_{M1} \end{bmatrix}$$

Then:

$$[F] \times [W] = [H],$$

$$[G] = [F]^{-1}$$

and

$$[W] = [G] \times [H].$$

The coefficients of the desired polynomial are calculated by inputting the degree desired and generating the $[F]$ and $[H]$ matrices from the concentration and absorbances of the calibration set, $Y(\)$ and $X(\)$.

The coefficient of determination is defined as:

$$\Sigma(Y_i - \bar{y})^2 / \Sigma(y_i - \bar{y})^2,$$

where Y_i is the value found on the least squares curve for the value x_i ; $\bar{y}$ is the mean y value and x_i and y_i are the experimental points. It is the ratio of the variation and is a measure of the "goodness of fit."

The polynomial is conventionally solved for absorbance as the dependent variable and concentration as the independent variable because the concentration of the calibration set is more accurately known than the experimentally determined absorbance value. However, this procedure requires solving the polynomial for concentration for each experimentally determined absorbance value rather than solving for concentration directly as is often done by reversing the independent and dependent variables. Experience has shown that the errors involved in this reversal are negligible.

Concentrations are calculated by solving the polynomial (first, second, or third degree) requested by the operator by direct substitution of the appropriate absorbance.

APPENDIX E

METHOD OF INTERPOLATION*

$C(J)$ = Concentration of Jth standard
 $S(J)$ = Absorbance of Jth standard
 A = Concentration of unknown
 $S(P)$ = Absorbance of Pth unknown

*Found at 9080 to 9160.

APPENDIX F CALCULATIONS OF RUNNING STATISTICS

APPENDIX G

FILE STRUCTURE FOR SEMIAUTOMATIC AND RANDOM PROGRAMS ^a

Record No.	Information
A. File: Standardization and Initialization Data.	
1 ^b	Concentration of standard, last absorbance of standard
2	Concentration of standard, last absorbance of standard
3	Concentration of standard, last absorbance of standard
4	Concentration of standard, last absorbance of standard
5	Concentration of standard, last absorbance of standard
6	Concentration of standard, last absorbance of standard
7	Concentration of standard, last absorbance of standard
8	Concentration of standard, last absorbance of standard
9	Concentration of standard, last absorbance of standard
10	Concentration of standard, last absorbance of standard
11	Concentration of spike
12	Concentration of spike
13	Concentration of spike
14	Concentration of spike
15	Concentration of spike
16	Concentration of spike
17	Concentration of spike
18	Concentration of spike
19	Concentration of spike
20	Number of standards, unknowns, spikes, alphanumerics, baseline limit, integration time, pause time
21	Number of runs, mode of calculations, baseline frequency
22	Least squares coefficients, coefficient of determination
23	Program name, sample file name, standard file name, random or sequential
B. File: Sample I.D. and Results.	
1 through 50	Sample name, last absorbance, average concentration, variance, interpolation flag, dilution factor

^aFiles opened in random mode.

^bRecords 1 through 19 are compressed upwards.

APPENDIX H

DEFINITIONS OF VARIABLES

Program SMASH1.LL (Semiautomatic, Single-Beam)

<i>Variable</i>	<i>Definition</i>
A	Number of unused spaces in sample identification
A(J, I)	Array containing concentration for run number and sample number
B	Baseline value
B1	Storage for previous baseline value
B2	Average of previous and new baseline value
B9	Baseline limit for drift warning
C\$	String for command string interpreter (CSI)
C9	Constant = 1000 to test coefficient of variation
C(I)	Concentration of standards
D1	Constant = 1
D(I)	Average value of unknowns
E5	Number of spikes
F1	Constant = 1 for file numbering for F1\$
F1\$	String name of variable file
F2	Constant = 2 for file numbering for F2\$
F2\$	String name of sample file
F3\$	String name of program
F4\$	String for file symmetry
I	For loop counter, sample number
J	For loop counter, spike number
K	Flag for baseline averaging
L(1)	Average counts from instrument reading
L(2)	Storage for current instrument reading
L(4)	Channel number for CALL 6 (take data)
L(6)	Integration time, number of points
L(10)	Constant for CALL 21 (raise arm)
L(11)	Constant for file symmetry
L(15)	Constant for CALL 1 (delay)
L(16)	Position variable per CALL 22 (position wheel)
L(20-29)	Spike concentrations
M	Store value of number part of C\$; index for calculated absorbances, wheel position
M0	Value from CSI which directs program to proper subroutine
M1	Value indicating type of calculation to be performed
N0	Number of standards
N1	Number of unknowns
N3	Maximum length of sample identification
P1	Sums of number of standards and unknowns for indexing
P2	Constant for file record number
Q	Dark current
R	Number of runs
S	Dummy variable to read and write file absorbance values
S(1, 60)	Absorbances for standards and unknowns for one run
T2	Pause time
V(I)	Variance
X\$	Dummy string variable to read and write sample identification into files
X1	Stores wheel position, number of corrections and baseline
X3	Index counter for filling in sample identifier blanks

<i>Variable</i>	<i>Definition</i>
Z2\$	String to hold operator's name and instrument
Z3\$	String to hold element and sample source
Z4\$	String to hold instrument condition
Z7\$	String to hold units
Z9	Constant to start location of spike values

Extra Variables for RSASH1.LL (Random, Sequential, Single-Beam)

<i>Variable</i>	<i>Definition</i>
B5	Counter for reading baseline
C\$	String for input correction query
E(I)	Table of random number use
F4\$	String for random or sequential flag
L(11)	Baseline frequency or averaging flag
M5	Value indicating type of calculation performed (M1 in Semiautomatic Program)
M9	Number of solution to be sampled next, generated by program (M in Semiautomatic Program)

Extra Variables for INT.ME (Interim Report)

<i>Variable</i>	<i>Definition</i>
A1	Absorbance value for regression equation; final volume of a dilution
A2	Initial volume of a dilution
B(I)	Array to hold previous average concentrations
C\$	String to hold partial value of sample identifiers and for queries
C0	Contains concentration from regression equation
D4	Temporarily holds relative standard deviation
D5	Constant containing number of decimal places for Interim Report (3)
F(I)	Dilution factors
L(19)	Temporarily holds numerical part of spike command
L(40)	Recovery of quality control samples
M1	Value of numerical part of sample identification
N7	Number of dilutions
O(I)	Array to hold previous variances
T0	Intermediate value for interpolation
V1	Variances
V(I)	Array for value used to calculate variance
X	Function variable [FNQ(X)]
X1	Used in calculation of spike locations
X3	Flag for hard copy print of quality control recoveries
Y0, Y1, Y2, Y3	Coefficients of regression equation

Extra Variables for RPT.ME (Final Report)

<i>Variable</i>	<i>Definition</i>
D\$	Dummy string variable to read files String for reagent blank query
D5	Temporarily contains average concentration
Gi	Number of places after decimal point for concentration and standard deviation
I2	Reagent blank index number
M2	M2 sample number found from sample identification for spikes
W\$	String flag for operator or customer report and renamed file
X5	Length of sample I.D. to find R for reagent blank signal

Extra Variables for LSQ.AA (Least Squares Calculations)

<i>Variable</i>	<i>Definition</i>
C6, C7, C8	Variables use in final calculation of coefficient of variation
C9	Coefficient of variation
F, G, H	Matrices for least squares calculation
J	Counter for array positioning
K	Matrix for coefficient of variation calculation
L	Counter for array positioning
P	Variable for matrix setup
Q	Matrix for coefficient of variation calculation
T	Variable for matrix setup
U	Variable for matrix setup
W	Matrix for least squares calculation
X1	Variable for matrix setup
X3	Temporarily holds concentration value
Y1	Temporarily holds absorbance value
Z	Matrix for coefficient of variation calculation

Extra Variables for SM305.LL and RS305.LL (Double-Beam, Semiautomatic or Random/Sequential)

<i>Variable</i>	<i>Definition</i>
L(3)	Difference between reference and sample beam signal
L(4)	Channel number for reference beam (CALL 11)
L(5)	Channel number for sample beam (CALL 11)
L(7)	Sample data
L(8)	Reference data or 10000 for typed input

Extra Variables for BRASH1.LL and BR305.LL
(Bracket Program, Single- and Double-Beam)

<i>Variable</i>	<i>Definition</i>
D4	Relative standard deviation
E	Counter to sound alarm
F2\$	ASCII file name for Interim Report or Final Report
F3\$	Dummy string to hold input from files
L(30)	Number of runs to get standard deviation
L(31)	Relative standard deviation requested
L(32)	Trial counter
L(33)	Number of attempts allowed before going on to next sample
T\$	String to hold concatenated sample file names
T(P1)	Store number of trials needed for each sample
Z2\$	String for initial information
Z3\$	String for sample information
Z4\$	String for instrument conditions
Z5\$	String for standards information
Z7\$	String for units

APPENDIX I

LISTINGS OF PROGRAMS

LISTING OF FILE SMASH1.LL ON 9 / 27 / 1977

PAGE 1

```

0002 REM: LLL,"SMASH1.LL";WALTER BOYLE; SEMI-AUTO PROGRAM
0003 REM: FILES: "VASH1.SM" FOR VARIABLES AND "IDASH1.SM" FOR SAMPLE ID
0004 REM: WHITTEN FOR USE ON JA 82-536 SINGLE-BEAM INSTRUMENT
0005 DIM Z2$(72),Z3$(72),Z4$(72),Z7$(72)
0009 DIM X$(15),E$(10),A$(10,50),C$(10),S$(60)
0011 DIM C$(25),F1$(20),F2$(20),F3$(20)
0012 DIM F4$(20)
0013 DIM L$(50)
0014 DIM D$(50),V$(50),O$(50),B$(50)
0015 LET M1=0
0016 LET X1=0
0017 LET F3$="SMASH1.LL"
0018 LET F4$=""
0019 LET K=0
0020 LET D1=1
0022 LET C9=1000
0024 LET R=1
0025 LET L1(1)=0
0026 CALL 21,D1,M1
0027 REM: INITIALIZE SAMPLER POSITION
0028 REM*****SET PROPER CHANNEL NUMBERS*****
0035 LET L(4)=1
0040 REM: CHANNEL NUMBER FOR JA 82-536
0042 LET P2=20
0043 LET L(10)=1
0045 GOSUB 0950
0047 CALL 1,T2
0050 GOSUB 9040
0100 PRINT "*";
0105 INPUT C$
0110 REM COMMAND STRING
0115 GOSUB 2000
0120 REM COMMAND STRING INTERPRETER
0130 LET M=M1
0135 IF M0>2 THEN LET M=M+N0

```

```
0140 ON M0+1 THEN GOSUB 0175, 5000, 5000, 6000, 7000, 9000, 5000, 5000
0143 REM M0 CODES ARE 0:ERROR,1:S W/B,2:S W/O BASE,3:C
0147 REM 4:B,5:H,6:U W/O B,7:U W/B
0150 IF M0=3 THEN GOTO 0100
0155 PRINT B
0165 PRINT
0170 GOTO 0100
0175 PRINT "BAD SYNTAX!"
0180 RETURN
0200 REM: FIRST READING AT EACH REPEAT IS BASELINE
0201 PRINT "SET-UP FOR BASELINE AND HIT RETURN"
0203 INPUT XS
0205 LET CS="B"
0210 LET M0=4
0212 LET M=0
0213 GOSUB 7000
0215 RETURN
0950 PRINT
0955 PRINT "OPERATOR'S NAME AND INSTRUMENT"
0960 INPUT Z2$
0965 PRINT "ELEMENT AND SAMPLE SOURCE"
0970 INPUT Z3$
1030 PRINT "MAX ID LENGTH, NO. OF SAMPLES";
1035 INPUT N3,N1
1045 PRINT "SAMPLE I. O. CODE"
1046 LET F2$="IDASH1.SM"
1047 LET F2=2
1048 OPEN FILE(F2,0),F2$
1050 FOR I=1 TO N1
1055 PRINT I;
1060 INPUT XS
1062 IF LEN(XS)>N3 THEN GOSUB 6500
1066 GOSUB 6600
1072 WRITE FILE(F2,I),XS
1073 NEXT I
```

LISTING OF FILE SMASH1.LL ON 9 / 27 / 1977
PAGE 3

```

1074 INPUT "CORRECTIONS Y/N ? ",CS
1076 IF CS(1,1)="Y" THEN GOTO 1080
1077 IF CS(1,1)="N" THEN GOTO 1093
1078 IF CS(1,1)<>"N" THEN GOTO 1074
1080 INPUT "NO. OF I.D. CORRECTIONS ? ",X1
1082 IF X1=0 THEN GOTO 1093
1084 FOR J=1 TO X1
1085   INPUT "NO. AND I.D. OF SAMPLE ? ",I,XS
1086   IF LEN(XS)>R3 THEN GOSUB 6500
1088   GOSUB 6600
1091   WRITE FILE(F2,I),XS
1092 NEXT J
1093 INPUT "INSTRUMENT CONDITIONS ",Z45
1135 PRINT "BASELINE LIMIT"
1140 INPUT B9
1145 PRINT "UNITS"
1150 INPUT Z75
1175 PRINT "INTEG. TIME IN SECONDS"
1180 INPUT L(6)
1183 LET L(6)=INT(L(6)*15/2)
1184 PRINT L(6),"POINTS"
1185 PRINT "PAUSE TIME IN SECONDS"
1190 INPUT T2
1193 LET T2=INT(60*T2)
1200 LET F15="VASH1.SM"
1205 LET F1=1
1210 OPEN FILE(F1,0),F15
1215 INPUT "NO. OF STDS. ",N0
1220 PRINT "CONC: "
1225 FOR I=1 TO N0
1230   PRINT I;
1235   INPUT C(I)
1240   LET S(I)=0
1245   WRITE FILE(F1,1),C(I),S(I)
1250 NEXT I

```

```

1260 INPUT "NO. OF SPIKES ",E5
1265 IF E5=0 THEN GOTO 1310
1270 LET Z9=19
1275 FOR J=1 TO E5
1280 LET Z9=Z9+1
1285 PRINT "SPIKE NO. ",J," "
1290 INPUT "VALUE ",L(Z9)
1300 WRITE FILE(F1,N0+1+J),L(Z9)
1305 NEXT J
1310 WRITE FILE(F1,P2),N0,N1,E5,Z28,Z38,Z40,Z75,89,L(1),T2
1312 WRITE FILE(F1,P2+1),R,M1
1313 WRITE FILE(F1,P2+2),0,0,0,0,C9
1314 WRITE FILE(F1,P2+3),F38,F28,F18,F48
1320 FOR I=1 TO N1
1325 FOR J=1 TO 10
1330 LET A(I,J)=0
1335 NEXT J
1340 NEXT I
1350 FOR I=1 TO N1
1355 WRITE FILE(F2,N1+I),A(1,I),A(2,I),A(3,I),A(4,I),A(5,I),A(6,I),A(7,I),A(8,I),A(9,I),A(10,I)
1360 NEXT I
1370 PRINT "COVER SLIT; HIT RETURN WHEN READY"
1380 INPUT K8
1390 GOSUB 8000
1400 LET Q=L(1)
1410 PRINT "DARK CURRENT= ";Q
1420 RETURN
2000 IF C$(1,1) < "A" THEN GOTO 2130
2002 IF C$(1,1) = "R" THEN LET M0=5
2005 IF C$(1,1) = "R" THEN RETURN
2010 IF C$(1,1) = "B" THEN LET M0=4
2015 IF C$(1,1) = "B" THEN RETURN
2020 IF C$(1,1) < "C" THEN GOTO 2060
2030 LET M0=3
2035 IF C$(1,1) = "C" THEN LET M1=0

```

LISTING OF FILE SMASH1.LL ON 9 / 27 / 1977

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```

2037 IF CS="CI" THEN RETURN
2038 IF CS="CA" THEN LET M1=4
2039 IF CS="CA" THEN RETURN
2040 REM M1 CODES CALC TYPE
2045 REM V:I,>0,DEGREE FIT
2050 GOTO 2150
2060 IF CS(LEN(CS)-1)<>"18" THEN GOTO 2090
2065 REM SKIP IF 8 NOT SPECIFIED
2070 LET K=1
2075 LET CS=CS(1,LEN(CS)-2)
2090 IF CS(1,1)="S" THEN LET M0=2-K
2100 IF CS(1,1)="S" THEN GOTO 2150
2110 IF CS(1,1)="U" THEN LET M0=6+K
2120 IF CS(1,1)="U" THEN GOTO 2150
2130 LET M0=0
2140 RETURN
2150 IF CS(2,2)<="0" THEN GOTO 2180
2155 IF CS(2,2)>=":" THEN GOTO 2180
2157 IF CS(3,3)="" THEN GOTO 2165
2160 IF CS(3,3)<="/" THEN GOTO 2180
2163 IF CS(3,3)>=":" THEN GOTO 2180
2165 LET M1=VAL(CS(2))
2170 RETURN
2180 LET M0=0
2185 RETURN
5000 REM GET WHEEL POSITION AND READ
5005 IF M0>2 THEN GOTO 5010
5007 IF M>N0 THEN GOSUB 0175
5008 IF M>N0 THEN RETURN
5010 GOSUB 8500
5020 GOSUB 8000
5030 LET L(2)=L(1)
5035 LET B1=B
5037 LET B2=B
5040 IF INT(M0/2)=M0/2 THEN GOTO 5100

```

LISTING OF FILE SMASH1.LL ON 9 / 27 / 1977
PAGE 6

```

5045 REM ODD M0; JB WAS SPECIFIED
5047 PRINT "SET-UP FOR BASELINE AND HIT RETURN"
5048 INPUT XS
5050 GOSUB 7000
5055 LET K=0
5080 LET B2=(B+B1)/2
5100 LET S(M)=LOG((B2-Q)/(L(2)-Q))/LOG(10)
5105 REM ABS=LOG(10)(100XT/XT)
5108 PRINT "ABS= ",S(M)
5110 RETURN
6000 REM: SET-UP TO CHAIN TO LSQ PROG
6005 FOR I=1 TO N0
6010 READ FILE(F1,I),C(I)
6015 WRITE FILE(F1,I),C(I),S(I)
6020 NEXT I
6030 READ FILE(F1,P2+1),R
6040 WRITE FILE(F1,P2+1),R,M1,L(11)
6044 IF M1=0 THEN PRINT "INTERPOLATION"
6048 IF M1=0 THEN RETURN
6050 SAVE "SMASH1.LL"
6060 CHAIN "LSQ.AA"
6070 RETURN
6500 PRINT
6505 PRINT N3," CHAARACTERS ONLY"
6510 PRINT "INPUT SAMPLE ID FOR ";I;" AGAIN";
6515 INPUT XS
6520 RETURN
6600 LET A=N3-LEN(XS)
6605 FOR X3=1 TO A
6610 LET XS=XS,"."
6615 NEXT X3
6620 RETURN
7000 PRINT "READ A BASELINE"
7010 LET X1=M
7020 LET M=0

```

LISTING OF FILE SMASH1.LL ON 9 / 27 / 1977
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```

7030 GOSUB 8500
7035 REM: POSITION WHEEL AND REINITIALIZE
7037 CALL 21,D1,M
7040 GOSUB 8000
7045 REM: TAKE A READING; RETURN AS L(1) COUNTS FOR BASELINE
7050 LET M=X1
7060 LET B=L(1)
7070 LET X1=B
7080 IF ABS(B)<ABS(B9) THEN RETURN
7085 LET L(15)=40
7090 FOR I=1 TO 5
7095   CALL 1,L(15)
7095   PRINT "<7>";
7097 NEXT I
7098 CALL 1,L(15)
7100 PRINT "BASELINE OUT OF RANGE"
7110 RETURN
8000 REM: READ ADC; RETURN AS L(1)
8010 PRINT "TAKE A READING"
8018 GOTO 8025
8020 INPUT " SAMPLE ",L(1)
8022 GOTO 8035
8025 CALL 6,L(4),L(6),L(1)
8030 REM: L(4) IS CHANNEL NO., L(6) IS NO. OF POINTS, L(1) IS AVERAGE
8035 RETURN
8500 REM: POSITION THE WHEEL
8503 PRINT "POSITION";M
8505 CALL 21,D1,L(10)
8507 LET L(16)=M+1
8510 CALL 22,D1,L(16)
8520 CALL 1,T2
8535 RETURN
9000 REM: CHAIN TO INTERIM REPORT PROGRAM
9001 FOR I=1 TO NO
9002   WRITE FILE(F1,I),C(I),S(I)

```

LISTING OF FILE SMASH1.LL ON 9 / 27 / 1977
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```
9003 NEXT I
9004 READ FILE(F1,P2+1),R,M1,L[11]
9006 WRITE FILE(F1,P2+1),R,M1,L[11]
9008 FOR I=1 TO N1
9010   LET P1=1+N0
9012   READ FILE(F2,I),XS,S[P1],D[I],V[I],J
9013   WRITE FILE(F2,I),XS,S[P1],D[I],V[I],J
9014 NEXT I
9015 SAVE "SMASH1.LL"
9020 CHAIN "INT.ME"
9030 RETURN
9040 FOR I=1 TO N1
9041   LET P1=1+N0
9042   READ FILE(F2,I),XS,S[P1],D[I],V[I],J
9044   LET S[P1]=0
9046   WRITE FILE(F2,I),XS,S[P1],D[I],V[I],J
9048 NEXT I
9049 GOSUB 0200
9059 PRINT B
9060 PRINT
9067 RETURN
```


REFERENCES AND SYMBOLS IN SMASH1.LL

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PAGE 1

0100 IS REFERENCED ON LINES:
0150 0170

0175 IS REFERENCED ON LINES:
0140 5007

0200 IS REFERENCED ON LINES:
9049

0950 IS REFERENCED ON LINES:
0045

1000 IS REFERENCED ON LINES:
0022

1074 IS REFERENCED ON LINES:
1078

1080 IS REFERENCED ON LINES:
1076

1093 IS REFERENCED ON LINES:
1077 1082

1310 IS REFERENCED ON LINES:
1265

2000 IS REFERENCED ON LINES:
0115

2060 IS REFERENCED ON LINES:
2020

2090 IS REFERENCED ON LINES:
2060

REFERENCES AND SYMBOLS IN SMASH1.LL

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2130 IS REFERENCED ON LINES:
2000

2150 IS REFERENCED ON LINES:
2050 2100 2120

2165 IS REFERENCED ON LINES:
2157

2180 IS REFERENCED ON LINES:
2150 2155 2160 2163

5000 IS REFERENCED ON LINES:
0140

5010 IS REFERENCED ON LINES:
5005

5100 IS REFERENCED ON LINES:
5040

6000 IS REFERENCED ON LINES:
0140

6500 IS REFERENCED ON LINES:
1062 1086

6600 IS REFERENCED ON LINES:
1066 1088

7000 IS REFERENCED ON LINES:
0140 0213 5050

8000 IS REFERENCED ON LINES:
1390 5020 7040

REFERENCES AND SYMBOLS IN SMASH1.LL

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8025 IS REFERENCED ON LINES:
8018

8035 IS REFERENCED ON LINES:
8022

8500 IS REFERENCED ON LINES:
5010 7030

9000 IS REFERENCED ON LINES:
0140

9040 IS REFERENCED ON LINES:
0050

A OCCURS ON LINES:
6600 6605

A[OCCURS ON LINES:
0009 1330 1355

B OCCURS ON LINES:
0155 5035 5037 5080 7060
7070 7080 9059

B1 OCCURS ON LINES:
5035 5080

B2 OCCURS ON LINES:
5037 5080 5100

B9 OCCURS ON LINES:
1140 1310 7080

B[OCCURS ON LINES:
0014

REFERENCES AND SYMBOLS IN SMASH1.LL

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CS OCCURS ON LINES:

0011	0105	0205	1074	1076
1077	1078	2000	2002	2005
2010	2015	2020	2035	2037
2038	2039	2060	2075	2090
2100	2110	2120	2150	2155
2157	2160	2163	2165	

C9 OCCURS ON LINES:

0022 1313

C1 OCCURS ON LINES:

0009 1235 1245 6010 6015
9002

D1 OCCURS ON LINES:

0020

D1 OCCURS ON LINES:

0014 9012 9013 9042 9046

E5 OCCURS ON LINES:

1260 1265 1275 1310

E1 OCCURS ON LINES:

0009

F1 OCCURS ON LINES:

1205	1210	1245	1300	1310
1312	1313	1314	6010	6015
6030	6040	9002	9004	9006

F1\$ OCCURS ON LINES:

0011 1200 1210 1314

F2 OCCURS ON LINES:

1047	1048	1072	1091	1355
9012	9013	9042	9046	

REFERENCES AND SYMBOLS IN SMASH1.LL

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F2\$ OCCURS ON LINES:

0011 1046 1048 1314

F3\$ OCCURS ON LINES:

0011 0017 1314

F4\$ OCCURS ON LINES:

0012 0018 1314

I OCCURS ON LINES:

1050 1055 1072 1073 1085
1091 1225 1230 1235 1240
1245 1250 1320 1330 1340
1350 1355 1360 6005 6010
6015 6020 6510 7090 7097
9001 9002 9003 9008 9010
9012 9013 9014 9040 9041
9042 9046 9048

J OCCURS ON LINES:

1084 1092 1275 1285 1305
1325 1330 1335 9012 9013
9042 9046

K OCCURS ON LINES:

0019 2070 5055

LI OCCURS ON LINES:

0013 0025 0035 0043 1180
1183 1184 1290 1300 1310
1400 5030 5100 6040 7060
7085 8020 8025 8505 8507
8510 9004 9006

M OCCURS ON LINES:

0130 0135 0212 5007 5008
5100 5108 7010 7020 7037
7050 8503 8507

REFERENCES AND SYMBOLS IN SMASH1.LL

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M0 OCCURS ON LINES:

0135	0140	0150	0210	2002
2010	2030	2090	2110	2130
2180	5005	5040		

M1 OCCURS ON LINES:

0015	0026	0130	1312	2035
2038	2165	6040	6044	6048
9004	9006			

N0 OCCURS ON LINES:

0135	1215	1225	1300	1310
5007	5008	6005	9001	9010
9041				

N1 OCCURS ON LINES:

1035	1050	1310	1320	1350
1355	9008	9040		

N3 OCCURS ON LINES:

1035	1062	1086	6505	6600
------	------	------	------	------

O1 OCCURS ON LINES:

0014

P1 OCCURS ON LINES:

9010	9013	9041	9042	9044
9046				

P2 OCCURS ON LINES:

0042	1310	1312	1313	1314
6030	6040	9004	9006	

U OCCURS ON LINES:

1400	1410	5100
------	------	------

REFERENCES AND SYMBOLS IN SMASH1.LL

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R OCCURS ON LINES:
0024 1312 6030 6040 9004
9006

S OCCURS ON LINES:
9012

SI OCCURS ON LINES:
0009 1240 1245 5100 5108
6015 9002 9013 9042 9044
9046

T2 OCCURS ON LINES:
1190 1193 1310

VI OCCURS ON LINES:
0014 9012 9013 9042 9046

X5 OCCURS ON LINES:
0009 0203 1060 1062 1072
1085 1086 1091 1580 5048
6515 6600 6610 9012 9013
9042 9046

X1 OCCURS ON LINES:
0016 1080 1082 1084 7010
7050 7070

X3 OCCURS ON LINES:
6605 6615

Z25 OCCURS ON LINES:
0005 0960 1310

Z35 OCCURS ON LINES:
0005 0970 1310

REFERENCES AND SYMBOLS IN SMASH1.LL

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245 OCCURS ON LINES:

0005 1093 1310

275 OCCURS ON LINES:

0005 1150 1310

29 OCCURS ON LINES:

1270 1280 1290 1300

LISTING WAS TAKEN FROM FILE SMASH1.LL

SYMBOL TABLE WAS IN FILE SMASH1.ST

117 SYMBOL SPACES WERE USED

0 OVERFLOWS OCCURRED

NEXT TIME SET ARRAYS TO

117

FOR MORE COPIES SET

OS=SMASH1.LL

NS=SMASH1.ST

RUN 3240 (OR THEREABOUTS)

LISTING OF FILE RSASH1.LL ON 9 / 27 / 1977

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```

0002 REM: LLL,"RSASH1.LL";WALTER BOYLE;PROGRAM FOR SEQUENTIAL/RANDOM SAMPLING
0003 REM: BINARY FILE; "VASH1.RS" FOR VARIABLES AND "IVASH1.RS" FOR SAMPLE ID
0004 REM: WRITTEN FOR USE ON JARREL ASH SINGLE BE... INSTRUMENT
0005 DIM Z28(72),Z38(72),Z48(72),Z58(72),Z78(72)
0006 DIM C8(25),F18(20),F28(20),F38(20)
0008 DIM U(10,1),F48(10)
0009 DIM X8(15),E(10),A(10,50),C(10),8(60)
0013 DIM L(50)
0014 DIM D(50),V(50),O(50),B(50)
0017 LET F38="RSASH1.LL"
0019 LET M9=0
0020 LET M5=0
0021 LET L(11)=0
0022 LET C9=1000
0023 LET P2=20
0024 LET R=1
0025 LET D1=1
0026 CALL Z1,D1,M9
0027 REM: INITIALIZE SAMPLER LOCATION AS ZERO
0034 REM:*****PUT THE PROPER CHANNEL NO. IN L(4)*****
0035 LET L(4)=1
0036 REM: CHANNEL NUMBER FOR JARREL ASH 82-536 SINGLE BEAM
0038 LET L(10)=1
0039 GOSUB 0950
0040 IF R=1 THEN GOSUB 0100
0045 IF R=1 THEN GOSUB 0200
0047 WRITE FILE(F1,P2+3),F38,F28,F18,F48
0050 IF F48(1,1)="R" THEN GOTO 3000
0055 IF F48(1,1)="S" THEN GOTO 3500
0100 PRINT "BASELINE AVERAGE; Y/N ?"
0105 INPUT X8
0110 IF X8="Y" THEN LET L(11)=1
0115 IF L(11,1)="Y" THEN GOTO 0155
0125 IF X8="N" THEN GOTO 0150
0130 PRINT "SYNTAX ERROR"

```

LISTING OF FILE RSASH1.LL ON 9 / 27 / 1977
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```

0135 GOTO 0100
0150 INPUT "FREQUENCY OF BASELINE ? ",L[11]
0155 WRITE FILE[F1,P2+1],R,M5,L[11]
0160 RETURN
0200 INPUT "RANDOM OR SEQUENTIAL ? ",F45
0210 IF F45[1,1]="R" THEN RETURN
0215 IF F45[1,1]="S" THEN RETURN
0220 PRINT "TRY AGAIN"
0225 GOTO 0200
0950 PRINT
0955 PRINT "OPERATOR'S NAME AND INSTRUMENT"
0960 INPUT Z25
0965 PRINT "ELEMENT AND SAMPLE SOURCE"
0970 INPUT Z35
1030 PRINT "MAX ID LENGTH, NO. OF SAMPLES";
1035 INPUT N5,N1
1045 PRINT "SAMPLE I. D. CODE"
1046 LET F25="IDASH1.RS"
1047 LET F2=2
1048 OPEN FILE[F2,0],F25
1050 FOR I=1 TO N1
1055   PRINT I;
1060   INPUT X5
1062   IF LEN(X5)>N5 THEN GOSUB 6500
1066   GOSUB 6600
1072   WRITE FILE[F2,1],X5
1073 NEXT I
1074 INPUT "CORRECTIONS Y/N ? ",C5
1076 IF C5[1,1]="Y" THEN GOTO 1080
1077 IF C5[1,1]="N" THEN GOTO 1093
1078 IF C5[1,1]<>"N" THEN GOTO 1074
1080 INPUT "NO. OF I.D. CORRECTIONS ? ",X1
1082 IF X1=0 THEN GOTO 1093
1084 FOR J=1 TO X1
1085   INPUT "NO. AND I.D. OF SAMPLE ? ",I,X5

```

LISTING OF FILE RSASH1.LL ON 9 / 27 / 1977
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```

1086 IF LEN(X$)>N3 THEN GOSUB 6500
1088 GOSUB 6600
1091 WRITE FILE(F2,1),X$
1092 NEXT J
1093 INPUT "INSTRUMENT CONDITIONS ",Z4$
1135 PRINT "BASELINE LIMIT"
1140 INPUT B9
1145 PRINT "UNITS"
1150 INPUT Z7$
1175 PRINT "INTEG. TIME IN SECONDS"
1180 INPUT L(6)
1183 LET L(6)=INT(L(6)*15/2)
1184 PRINT L(6),"POINTS"
1185 PRINT "PAUSE TIME IN SECONDS"
1190 INPUT T2
1193 LET T2=INT(60*T2)
1200 LET F1$="VASH1.RS"
1205 LET F1=1
1210 OPEN FILE(F1,0),F1$
1215 INPUT "NO. OF STDS ",N0
1220 PRINT "CONC:"
1225 FOR I=1 TO N0
1230 PRINT I;
1235 INPUT C(I)
1240 LET S(I)=0
1245 WRITE FILE(F1,I),C(I),S(I)
1250 NEXT I
1260 INPUT "NO. OF SPIKES ",E5
1265 IF E5=0 THEN GOTO 1310
1270 LET Z9=19
1275 FOR J=1 TO E5
1280 LET Z9=Z9+1
1285 PRINT "SPIKE NO. ";J;" ";
1290 INPUT "VALUE ",L(Z9)
1300 WRITE FILE(F1,N0+1+J),L(Z9)

```

```

1305 NEXT J
1310 WRITE FILE(F1,P2),N0,N1,E5,228,238,248,278,89,L(6),T2
1313 WRITE FILE(F1,P2+2),0,0,0,0,C9
1320 FOR I=1 TO N1
1325   FOR J=1 TO 10
1330     LET A(I,J)=0
1335   NEXT J
1340 NEXT I
1350 FOR I=1 TO N1
1355   WRITE FILE(F2,N1+I),A(1,I),A(2,I),A(3,I),A(4,I),A(5,I),A(6,I),A(7,I),A(8,I),A(9,I),A(10,I)
1360 NEXT I
1370 PRINT " COVER SLIT: HIT RETUR WHEN READY"
1380 INPUT X8
1390 GOSUB 6000
1400 LET Q=L(1)
1410 PRINT "DARK CURRENT= "Q
1420 RETURN
2000 REM: PICK CALCULATION FIRST ROUND ONLY
2050 PRINT "CALCULATE C1,C1,C2,C3,OR CA"
2055 INPUT X8
2060 IF X8="C1" THEN LET M5=0
2065 IF X8="C1" THEN RETURN
2070 IF X8="C1" THEN LET M5=1
2075 IF X8="C1" THEN RETURN
2080 IF X8="C2" THEN LET M5=2
2085 IF X8="C2" THEN RETURN
2090 IF X8="C3" THEN LET M5=3
2095 IF X8="C3" THEN RETURN
2097 IF X8="CA" THEN LET M5=4
2098 IF X8="CA" THEN RETURN
2100 PRINT "SYNTAX ERROR"
2105 GOTO 2050
3000 REM: ROUTINE FOR RANDOM SAMPLING OF WHEEL
3005 FOR I=1 TO N1+N0
3010   LET E(I)=0

```

```
3015 NEXT I
3050 RANDOMIZE
3055 LET B5=0
3060 GOSUB 7000
3065 LET M9=INT((N0+N1)*RND(0)+1)
3070 IF E(M9)>0 THEN GOTO 3065
3075 LET E(M9)=1
3080 GOSUB 5000
3083 IF L(11)=-1 THEN GOTO 3105
3084 REM: L(11)=-1 MEANS BASELINE AVERAGED AFTER EACH READING
3085 LET B5=B5+1
3090 IF B5<L(11) THEN GOTO 3105
3095 GOSUB 7000
3100 LET B5=0
3105 FOR I=1 TO N0+N1
3110 IF E(I)=0 THEN GOTO 3065
3115 NEXT I
3200 GOTO 3552
3500 REM: ROUTINE FOR SEQ SAMPLING OF WHEEL
3505 LET B5=0
3510 LET M9=0
3515 GOSUB 7000
3520 LET M9=M9+1
3525 GOSUB 5000
3527 IF L(11)=-1 THEN GOTO 3550
3530 LET B5=B5+1
3535 IF B5<L(11) THEN GOTO 3550
3540 GOSUB 7000
3545 LET B5=0
3550 IF M9<N0+N1 THEN GOTO 3520
3552 LET M9=0
3553 GOSUB 8500
3555 IF K=1 THEN GOSUB 2000
3560 GOSUB 6000
3565 GOTO 9000
```

```
5000 REM GET WHEEL POSITION AND READ
5010 GOSUB 8500
5020 GOSUB 8000
5030 LET L[2]=L[1]
5035 LET B1=B
5037 LET B2=B
5040 IF L[11]<>-1 THEN GOTO 5100
5045 REM: MINUS L[11] BASELINE AVERAGE WAS SPECIFIED
5050 GOSUB 7000
5055 LET K=0
5080 LET B2=(B+B1)/2
5100 LET S[M9]=LOG((B2-Q)/(L[2]-Q))/LOG(10)
5105 REM ABS=LOG(10)(100XT/XT)
5108 PRINT "ABS= ";S[M9]
5110 RETURN
6000 REM: SET-UP TO CHAIN TO LSG PROG
6005 FOR I=1 TO N0
6010 READ FILE(F1,I),C[I]
6015 WRITE FILE(F1,I),C[I],S[I]
6020 NEXT I
6030 READ FILE(F1,P2+1),R
6040 WRITE FILE(F1,P2+1),R,M5,L[11]
6044 IF M5=0 THEN PRINT "INTERPOLATION"
6048 IF M5=0 THEN RETURN
6050 SAVE "RSASH1.LL"
6060 CHAIN "LSQ.AA"
6070 RETURN
6500 PRINT
6505 PRINT N3," CHARACTERS ONLY"
6510 PRINT "INPUT SAMPLE ID FOR ";I;" AGAIN";
6515 INPUT X5
6520 RETURN
6600 LET A=N3-LEN(X5)
6605 FOR X3=1 TO A
6610 LET X5=X5,"."
```

```

6615 NEXT X3
6620 RETURN
7000 PRINT "READ A BASELINE"
7010 LET K=M9
7020 LET M9=0
7030 GOSUB 8500
7035 REM**POSITION WHEEL AND REINITIALIZE
7037 CALL 21,D1,M9
7040 GOSUB 8000
7045 REM: TAKE A READING; RETURN AS L(1) COUNTS FOR BASELINE
7060 LET B=L(1)
7065 LET M9=K
7070 PRINT B
7080 IF ABS(B)<ABS(B9) THEN RETURN
7085 LET L(15)=30
7090 FOR I=1 TO 10
7093   PRINT "<?>";
7095   CALL 1,L(15)
7097 NEXT I
7100 PRINT "BASELINE OUT OF RANGE"
7110 RETURN
8000 REM: READ ADC; RETURN AS L(1)
8010 PRINT "TAKE A READING"
8015 REM INPUT "READY ? ",X$ FOR HAND OPERATION
8018 GOTO 8025
8020 INPUT "SAMPLE ",L(1)
8022 GOTO 8035
8025 CALL 6,L(4),L(6),L(1)
8030 REM: L(4) IS CHANNEL NO., L(6) IS NO. OF POINTS, L(1) IS AVERAGE
8035 RETURN
8500 REM: POSITION THE WHEEL
8503 PRINT "POSITION ";M9
8505 CALL 21,D1,L(10)
8507 LET L(16)=M9+1
8510 CALL 22,D1,L(16)

```

LISTING OF FILE RSASH1.LL ON 9 / 27 / 1977

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8520 CALL 1,T2

8535 RETURN

9000 REM: CHAIN TO INTERIM REPORT PROGRAM

9004 READ FILE(F1,P2+1),R,MS,L(11)

9006 WRITE FILE(F1,P2+1),R,MS,L(11)

9008 FOR I=1 TO N1

9010 LET P1=I+N0

9012 READ FILE(F2,I),XS,S,D(1),V(1),J

9013 WRITE FILE(F2,I),XS,S(P1),D(1),V(1),J

9014 NEXT I

9015 SAVE "RSASH1.LL"

9020 CHAIN "INT.ME"

9030 GOTO 3555

9040 FOR I=1 TO N1

9041 LET P1=I+N0

9042 READ FILE(F2,I),XS,S(P1),D(1),V(1),J

9044 LET S(P1)=0

9046 WRITE FILE(F2,I),XS,S(P1),D(1),V(1),J

9047 NEXT I

9048 READ FILE(F1,P2+1),R,MS,L(11)

9049 GOTO 0050

REFERENCES AND SYMBOLS IN RSASH1.LL

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0050 IS REFERENCED ON LINES:
9049

0100 IS REFERENCED ON LINES:
0040 0135

0150 IS REFERENCED ON LINES:
0125

0155 IS REFERENCED ON LINES:
0115

0200 IS REFERENCED ON LINES:
0045 0225

0250 IS REFERENCED ON LINES:
0039

1000 IS REFERENCED ON LINES:
0022

1074 IS REFERENCED ON LINES:
1078

1080 IS REFERENCED ON LINES:
1076

1093 IS REFERENCED ON LINES:
1077 1082

1310 IS REFERENCED ON LINES:
1265

2000 IS REFERENCED ON LINES:
3555

REFERENCES AND SYMBOLS IN RSASH1.LL

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2050 IS REFERENCED ON LINES:
2105

3000 IS REFERENCED ON LINES:
0050

3065 IS REFERENCED ON LINES:
3070 3110

3105 IS REFERENCED ON LINES:
3083 3090

3500 IS REFERENCED ON LINES:
0055

3520 IS REFERENCED ON LINES:
3550

3550 IS REFERENCED ON LINES:
3527 3535

3552 IS REFERENCED ON LINES:
3200

3555 IS REFERENCED ON LINES:
9030

5000 IS REFERENCED ON LINES:
3080 3525

5100 IS REFERENCED ON LINES:
5040

6000 IS REFERENCED ON LINES:
3560

REFERENCES AND SYMBOLS IN RSASH1.LL

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6500 IS REFERENCED ON LINES:
1062 1086

6600 IS REFERENCED ON LINES:
1066 1088

7000 IS REFERENCED ON LINES:
3060 3095 3515 3540 5050

8000 IS REFERENCED ON LINES:
1390 5020 7040

8025 IS REFERENCED ON LINES:
8018

8035 IS REFERENCED ON LINES:
8022

8500 IS REFERENCED ON LINES:
3553 5010 7030

9090 IS REFERENCED ON LINES:
3565

A OCCURS ON LINES:
6600 6605

A(OCCURS ON LINES:
0009 1330 1355

B OCCURS ON LINES:
5035 5037 5080 7060 7070
7080

B1 OCCURS ON LINES:
5035 5080

REFERENCES AND SYMBOLS IN RSASH1.LL

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B2 OCCURS ON LINES:

5037 5080 5100

B5 OCCURS ON LINES:

3055 3085 3090 3100 3505
3530 3535 3545

B9 OCCURS ON LINES:

1140 1310 7080

B1 OCCURS ON LINES:

0014

C3 OCCURS ON LINES:

0006 1074 1076 1077 1078

C9 OCCURS ON LINES:

0022 1313

C1 OCCURS ON LINES:

0009 1235 1245 6010 6015

D1 OCCURS ON LINES:

0025

D1 OCCURS ON LINES:

0014 9012 9013 9042 9046

E5 OCCURS ON LINES:

1260 1265 1275 1310

E1 OCCURS ON LINES:

0009 3010 3070 3075 3110

F1 OCCURS ON LINES:

0047 0155 1205 1210 1245
1300 1310 1313 6010 6015
6030 6040 9004 9006 9048

REFERENCES AND SYMBOLS IN RSASH1.LL

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F1\$ OCCURS ON LINES:

0006 0047 1200 1210

F2 OCCURS ON LINES:

1047 1048 1072 1091 1355
9012 9013 9042 9046

F2\$ OCCURS ON LINES:

0006 0047 1046 1048

F3\$ OCCURS ON LINES:

0006 0017 0047

F4\$ OCCURS ON LINES:

0008 0047 0050 0055 0200
0210 0215

I OCCURS ON LINES:

1050 1055 1072 1073 1085
1091 1225 1230 1235 1240
1245 1250 1320 1330 1340
1350 1355 1360 3005 3010
3015 3105 3110 3115 6005
6010 6015 6020 6510 7090
7097 9008 9010 9012 9013
9014 9040 9041 9042 9046
9047

J OCCURS ON LINES:

1084 1092 1275 1285 1305
1325 1330 1355 9012 9013
9042 9046

K OCCURS ON LINES:

5055 7010 7065

REFERENCES AND SYMBOLS IN RSASH1.LL

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L1 OCCURS ON LINES:

0013	0021	0035	0038	0110
0150	0155	1180	1183	1184
1290	1300	1310	1400	3083
3090	3527	3535	5030	5040
5100	6040	7060	7085	8020
8025	8505	8507	8510	9004
9006	9048			

M5 OCCURS ON LINES:

0020	0155	2060	2070	2080
2090	2097	6040	6044	6048
9004	9006	9048		

M9 OCCURS ON LINES:

0019	0026	3065	3070	3075
3510	3520	3550	3552	5100
5108	7010	7020	7037	7065
8503	8507			

N0 OCCURS ON LINES:

1215	1225	1300	1310	3005
3065	3105	3550	6005	9010
9041				

N1 OCCURS ON LINES:

1035	1050	1310	1320	1350
1355	3005	3065	3105	3550
9008	9040			

N3 OCCURS ON LINES:

1035	1062	1086	6505	6600
------	------	------	------	------

O1 OCCURS ON LINES:

0014

REFERENCES AND SYMBOLS IN RSASH1.LL

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P1 OCCURS ON LINES:

9010 9013 9041 9042 9044
9046

P2 OCCURS ON LINES:

0023 0047 0155 1310 1313
6030 6040 9004 9006 9048

Q OCCURS ON LINES:

1400 1410 5100

R OCCURS ON LINES:

0024 0040 0045 0155 3555
6030 6040 9004 9006 9048

S OCCURS ON LINES:

9012

SI OCCURS ON LINES:

0009 1240 1245 5100 5108
6015 9013 9042 9044 9046

T2 OCCURS ON LINES:

1190 1193 1310

UI OCCURS ON LINES:

0008

VI OCCURS ON LINES:

0014 9012 9013 9042 9046

X5 OCCURS ON LINES:

0009 0105 2110 0115 0125
1060 1062 1072 1085 1086
1091 1360 2055 2060 2065
2070 2075 2080 2085 2090
2095 2097 2098 6515 6600
6610 9012 9013 9042 9046

REFERENCES AND SYMBOLS IN RSASH1.LL

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X1 OCCURS ON LINES:
1080 1082 1084

X3 OCCURS ON LINES:
6605 6615

Z2\$ OCCURS ON LINES:
0005 0960 1310

Z3\$ OCCURS ON LINES:
0005 0970 1310

Z4\$ OCCURS ON LINES:
0005 1093 1310

Z5\$ OCCURS ON LINES:
0005

Z7\$ OCCURS ON LINES:
0005 1150 1310

Z9 OCCURS ON LINES:
1270 1280 1290 1300

LISTING WAS TAKEN FROM FILE RSASH1.LL

SYMBOL TABLE WAS IN FILE RSASH1.ST

121 SYMBOL SPACES WERE USED

0 OVERFLOWS OCCURRED

NEXT TIME SET ARRAYS TO

121

FOR MORE COPIES SET

US=RSASH1.LL

NS=RSASH1.ST

RUN 3240 (OR THEREABOUTS)

LISTING OF FILE INT.ME ON 9 / 27 / 1977
PAGE 1

```

0002 MEM: LLL;"INT.ME";PROGRAM FOR INTERIM AA REPORTS;WALTER BOYLE
0005 DIM Z28(72),Z38(72),Z48(72),Z78(72)
0009 DIM X8(15),E(10),A(10,50),C(10),S(60)
0011 DIM C8(25),F18(20),F38(20),F28(20)
0013 DIM L(50),F(50),F48(20)
0014 DIM D(50),V(50),D(50),B(50)
0020 LET P2=20
0025 LET F1=1
0030 LET F2=2
0040 MEM: READ STANDARD FILES
3010 HEAD FILE(F1,P2),N0,N1,E5,Z28,Z38,Z48,Z78,89,L(6),T2
3030 HEAD FILE(F1,P2+1),N,M5,L(11)
3035 HEAD FILE(F1,P2+2),Y0,Y1,Y2,Y3,C9
3036 IF M5=0 THEN GOTO 3040
3037 IF C9=1000 THEN PRINT " NO STANDARDIZATION "
3038 IF C9=1000 THEN GOTO 3133
3040 FOR I=1 TO N0
3050 READ FILE(F1,I),C(I),S(I)
3060 NEXT I
3063 IF E5=0 THEN GOTO 3100
3065 LET Z9=19
3070 FOR I=1 TO E5
3075 LET Z9=Z9+1
3080 HEAD FILE(F1,N0+1+I),L(Z9)
3090 NEXT I
3100 FOR I=1 TO N1
3110 LET P1=1+N0
3120 READ FILE(F2,I),X8,S(P1)
3130 NEXT I
3132 HEAD FILE(F1,P2+3),F38,F28,F18,F48
3133 IF M5=0 THEN GOTO 3135
3134 IF C9=1000 THEN GOTO 9740
3135 FOR I=1 TO N1
3137 READ FILE(F2,N1+I),A(1,I),A(2,I),A(5,I),A(6,I),A(7,I),A(8,I),A(9,I),A(10,I)
3145 NEXT I

```

```

3150 GOTO 9000
6500 REM: SOLVE THE EQUATION: CONCENTRATION AS A FUNCTION
6505 REM: OF ABSORBANCE BY A METHOD OF SIMPLE SUBSTITUTION
6515 LET C0=Y0+Y1*A1+Y2*A1*A1+Y3*A1^3
6520 RETURN
6600 REM: LSO CALCULATION FOR METHOD OF ADDITION
6610 IF I=1 THEN LET C0=-Y0
6620 IF I=1 THEN RETURN
6630 LET C0=Y1*A1
6640 RETURN
7000 REM: ENTER DILUTION FACTORS
7010 FOR I=1 TO N1
7020 LET F(I)=1
7030 NEXT I
7040 INPUT "NO. OF DILUTIONS ",N7
7050 IF N7<=0 THEN GOTO 7160
7060 FOR I=1 TO N7
7070 PRINT "SAMPLE NUMBER, VOL 1,(DILUTED TO) VOL 2 ";
7080 INPUT J,A1,A2
7090 LET F(I)=A1/A2
7100 NEXT I
7110 PRINT "CORRECTIONS Y/N ";
7120 INPUT XS
7130 IF XS(I,1)="Y" THEN GOTO 7040
7140 IF XS(I,1)="N" THEN GOTO 7160
7150 IF XS(I,1)<>"N" THEN GOTO 7110
7160 FOR I=1 TO N1
7165 LET P1=1+N0
7170 READ FILE(F2,I),XS,S(P1),D(I),V(I),J
7180 WRITE FILE(F2,I),XS,S(P1),D(I),V(I),J,F(I)
7190 NEXT I
7195 CLOSE
7200 CHAIN "RPT.ME"
8700 REM: VALUES CALCULATED FOR CHECK STANDARDS
8710 LET C5=XS(3)

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```

8715 LET M1=VAL(C8)
8720 IF M1<1 THEN RETURN
8725 IF M1>90 THEN RETURN
8730 REM: M1 CONTAINS NUMBER OF STANDARD
8735 LET L(40)=100*(A(R,1)/C(M1))
8740 IF X3=0 THEN GOTO 8745
8742 IF X3=1 THEN GOTO 8750
8745 PRINT "RECOVERY OF STANDARD ";M1;C(M1);278;" IS ";FNG(L(40));" PERCENT"
8748 GOTO 8760
8750 PRINT FILE(0),"RECOVERY OF STANDARD ";M1;C(M1);278;" IS ";FNG(L(40));" PERCENT"
8760 RETURN
8800 REM: ROUTINE FOR CALCULATING SPIKE RECOVERY
8801 REM: SPIKE VALUES CONTAINED IN L(20) TO L(30)
8803 LET C8=X8(3)
8805 IF C8(2,2)="#0" THEN RETURN
8807 LET M1=VAL(C8)
8809 IF M1<10 THEN RETURN
8810 IF M1>999 THEN RETURN
8813 LET C8=STR$(M1)
8814 IF LEN(C8)=2 THEN LET X1=10
8815 IF LEN(C8)=3 THEN LET X1=100
8818 REM: M1 CONTAINS SPIKE NO. AND UNKNOWN NO. COMBINED
8819 LET L(19)=M1
8823 LET M1=INT(M1/X1)
8825 REM: M1 NOW CONTAINS SPIKE NO.
8830 LET E5=M1+19
8835 LET M1=L(19)-M1*X1
8845 REM: M1 CONTAINS UNKNOWN NO
8855 LET L(40)=100*(A(R,1)-A(R,M1))/L(E5)
8860 IF X3=0 THEN GOTO 8870
8862 IF X3=1 THEN GOTO 8875
8870 PRINT "RECOVERY OF SPIKE ";E5-19;L(E5);278;" IS ";FNG(L(40));" PERCENT"
8873 GOTO 8877
8875 PRINT FILE(0),"RECOVERY OF SPIKE ";E5-19;L(E5);278;" IS ";FNG(L(40));" PERCENT "
8877 LET E5=E5-19

```

LISTING OF FILE INT.ME ON 9 / 27 / 1977

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```

8880 RETURN
8900 REM: VALUES CALCULATED FOR DUPLICATE UNKNOWNNS
8910 LET C3=X5[3]
8915 LET M1=VAL(C3)
8917 IF M1<1 THEN RETURN
8920 IF M1>N1 THEN RETURN
8925 LET L[40]=100*A[R,I]/A[R,M1]
8927 IF X3=0 THEN GOTO 8930
8929 IF X3=1 THEN GOTO 8935
8930 PRINT "RECOVERY OF UNKNOWN ";M1;" IS ";FNU(L[40]);" PERCENT"
8933 GOTO 8940
8935 PRINT FILE[0],"RECOVERY OF UNKNOWN ";M1;" IS ";FNU(L[40]);" PERCENT"
8940 RETURN
9000 REM: CALCULATE AND STORE ANSWERS FOR EACH RUN AND WRITE FILE
9007 LET Z9=19
9018 FOR I=1 TO N1
9021 LET P1=I+NU
9022 READ FILE[F2,I],XS,S[P1],D[I],V[I],J
9023 IF M5>0 THEN LET J=0
9024 IF M5>0 THEN GOTO 9087
9027 REM: INTERPOLATE FOR M5=0
9033 FOR J=1 TO NO
9036 IF S[P1]<S[J] THEN GOTO 9057
9039 NEXT J
9042 IF S[P1]=S[J] THEN GOTO 9066
9045 IF S[P1]>S[J] THEN LET J=NO+1
9048 LET T0=(C[NO]-C[NO-1])/(S[NO]-S[NO-1])
9051 LET A[R,I]=T0*(S[P1]-S[NO])+C[NO]
9054 GOTO 9111
9057 IF J=1 THEN LET T0=(C[2]-C[1])/(S[2]-S[1])
9060 IF J=1 THEN LET A[R,I]=T0*(S[P1]-S[1])+C[1]
9063 IF J=1 THEN GOTO 9111
9066 LET T0=(C[J]-C[J-1])/(S[J]-S[J-1])
9069 LET A[R,I]=T0*(S[P1]-S[J-1])+C[J-1]
9075 GOTO 9111

```

```

9078 REM: FOM LEAST SQUARES SUB 6500 SOLVES CONC AS A F(AB3)
9081 REM: ALREADY DETERMINED AT LEAST SQUARES PROGRAM
9087 LET A1=S/P1
9088 IF M5=4 THEN GOSUB 6600
9089 IF M5=4 THEN GOTO 9102
9093 IF A1=0 THEN LET A(N,I)=1E-07
9096 IF A1=0 THEN GOTO 9111
9099 GOSUB 6500
9102 LET A(N,I)=C0
9105 REM: CALCULATE STATISTICS FOR RUN; CALCULATE
9108 REM: MUNNING AVERAGE AND RUNNING VARIANCE
9111 IF R=1 THEN LET D(I)=A(I,I)
9114 IF R=1 THEN LET V(I)=0
9120 IF R=1 THEN GOTO 9135
9123 LET D(I)=D(I)
9126 LET D(I)=D(I)*(R-1)/R+A(N,I)/R
9129 LET O(I)=V(I)
9132 LET V(I)=V(I)*(R-1)/R+1*(D(I)-A(N,I))^2/(R-1)
9135 WRITE FILE(F2,I),X3,S(P1),O(I),V(I),J
9136 WRITE FILE(F2,N1+I),A(1,I),A(2,I),A(3,I),A(4,I),A(5,I),A(6,I),A(7,I),A(8,I),A(9,I),A(10,I)
9138 NEXT J
9163 LET D5=3
9164 DEF FND(X)=INT(X*10^D5+.5)/10^D5
9200 LET A3=0
9205 REM: PRINT INTERIM REPORT ON TERMINAL
9206 PRINT TAB(25),"RUN NO. ";R;"(";I78;")"
9207 PRINT
9208 PRINT TAB(8);"SAMPLE NO. "; TAB(30);"VALUE";
9209 PRINT TAB(45);"AVERAGE"; TAB(58);"SD"; TAB(67);"RSD"
9210 FOR I=1 TO N1
9211 LET P1=I+N0
9213 READ FILE(F2,I),X3,S(P1),O(I),V(I),J
9216 PRINT
9219 PRINT "NO. ";I;" ";X3;
9222 PRINT TAB(28);FND(A(N,I));

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```

9225 PRINT TAB(43);FNO(D[I]);
9226 IF R=1 THEN LET V1=0
9227 IF R=1 THEN GOTO 9231
9228 LET V1=V1[I]*R/(R-1)
9231 PRINT TAB(55);FNO(SQR(V1));
9234 LET D4=SQR(V1)*100/D[I]
9237 PRINT TAB(62);FNO(D4)
9240 IF M5=0 THEN GOSUB 9264
9243 IF M5=0 THEN GOTO 9249
9244 IF M5=4 THEN GOTO 9249
9246 IF S1P1=0 THEN PRINT " NOT READ ?"
9249 IF X$[1,2]="CS" THEN GOSUB 8700
9252 IF X$[1,2]="SP" THEN GOSUB 8800
9255 IF X$[1,2]="DU" THEN GOSUB 8900
9258 NEXT I
9259 GOTO 9285
9261 REM: INTERPOLATION WARNING ROUTINE
9264 IF J=1 THEN PRINT " OUT OF RANGE ON LOW SIDE"
9267 IF J>N0 THEN PRINT " OUT OF RANGE ON HIGH SIDE"
9269 RETURN
9285 PRINT
9288 PRINT "HARD COPY (Y/N) ";
9290 INPUT X$
9291 IF X$[1,1]="N" THEN GOTO 9295
9292 IF X$[1,1]="Y" THEN GOTO 9520
9294 IF X$[1,1]<>"Y" THEN GOTO 9288
9295 IF F3$[1,2]="RS" THEN GOTO 9760
9296 PRINT "RECALCULATE Y/N ";
9298 INPUT X$
9299 IF X$[1,1]="Y" THEN GOSUB 9350
9300 IF X$[1,1]="Y" THEN GOTO 9740
9302 IF X$[1,1]="N" THEN GOTO 9308
9304 IF X$[1,1]<>"N" THEN PRINT "SYNTAX ERROR"
9306 IF X$[1,1]<>"N" THEN GOTO 9296
9308 INPUT "ACCEPT OR REJECT (A/R) ?",CS

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```

9312 IF C8(1,1)="A" THEN GOSUB 9368
9313 IF C8(1,1)="A" THEN GOTO 9317
9314 IF C8(1,1)="R" THEN GOSUB 9350
9315 IF C8(1,1)="R" THEN GOTO 9317
9316 IF C8(1,1)<>"R" THEN GOTO 9308
9317 PRINT "ANOTHER RUN ? (Y/N)"
9318 INPUT X$
9320 IF X8(1,1)="Y" THEN GOTO 9750
9335 IF X8(1,1)="N" THEN GOTO 9717
9340 IF X8(1,1)<>"N" THEN GOTO 9317
9350 FOR I=1 TO N1
9355   LET D(I)=B(I)
9357   LET V(I)=O(I)
9359   LET P1=I+N0
9361   READ FILE(F2,I),X8,S(P1),D(I),V(I),J
9362   WRITE FILE(F2,I),X8,S(P1),D(I),V(I),J
9365 NEXT I
9366 LET X8="Y"
9367 RETURN
9368 READ FILE(F1,P2+1),R,M5,L(11)
9370 LET R=R+1
9372 WRITE FILE(F1,P2+1),R,M5,L(11)
9375 FOR I=1 TO N1
9377   LET P1=I+N0
9380   READ FILE(F2,I),X8,S(P1),D(I),V(I),J
9382   LET S(P1)=0
9383   WRITE FILE(F2,I),X8,S(P1),D(I),V(I),J
9385 NEXT I
9387 LET C8="A"
9390 RETURN
9520 OPEN FILE(0,1),"SLPT"
9530 LET X3=1
9535 PRINT FILE(0), TAB(54),"RUN NO.      ";R
9540 PRINT FILE(0)
9545 PRINT FILE(0), TAB(8),"SAMPLE NO. AND DESCRIPTION  "; TAB(42),"VALUE (";Z7$;")";

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```

9550 PRINT FILE{0}, TAB(5);"AVERAGE"; TAB(30);"SD"; TAB(55);"RSD"
9555 PRINT FILE{0}
9560 FOR I=1 TO N1
9563 LET P1=I+N0
9565 READ FILE{F2,I},XS,S{P1},D{I},V{I},J
9570 PHINT FILE{0}
9575 PRINT FILE{0}," NO. ";I;" ";XS;
9580 PRINT FILE{0}, TAB(10);
9585 PRINT FILE{0},FNQ(A{R,I});
9590 PRINT FILE{0}, TAB(13);
9595 PRINT FILE{0},FNQ(D{I});
9596 IF R=1 THEN LET V1=0
9597 IF R=1 THEN GOTO 9600
9598 LET V1=V{I}*N/(R-1)
9600 PRINT FILE{0}, TAB(17);
9605 PRINT FILE{0},FNQ(SQR(V1));
9607 LET D4=SQR(V1)*100/D{I}
9610 PRINT FILE{0}, TAB(18);
9615 PRINT FILE{0},FNQ(D4)
9620 IF M5=0 THEN GOSUB 9700
9625 IF M5=0 THEN GOTO 9640
9627 IF M5=4 THEN GOTO 9640
9630 IF S{P1}=0 THEN PRINT FILE{0}," NOT READ ?"
9640 IF XS{1,2}="CS" THEN GOSUB 8700
9645 IF XS{1,2}="SP" THEN GOSUB 8800
9650 IF XS{1,2}="DU" THEN GOSUB 8900
9660 NEXT I
9665 PRINT FILE{0}
9670 IF M5=0 THEN PRINT FILE{0}, TAB(20);"INTERPOLATION"
9675 IF M5>0 THEN PRINT FILE{0}, TAB(20);"CALCULATED BY";M5;"DEGREE FIT"
9680 IF M5>0 THEN PRINT FILE{0}, TAB(20);"COEFF. OF DET.= ";C9
9685 CLOSE FILE{0}
9690 GOTO 9295
9695 REM: INTERPOLATION WARNING ROUTINE
9700 IF J=1 THEN PRINT FILE{0}," OUT OF RANGE ON LOW SIDE"

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```

9705 IF J>N0 THEN PRINT FILE{0}," OUT OF RANGE ON HIGH SIDE"
9710 RETURN
9715 REM: SECTION TO PRODUCE FINAL REPORTS FOR OPERATOR OR CUSTOMER
9717 REM: DD DILUTION FACTORS
9720 GOTO 7000
9740 CHAIN F3S THEN GOTO 9030
9750 CHAIN F3S THEN GOTO 9040
9760 IF R<>1 THEN GOTO 9308
9770 IF R=1 THEN GOTO 9296

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REFERENCES AND SYMBOLS IN INT.ME

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PAGE 1

1000 IS REFERENCED ON LINES:
3037 3038 3134

3040 IS REFERENCED ON LINES:
3036

3100 IS REFERENCED ON LINES:
3063

3133 IS REFERENCED ON LINES:
3038

3135 IS REFERENCED ON LINES:
3133

6500 IS REFERENCED ON LINES:
9099

6600 IS REFERENCED ON LINES:
9088

7000 IS REFERENCED ON LINES:
9720

7040 IS REFERENCED ON LINES:
7130

7110 IS REFERENCED ON LINES:
7150

7160 IS REFERENCED ON LINES:
7050 7140

8700 IS REFERENCED ON LINES:
9249 9640

REFERENCES AND SYMBOLS IN INT.ME
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8745 IS REFERENCED ON LINES:
8740

8750 IS REFERENCED ON LINES:
8742

8760 IS REFERENCED ON LINES:
8748

8800 IS REFERENCED ON LINES:
9252 9645

8870 IS REFERENCED ON LINES:
8860

8875 IS REFERENCED ON LINES:
8862

8877 IS REFERENCED ON LINES:
8873

8900 IS REFERENCED ON LINES:
9255 9650

8930 IS REFERENCED ON LINES:
8927

8935 IS REFERENCED ON LINES:
8929

8940 IS REFERENCED ON LINES:
8933

9000 IS REFERENCED ON LINES:
3150

REFERENCES AND SYMBOLS IN INT.ME

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9030 IS REFERENCED ON LINES:
9740

9040 IS REFERENCED ON LINES:
9750

9057 IS REFERENCED ON LINES:
9036

9066 IS REFERENCED ON LINES:
9042

9087 IS REFERENCED ON LINES:
9024

9102 IS REFERENCED ON LINES:
9089

9111 IS REFERENCED ON LINES:
9054 9063 9075 9096

9135 IS REFERENCED ON LINES:
9120

9231 IS REFERENCED ON LINES:
9227

9249 IS REFERENCED ON LINES:
9243 9244

9264 IS REFERENCED ON LINES:
9240

9285 IS REFERENCED ON LINES:
9259

REFERENCES AND SYMBOLS IN INT.ME
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9288 IS REFERENCED ON LINES:
9294

9295 IS REFERENCED ON LINES:
9291 9690

9296 IS REFERENCED ON LINES:
9306 9770

9308 IS REFERENCED ON LINES:
9302 9316 9760

9317 IS REFERENCED ON LINES:
9313 9315 9340

9350 IS REFERENCED ON LINES:
9299 9314

9368 IS REFERENCED ON LINES:
9312

9520 IS REFERENCED ON LINES:
9292

9600 IS REFERENCED ON LINES:
9597

9640 IS REFERENCED ON LINES:
9625 9627

9700 IS REFERENCED ON LINES:
9620

9717 IS REFERENCED ON LINES:
9335

REFERENCES AND SYMBOLS IN INT.ME

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9740 IS REFERENCED ON LINES:

3134 9500

9750 IS REFERENCED ON LINES:

9320

9760 IS REFERENCED ON LINES:

9295

A1 OCCURS ON LINES:

6515 6630 7080 7090 9087

9093 9096

A2 OCCURS ON LINES:

7080 7090

A1 OCCURS ON LINES:

0009 3137 8855 8925 9051

9060 9069 9093 9102 9111

9126 9132 9136 9222 9585

B9 OCCURS ON LINES:

3010

B1 OCCURS ON LINES:

0014 9123 9355

C5 OCCURS ON LINES:

0011 8710 8715 8803 8805

8807 8813 8814 8815 8910

8915 9308 9312 9313 9314

9315 9316 9387

C0 OCCURS ON LINES:

6515 6610 6630 9102

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C9 OCCURS ON LINES:
3035 3037 3038 3134 9680

C1 OCCURS ON LINES:
0009 3050 8735 8745 8750
9048 9051 9057 9060 9066
9069

D4 OCCURS ON LINES:
9234 9237 9607 9615

D5 OCCURS ON LINES:
9163

D1 OCCURS ON LINES:
0014 7170 7180 9022 9111
9125 9126 9132 9135 9213
9225 9355 9362 9380 9383
9565 9595

E5 OCCURS ON LINES:
3010 3063 3070 8830 8855
8870 8875 8877

E1 OCCURS ON LINES:
0009

F1 OCCURS ON LINES:
0025 3010 3030 3035 3050
3080 3132 9368 9372

F15 OCCURS ON LINES:
0011 3132

F2 OCCURS ON LINES:
0030 3120 3137 7170 7180
9022 9135 9136 9213 9361
9362 9380 9383 9565

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F2S OCCURS ON LINES:

0011 3132

F3S OCCURS ON LINES:

0011 3132 9295 9740 9750

F4S OCCURS ON LINES:

0013 3132

F1 OCCURS ON LINES:

0013 7020 7090 7180

I OCCURS ON LINES:

3040	3050	3060	3070	3090
3100	3110	3120	3130	3135
3137	3145	6610	6620	7010
7020	7030	7060	7100	7160
7165	7170	7180	7190	8735
8855	8925	9018	9021	9022
9051	9060	9069	9093	9102
9111	9114	9123	9126	9129
9132	9135	9136	9138	9210
9211	9213	9219	9222	9225
9228	9234	9258	9350	9355
9357	9359	9361	9362	9365
9375	9377	9380	9383	9385
9560	9563	9565	9575	9585
9595	9598	9607	9660	

J OCCURS ON LINES:

7080	7090	7170	7180	9022
9023	9033	9036	9039	9042
9045	9057	9060	9063	9066
9069	9135	9213	9264	9267
9362	9380	9383	9565	9700
9705				

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L1 OCCURS ON LINES:

0015	3010	3030	3080	8735
8745	8750	8819	8835	8855
8870	8875	8925	8930	8935
9368	9372			

M1 OCCURS ON LINES:

8715	8720	8725	8735	8745
8750	8807	8809	8810	8813
8819	8823	8830	8835	8855
8915	8917	8920	8925	8930
8935				

M5 OCCURS ON LINES:

3030	3036	3133	9023	9024
9088	9089	9240	9243	9244
9368	9372	9620	9625	9627
9670	9675	9680		

M0 OCCURS ON LINES:

3010	3040	3080	3110	7165
8725	9021	9033	9045	9048
9051	9211	9267	9359	9377
9563	9705			

M1 OCCURS ON LINES:

3010	3100	3135	3137	7010
7160	8920	9018	9136	9210
9350	9375	9560		

M7 OCCURS ON LINES:

7040	7050	7060
------	------	------

01 OCCURS ON LINES:

0014	9129	9357
------	------	------

REFERENCES AND SYMBOLS IN INT.ME

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P1 OCCURS ON LINES:

3110	3120	7165	7170	7180
9021	9022	9036	9042	9045
9051	9060	9069	9087	9135
9211	9213	9246	9359	9362
9377	9380	9382	9383	9563
9565	9630			

P2 OCCURS ON LINES:

0020	3010	3030	3035	3132
9368	9372			

R OCCURS ON LINES:

3030	8735	8855	8925	9051
9060	9069	9093	9102	9111
9114	9120	9126	9132	9206
9222	9226	9227	9228	9368
9370	9372	9535	9585	9596
9597	9598	9760	9770	

SI OCCURS ON LINES:

0009	3050	3120	7170	7180
9022	9036	9042	9045	9048
9051	9057	9060	9066	9069
9087	9135	9213	9246	9362
9380	9382	9383	9565	9630

T0 OCCURS ON LINES:

9048	9051	9057	9060	9066
9069				

T2 OCCURS ON LINES:

3010

V1 OCCURS ON LINES:

9226	9228	9231	9234	9596
9598	9605	9607		

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VI OCCURS ON LINES:

0014	7170	7180	9022	9114
9129	9132	9135	9213	9228
9357	9362	9380	9383	9565
9598				

X OCCURS ON LINES:

9164

XS OCCURS ON LINES:

0009	3120	7120	7130	7140
7150	7170	7180	8710	8803
8910	9022	9135	9213	9219
9249	9252	9255	9290	9291
9292	9294	9298	9299	9300
9302	9304	9306	9318	9320
9335	9340	9361	9362	9366
9380	9383	9565	9575	9640
9645	9650			

X1 OCCURS ON LINES:

8814 8815 8823 8835

X3 OCCURS ON LINES:

8740 8742 8860 8862 8927
8929 9200 9530

Y0 OCCURS ON LINES:

3035 6515 6610

Y1 OCCURS ON LINES:

3035 6515 6630

Y2 OCCURS ON LINES:

3035 6515

REFERENCES AND SYMBOLS IN INT.ME
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Y3 OCCURS ON LINES:
3035 6515

Z25 OCCURS ON LINES:
0005 3010

Z35 OCCURS ON LINES:
0005 3010

Z45 OCCURS ON LINES:
0005 3010

Z75 OCCURS ON LINES:
0005 3010 8745 8750 8870
8875 9206 9545

Z9 OCCURS ON LINES:
3065 3075 3080 9007

LISTING WAS TAKEN FROM FILE INT.ME
SYMBOL TABLE WAS IN FILE INT.ST
181 SYMBOL SPACES WERE USED
0 OVERFLOWS OCCURRED
NEXT TIME SET ARRAYS TO 181
FOR MORE COPIES SET
US=INT.ME
NS=INT.ST
RUN 3240 (OR THEREABOUTS)

LISTING OF FILE RPT.ME ON 9 / 27 / 1977

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```

0002 REM: LLL;"RPT.ME;PROG TO WRITE FINAL REPORTS;WALTER BOYLE
0005 DIM CS(10),XS(100),YS(11),WS(10)
0010 DIM ZS(72),Z3S(72),Z4S(72),Z7S(72)
0015 DIM F(50)
0020 DIM L(50),C(10),S(60)
0030 DIM T(50),A(10,50),D(50),V(50)
0040 DIM F1S(20),F2S(20),F3S(20)
0042 DIM DS(20),F4S(20)
0045 LET P2=20
0050 LET F1=1
0055 LET F2=2
0057 REM: DETERMINE DECIMAL PLACES AND FILE NAMES
0058 GOTO 3000
0060 INPUT "FILE NAME FOR STORAGE OF VARIABLES ",F1S
0065 INPUT "FILE NAME FOR SAMPLE I D ",F2S
0070 OPEN FILE(F1,0),F1S
0075 OPEN FILE(F2,0),F2S
0085 READ FILE(F1,P2),N0,N1,E5,Z2S,Z3S,Z4S,Z7S,B9,L(6),T2
0090 READ FILE(F1,P2+1),R,M5,L(11)
0095 READ FILE(F1,P2+2),Y0,Y1,Y2,Y3,C9
0100 READ FILE(F1,P2+3),F3S,DS,DS,F4S
0102 LET R=R-1
0105 FOR I=1 TO N0
0110 READ FILE(F1,I),C(I),S(I)
0120 NEXT I
0125 LET Z9=19
0130 FOR J=1 TO E5
0135 LET Z9=Z9+1
0140 READ FILE(F1,N0+1+J),L(Z9)
0145 NEXT J
0147 REM: READ SAMPLE FILES AND GET REAGENT BLANKS
0148 GOTO 2000
0150 INPUT "FINAL REPORT; OPERATOR OR CUSTOMER; OP/CU/NO ? ",WS
0153 IF WS(1,2)="OP" THEN GOTO 0158
0155 IF WS(1,2)="CU" THEN GOTO 0158

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```

0156 IF W$11,2)=="NO" THEN GOTO 0490
0157 IF W$11,2) <> "NO" THEN GOTO 0150
0158 OPEN FILE(U,I),"&LPT"
0159 IF W$11,2)=="OP" THEN PRINT FILE(0), TAB(40);"ATOMIC ABSORPTION REPORT---OPERATOR"
0160 IF W$11,2)=="CU" THEN PRINT FILE(0), TAB(40);"ATOMIC ABSORPTION ANALYSIS REPORT"
0165 PRINT FILE(0)
0170 IF W$11,2)=="CU" THEN GOTO 0185
0175 PRINT FILE(0),"DATE: ";SYS(2);"/";SYS(1);"/";SYS(3);" ";Z28
0180 GOTO 0190
0185 PRINT FILE(0),"DATE: ";SYS(2);"/";SYS(1);"/";SYS(3)
0190 PRINT FILE(0)
0195 PRINT FILE(0),"ELEMENT AND SAMPLE SOURCE: ";Z38
0200 PRINT FILE(0)
0205 PRINT FILE(0), TAB(33);"AVERAGE CONC.(";Z73;")";
0210 PRINT FILE(0), TAB(6);" STANDARD"
0215 PRINT FILE(0), TAB(6);"% RELATIVE STANDARD"; TAB(31);"AVERAGE % RECOVERY"
0220 PRINT FILE(0),"SAMPLE NO. AND DESCRIPTION"; TAB(38);"OF";R;"RUNS"
0225 PRINT FILE(0), TAB(14);"DEVIATION"; TAB(35);"DEVIATION"; TAB(54);"SPIKE, STD, OR UNK. "
0230 PRINT FILE(0)
0235 FOR I=1 TO N1
0237 LET P1=I+N0
0240 READ FILE(F2,I),X$,S(P1),D(I),V(I),J,F(I)
0250 LET D5=D(I)
0255 IF I2=I THEN GOTO 0270
0257 IF X$11,2)=="C8" THEN GOTO 0270
0258 IF X$11,2)=="SP" THEN GOTO 0270
0260 IF D$11,1)=="Y" THEN LET D5=D(I)-D(I2)
0270 PRINT FILE(0)
0273 PRINT FILE(0)," NO. ";
0275 PRINT FILE(0),USING "##",I;" ";
0280 PRINT FILE(0),X$; TAB(25);
0285 PRINT FILE(0),FNO(05);
0296 IF R=1 THEN LET V1=0
0297 IF R=1 THEN GOTO 0300
0298 LET V1=V(I)*R/(R-1)

```

LISTING OF FILE RPT.ME ON 9 / 27 / 1977
PAGE 3

```

0300 PRINT FILE(0), TAB(16);
0305 PRINT FILE(0), FNQ(SQR(V1));
0407 LET D4=SQR(V1)*100/(D(I)*F(I))
0310 PRINT FILE(0), TAB(15);
0315 PRINT FILE(0), USING "---#.##", D4;
0320 PRINT FILE(0), TAB(13);
0325 IF X$(1,2)="CS" THEN GOTO 0600
0330 IF X$(1,2)="SP" THEN GOTO 0700
0335 IF X$(1,2)="DU" THEN GOTO 0800
0340 GOTO 0390
0350 PRINT FILE(0), USING "---#.##", 100*(D(I)*F(I)/C(M1))
0355 GOTO 0395
0365 PRINT FILE(0), USING "---#.##", 100*(D(I)*F(I)-D(M2)*F(M2))/L(M1)
0370 GOTO 0395
0380 PRINT FILE(0), USING "---#.##", 100*(D(I)/D(M1))
0385 GOTO 0395
0390 PRINT FILE(0), "-----"
0395 NEXT I
0397 IF D$(1,1) <> "Y" THEN GOTO 0400
0398 PRINT FILE(0)
0399 PRINT FILE(0), "REAGENT BLANK OF "; D(I2); " # "; I2; " SUBTRACTED"
0400 IF W$="CU" THEN GOTO 0480
0405 PRINT FILE(0)
0406 PRINT FILE(0)
0407 PRINT FILE(0), "STANDARDS "; Z7$
0408 FOR I=1 TO N0
0409 PRINT FILE(0), " "; C(I)
0410 NEXT I
0411 PRINT FILE(0)
0412 PRINT FILE(0)
0415 IF L(11)=-1 THEN PRINT FILE(0), "FREQUENCY OF BASELINE READ: AVERAGED"
0420 IF L(11)=-1 THEN GOTO 0435
0425 IF L(11)=0 THEN PRINT FILE(0), "FREQUENCY OF BASELINE READ: VARIES"
0430 IF L(11) <> 0 THEN PRINT FILE(0), "FREQUENCY OF BASELINE READ: "; L(11)
0435 PRINT FILE(0)

```

```

0437 IF M5=0 THEN GOTO 0453
0438 IF M5=4 THEN GOTO 0445
0440 PRINT FILE(0),"STANDARD CURVE DEGREE OF FIT",M5
0445 PRINT FILE(0)
0448 IF M5=4 THEN PRINT FILE(0),"METHOD OF ADDITIONS WITH SAMPLE #1."
0450 PRINT FILE(0),"COEFFICIENT OF DETERMINATION:",C9
0453 IF M5=0 THEN PRINT FILE(0),"INTERPOLATION WITH TWO CLOSEST STANDARDS"
0455 PRINT FILE(0)
0460 PRINT FILE(0),"MODE OF ANALYSIS AND ORDER OF SAMPLING"
0462 IF F3$(1,2)="SM" THEN PRINT FILE(0)," SEMIAUTO"
0464 IF F3$(1,2)="RS" THEN PRINT FILE(0)," AUTOMATIC"
0465 IF F4$(1,1)="R" THEN PRINT FILE(0)," RANDOM SAMPLING"
0466 IF F4$(1,1)="S" THEN PRINT FILE(0)," SEQUENTIAL SAMPLING"
0468 PRINT FILE(0)
0470 PRINT FILE(0),"INSTRUMENT CONDITIONS"
0475 PRINT FILE(0),Z4$
0480 CLOSE FILE(0)
0485 GOTO 0150
0490 FOR I=1 TO N1
0491 LET PI=I+N0
0492 READ FILE(F2,I),X$,S(P1),D(I),V(I),J,F(I)
0493 WRITE FILE(F2,I),X$,S(P1),D(I)*F(I),V(I),J,F(I)
0494 NEXT I
0495 INPUT "CHANGE FILE NAMES (Y/N) ",C$
0497 IF C$(1,1)="Y" THEN GOTO 0510
0500 IF C$(1,1)="N" THEN GOTO 0530
0505 IF C$(1,1) <> "N" THEN GOTO 0495
0510 INPUT "NEW FILE NAME FOR VARIABLE STORAGE ",W$
0512 CLOSE
0515 RENAME F1$,W$
0520 INPUT "NEW SAMPLE ID FILE NAME ",W$
0525 RENAME F2$,W$
0530 CLOSE
0533 PRINT "ALL DONE"
0535 END

```

LISTING OF FILE RPT.ME ON 9 / 27 / 1977
PAGE 5

```

0600 LET CS=XS(3)
0605 LET M1=VAL(CS)
0610 IF M1<1 THEN GOTO 0390
0615 IF M1>90 THEN GOTO 0390
0620 REM: M1 CONTAINS STANDARD NUMBER
0625 GOTO 0350
0700 LET CS=XS(3)
0705 IF CS(2,2)="0" THEN GOTO 0390
0707 LET M1=VAL(CS)
0710 IF M1<=10 THEN GOTO 0390
0715 IF M1>999 THEN GOTO 0390
0717 LET CS=STR$(M1)
0720 IF LEN(CS)=2 THEN LET X1=10
0723 IF LEN(CS)=3 THEN LET X1=100
0725 REM: M1 CONTAINS SPIKE NO. AND UNKNOWN NO. COMBINED
0730 LET M2=M1
0735 LET M1=INT(M1/X1)
0740 REM: M1 IS NOW SPIKE NO.
0745 LET M2=M2-M1*X1
0750 REM: M2 IS NOW UNKNOWN NO.
0752 LET Z9=19
0753 LET M1=Z9+M1
0755 GOTO 0365
0800 LET CS=XS(3)
0805 LET M1=VAL(CS)
0810 IF M1<1 THEN GOTO 0390
0812 IF M1>91 THEN GOTO 0390
0815 REM: M1 CONTAINS UNKNOWN NUMBER
0820 GOTO 0380
2000 LET I2=0
2010 FOR I=1 TO N1
2020 LET P1=I+N0
2030 READ FILE(F2,I),XS,SIP1,D(1),V(1),J,F(1)
2040 LET X5=LEN(XS)
2050 IF XS(X5,X5)="-R" THEN LET I2=I

```


LISTING OF FILE RPT.ME ON 9 / 27 / 1977
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```

2053 LET D[I]=D[I]/F[I]
2057 WRITE FILE(F2,I),XS,S(P1),D[I],V[I],J,F[I]
2060 NEXT I
2070 IF I2=0 THEN GOTO 0150
2075 LET DS=""
2080 PRINT "REAGENT BLANK (SAMPLE " ;I2;" ) = " ;D[I2]
2090 INPUT "SUBTRACT REAGENT BLANK Y/N ",DS
2100 IF DS[1,1]="Y" THEN GOTO 0150
2110 IF DS[1,1]="N" THEN GOTO 0150
2120 IF DS[1,1]<>"N" THEN GOTO 2090
3000 INPUT "NUMBER OF PLACES AFTER DECIMAL POINT ? ",G1
3005 DEF FNQ(X)=INT(X*10^G1+.5)/10^G1
3010 INPUT "STANDARD VARIABLE FILE NAMES ? Y/N ",WS
3015 IF WS[1,1]="Y" THEN GOTO 3030
3020 IF WS[1,1]="N" THEN GOTO 0060
3025 IF WS[1,1]<>"N" THEN GOTO 3010
3030 PRINT "SMASH1.LL,RSASH1.LL,SM305.LL,RS305.LL"
3035 INPUT "PROGRAM NAME ? ",F3$
3040 IF F3$="SMASH1.LL" THEN LET F1$="VASH1.SM"
3045 IF F3$="SMASH1.LL" THEN LET F2$="IDASH1.SM"
3050 IF F3$="RSASH1.LL" THEN LET F1$="VASH1.RS"
3055 IF F3$="RSASH1.LL" THEN LET F2$="IDASH1.RS"
3060 IF F3$="SM305.LL" THEN LET F1$="V305.SM"
3065 IF F3$="SM305.LL" THEN LET F2$="ID305.SM"
3070 IF F3$="RS305.LL" THEN LET F1$="V305.RS"
3075 IF F3$="RS305.LL" THEN LET F2$="ID305.RS"
3080 GOTO 0070

```

REFERENCES AND SYMBOLS IN RPT.ME
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PAGE 1

0060 IS REFERENCED ON LINES:
3020

0070 IS REFERENCED ON LINES:
3080

0150 IS REFERENCED ON LINES:
0157 0485 2070 2100 2110

0158 IS REFERENCED ON LINES:
0153 0155

0165 IS REFERENCED ON LINES:
0170

0190 IS REFERENCED ON LINES:
0180

0270 IS REFERENCED ON LINES:
0255 0257 0258

0300 IS REFERENCED ON LINES:
0297

0350 IS REFERENCED ON LINES:
0625

0365 IS REFERENCED ON LINES:
0755

0380 IS REFERENCED ON LINES:
0820

0390 IS REFERENCED ON LINES:
0340 0610 0615 0705 0710
0715 0810 0812

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0395 IS REFERENCED ON LINES:

0355 0370 0385

0400 IS REFERENCED ON LINES:

0397

0435 IS REFERENCED ON LINES:

0420

0445 IS REFERENCED ON LINES:

0438

0453 IS REFERENCED ON LINES:

0437

0480 IS REFERENCED ON LINES:

0400

0490 IS REFERENCED ON LINES:

0156

0495 IS REFERENCED ON LINES:

0505

0510 IS REFERENCED ON LINES:

0497

0530 IS REFERENCED ON LINES:

0500

0600 IS REFERENCED ON LINES:

0325

0700 IS REFERENCED ON LINES:

0330

REFERENCES AND SYMBOLS IN RPT.ME

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0800 IS REFERENCED ON LINES:
0335

2000 IS REFERENCED ON LINES:
0148

2090 IS REFERENCED ON LINES:
2120

3000 IS REFERENCED ON LINES:
0058

3010 IS REFERENCED ON LINES:
3025

3030 IS REFERENCED ON LINES:
3015

A1 OCCURS ON LINES:
0030

B9 OCCURS ON LINES:
0065

C5 OCCURS ON LINES:
0005 0495 0497 0500 0505
0600 0605 0700 0705 0707
0717 0720 0723 0800 0805

C9 OCCURS ON LINES:
0095 0450

C1 OCCURS ON LINES:
0020 0110 0350 0409

D5 OCCURS ON LINES:
0042 0100 0260 0397 2075
2090 2100 2110 2120

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D4 OCCURS ON LINES:

0307 0315

D5 OCCURS ON LINES:

0250 0260 0285

D1 OCCURS ON LINES:

0030 0240 0250 0260 0307

0365 0380 0399 0492 0493

2030 2053 2057 2080

E5 OCCURS ON LINES:

0085 0130

F1 OCCURS ON LINES:

0050 0070 0085 0090 0095

0100 0110 0140

F15 OCCURS ON LINES:

0040 0060 0070 0515 3040

3050 3060 3070

F2 OCCURS ON LINES:

0055 0075 0240 0492 0493

2030 2057

F25 OCCURS ON LINES:

0040 0065 0075 0525 3045

3055 3065 3075

F35 OCCURS ON LINES:

0040 0100 0462 0464 3035

3040 3045 3050 3055 3060

3065 3070 3075

F45 OCCURS ON LINES:

0042 0100 0465 0466

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F1 OCCURS ON LINES:

0015	0240	0307	0350	0365
0492	0493	2030	2053	2057

G1 OCCURS ON LINES:

3000

I OCCURS ON LINES:

0105	0110	0120	0235	0237
0240	0250	0255	0260	0275
0298	0307	0350	0365	0380
0395	0408	0409	0410	0490
0491	0492	0493	0494	2010
2020	2030	2050	2053	2057
2060				

I2 OCCURS ON LINES:

0255	0260	0399	2000	2050
2070	2080			

J OCCURS ON LINES:

0130	0145	0240	0492	0493
2030	2057			

L1 OCCURS ON LINES:

0020	0085	0090	0140	0365
0415	0420	0425	0430	

M1 OCCURS ON LINES:

0350	0365	0380	0605	0610
0615	0707	0710	0715	0717
0730	0735	0745	0753	0805
0810	0812			

M2 OCCURS ON LINES:

0365	0730	0745
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REFERENCES AND SYMBOLS IN RPT.ME

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M5 OCCURS ON LINES:
0090 0437 0438 0440 0448
0453

N0 OCCURS ON LINES:
0085 0105 0140 0237 0408
0491 0615 2020

N1 OCCURS ON LINES:
0085 0235 0490 0812 2010

P1 OCCURS ON LINES:
0237 0240 0491 0492 0493
2020 2030 2057

P2 OCCURS ON LINES:
0045 0085 0090 0095 0100

R OCCURS ON LINES:
0090 0102 0220 0296 0297
0298

S1 OCCURS ON LINES:
0020 0110 0240 0492 0493
2030 2057

T2 OCCURS ON LINES:
0085

T1 OCCURS ON LINES:
0030

V1 OCCURS ON LINES:
0296 0298 0305 0307

V1 OCCURS ON LINES:
0030 0240 0298 0492 0493
2030 2057

REFERENCES AND SYMBOLS IN RPT.ME

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WS OCCURS ON LINES:

0005	0150	0153	0155	0156
0157	0159	0160	0170	0400
0510	0515	0520	0525	3010
3015	3020	3025		

X OCCURS ON LINES:

3005

XS OCCURS ON LINES:

0005	0240	0257	0258	0280
0325	0330	0335	0492	0493
0600	0700	0800	2030	2040
2050	2057			

X1 OCCURS ON LINES:

0720 0723 0735 0745

X5 OCCURS ON LINES:

2040 2050

YS OCCURS ON LINES:

0005

Y0 OCCURS ON LINES:

0095

Y1 OCCURS ON LINES:

0095

Y2 OCCURS ON LINES:

0095

Y3 OCCURS ON LINES:

0095

REFERENCES AND SYMBOLS IN RPT.ME

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22\$ OCCURS ON LINES:

0010 0085 0175

23\$ OCCURS ON LINES:

0010 0085 0195

24\$ OCCURS ON LINES:

0010 0085 0475

27\$ OCCURS ON LINES:

0010 0085 0205 0407

29 OCCURS ON LINES:

0125 0135 0140 0752 0753

LISTING WAS TAKEN FROM FILE RPT.ME

SYMBOL TABLE WAS IN FILE RPT.ST

117 SYMBOL SPACES WERE USED

0 OVERFLOWS OCCURRED

NEXT TIME SET ARRAYS TO

117

FOR MORE COPIES SET

OS=RPT.ME

NS=RPT.ST

RUN 3240 (OR THEREABOUTS)

```

0040 REM: LLL,"LSQ.AA";PROGRAM FOR LEAST SQUARES FITS FOR AA";WALTER BOYLE
0050 REM: LEAST SQUARES ROUTINE FOR SM306
0100 DIM F(5,5),Z(15,4),Q(15,4),K(15,4)
0110 DIM U(10,1),W(5,1),G(5,5),H(11,1)
0120 DIM T(15),P(15)
0130 DIM S(10),C(10)
0140 DIM F3$(20)
0150 DIM L(20)
0500 LET P1=20
1000 LET F1=1
1030 READ FILE(F1,P1),N0,N1
1040 READ FILE(F1,P1+1),R,M1,L(11)
1050 FOR I=1 TO N0
1060   READ FILE(F1,I),C(11),S(1)
1070 NEXT I
6000 REM ROUTINE TO CALCULATE LEAST SQUARES
6001 IF M1=4 THEN LET MS=1
6002 IF M1=4 THEN GOTO 6010
6003 LET MS=M1
6005 IF MS=0 THEN GOTO 6320
6010 PRINT "LEAST SQUARES"
6015 FOR I=1 TO 15
6015   LET P(I)=0
6017   LET T(I)=0
6019 NEXT I
6020 REM MS=M1 TYPE OF CALCULATION
6025 MAT F=ZER(MS+1,MS+1)
6027 MAT Z=ZER(N0+4,MS+1)
6029 MAT Q=ZER(N0+4,MS+1)
6032 MAT K=ZER(N0+4,MS+1)
6033 MAT U=ZER(N0,1)
6035 MAT W=ZER(MS+1,1)
6040 MAT G=ZER(MS+1,1)
6042 MAT H=ZER(MS+1,1)
6045 FOR I=1 TO N0

```

```

6060 LET X1=1
6065 LET Y1=C(I)
6070 LET X3=S(I)
6075 LET J=-1
6080 LET J=J+1
6085 LET T(2*J+1)=T(2*J+1)+X1
6090 LET X1=X1*X3
6095 REM: T(K)=SUM(S(I)**K);S(I) INDEPENDENT VAR.
6100 LET P(J+1)=P(J+1)+Y1
6105 LET Y1=Y1*X3
6110 REM: P(K)=SUM(C(I)*S(I)**K) C(I) DEPENDENT VAR
6115 IF J=M5 THEN GOTO 6132
6120 LET T(2*J+2)=T(2*J+2)+X1
6125 LET X1=X1*X3
6130 GOTO 6080
6132 IF S(I)=0 THEN PRINT "MISSED STD NO.,";I;" ? (1ST RUN WARNS ONLY)"
6135 NEXT I
6140 FOR J=0 TO M5
6145   FOR L=0 TO M5
6150     LET F(J+1,L+1)=T(J+1+L)
6155   NEXT L
6156   LET H(J+1,1)=P(J+1)
6158 NEXT J
6160 MAT G=INV(F)
6165 MAT W=G*H
6170 REM W(L+1,1) IS LTH COEFFICIENT
6175 LET Y0=W(1,1)
6180 LET Y1=W(2,1)
6185 LET Y2=0
6190 LET Y3=0
6195 ON M5 THEN GOTO 6220, 6200, 6210
6200 LET Y2=W(3,1)
6205 GOTO 6220
6210 LET Y2=W(3,1)
6215 LET Y3=W(4,1)

```

```

6220 REM IF INTERPOLATION WAS NOT SPECIFIED
6221 REM WE HAVE AT THIS POINT ABS AS A F(CONC)
6222 REM: CONC=Y0+Y1*ABS1+Y2*ABS**2+Y3*ABS**3
6225 REM WHERE Y2 AND/LR Y3 MAY BE ZERO
6235 PRINT "COEFFICIENTS Y0,Y1,Y2,Y3 ARE ";Y0;Y1;Y2;Y3
6240 FOR I=1 TO N0
6245 LET U[I,1]=C[I]
6250 NEXT I
6255 MAT Z=TRN(U)
6260 MAT Q=Z*U
6265 LET C6=Q[1,1]
6270 LET C7=H[1,1]*H[1,1]/N0
6275 MAT Z=F*W
6280 MAT K=TRN(W)
6285 MAT Q=K*Z
6290 LET C8=Q[1,1]
6292 IF (C6-C7)=0 THEN GOTO 6540
6295 LET C9=(C8-C7)/(C6-C7)
6300 PRINT
6305 PRINT "COEFFICIENT OF DETERMINATION=" ";C9
6310 PRINT
6312 WRITE FILE[F1,P1+2],Y0,Y1,Y2,Y3,C9
6313 GUSUB 7000
6315 GOTO 6520
6320 PRINT "INTERPOLATION"
6325 GOTO 6520
6500 REM: SOLVE THE EQUATION; CONCENTRATION AS A FUNCTION
6505 REM: OF ABSORBANCE BY A METHOD OF SIMPLE SUBSTITUTION
6520 READ FILE[F1,P1+3],F3$
6530 CHAIN F3$ THEN GOTO 6070
6540 PRINT
6550 PRINT "COEFFICIENT OF DETERMINATION IS INDETERMINATE"
6560 PRINT
6570 GOTO 6520
7000 REM: PRINT STD DIFFERENCES
7010 PRINT "CONC=" ";Y0;" + ";Y1;" *ABS ";Y2;" *ABS^2 ";Y3;" *ABS^3"
7020 FOR I=1 TO N0
7030 LET X1=C[I]-(Y0+Y1*S[I]+Y2*S[I]*S[I]+Y3*S[I]^3)
7040 PRINT I;" DIFF ";C[I];" - ";C[I]-X1;" = ";X1
7050 NEXT I
7060 RETURN

```

REFERENCES AND SYMBOLS IN LSD.AA
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6010 IS REFERENCED ON LINES:
6002

6070 IS REFERENCED ON LINES:
6530

6080 IS REFERENCED ON LINES:
6130

6132 IS REFERENCED ON LINES:
6115

6200 IS REFERENCED ON LINES:
6195

6210 IS REFERENCED ON LINES:
6195

6220 IS REFERENCED ON LINES:
6195 6205

6320 IS REFERENCED ON LINES:
6005

6520 IS REFERENCED ON LINES:
6315 6325 6570

6540 IS REFERENCED ON LINES:
6292

7000 IS REFERENCED ON LINES:
6315

C6 OCCURS ON LINES:
6265 6292 6295

REFERENCES AND SYMBOLS IN LSG.AA

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C7 OCCURS ON LINES:
6270 6292 6295

C8 OCCURS ON LINES:
6290 6295

C9 OCCURS ON LINES:
6295 6305 6312

C1 OCCURS ON LINES:
0130 1060 6065 6245 7030
7040

F OCCURS ON LINES:
6025 6160 6275

F1 OCCURS ON LINES:
1000 1030 1040 1060 6312
6520

F35 OCCURS ON LINES:
0140 6520 6530

F1 OCCURS ON LINES:
0100 6150

G OCCURS ON LINES:
6040 6160 6165

G1 OCCURS ON LINES:
0110

H OCCURS ON LINES:
6042 6165

H1 OCCURS ON LINES:
0110 6156 6270

REFERENCES AND SYMBOLS IN LSQ.AA

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I OCCURS ON LINES:

1050 1060 1070 6013 6015
6017 6019 6045 6065 6070
6132 6135 6240 6245 6250
7020 7030 7040 7050

J OCCURS ON LINES:

6075 6080 6100 6115 6140
6150 6156 6158

K OCCURS ON LINES:

6032 6280 6285

K1 OCCURS ON LINES:

0100

L OCCURS ON LINES:

6145 6155

L1 OCCURS ON LINES:

0150 1040

M1 OCCURS ON LINES:

1040 6001 6002 6003

M5 OCCURS ON LINES:

6001 6003 6005 6025 6135
6040 6042 6115 6140 6145
6195

N0 OCCURS ON LINES:

1030 1050 6027 6029 6032
6033 6045 6240 6270 7020

N1 OCCURS ON LINES:

1030

REFERENCES AND SYMBOLS IN LSQ.AA
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P1 OCCURS ON LINES:
0500 1030 1040 6312 6520

PI OCCURS ON LINES:
0120 6015 6100 6156

Q OCCURS ON LINES:
6029 6260 6285

QI OCCURS ON LINES:
0100 6265 6290

R OCCURS ON LINES:
1040

SI OCCURS ON LINES:
0130 1060 6070 6132 7030

TI OCCURS ON LINES:
0120 6017 6085 6120 6150

U OCCURS ON LINES:
6033 6255 6260

UI OCCURS ON LINES:
0110 6245

W OCCURS ON LINES:
6035 6155 6275 6280

WI OCCURS ON LINES:
0110 6175 6180 6200 6210
6215

XI OCCURS ON LINES:
6060 6085 6090 6120 6125
7030 7040

REFERENCES AND SYMBOLS IN LSQ.AA

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X3 OCCURS ON LINES:
6070 6090 6105 6125

Y0 OCCURS ON LINES:
6175 6235 6312 7010 7030

Y1 OCCURS ON LINES:
6065 6100 6105 6180 6235
6312 7010 7030

Y2 OCCURS ON LINES:
6185 6200 6210 6235 6312
7010 7030

Y3 OCCURS ON LINES:
6190 6215 6235 6312 7010
7030

Z OCCURS ON LINES:
6027 6255 6260 6275 6285

Z1 OCCURS ON LINES:
0100

LISTING WAS TAKEN FROM FILE LSQ.AA

SYMBOL TABLE WAS IN FILE LSQ.ST

67 SYMBOL SPACES WERE USED

0 OVERFLWS OCCURRED

NEXT TIME SET ARRAYS TO 67

FOR MORE COPIES SET

US=LSQ.AA

NS=LSQ.ST

RUN 240 (OR THEREABOUTS)

```
0002 REM: LLL;"SM305.LL";WALTER BOYLE; SEMI-AUTO PROGRAM
0003 REM: FILES; "V305.SM" FOR VARIABLES AND "I0305.SM" FOR SAMPLE ID
0004 REM: WRITTEN FOR USE ON PE 305 DOUBLE BEAM INSTRUMENT
0005 DIM Z$(72),Z3$(72),Z4$(72),Z7$(72)
0009 DIM X$(15),E(10),A(10,50),C(10),S(60)
0011 DIM C$(25),F1$(20),F2$(20),F3$(20)
0012 DIM F4$(20)
0013 DIM L(50)
0014 DIM D(50),V(50),O(50),B(50)
0015 LET M1=0
0016 LET X1=0
0017 LET F3$="SM305.LL"
0018 LET F4$=""
0019 LET K=0
0020 LET D1=1
0022 LET C9=1000
0024 LET R=1
0025 LET L(11)=0
0026 CALL Z1,O1,M1
0027 REM: INITIALIZE SAMPLER POSITION
0028 REM*****SET PROPER CHANNEL NUMBERS*****
0030 REM: L(4) IS CHAN 8 REF; L(5) IS CHAN 7 SAMPLE
0031 REM: L(8) IS FOR REF DATA; L(7) IS SAMPLE DATA
0032 REM: L(6) NO. OF POINTS (TIME); L(3) IS CORRECTOR
0035 LET L(4)=8
0036 LET L(5)=7
0037 LET L(3)=0
0042 LET P2=20
0043 LET L(10)=1
0045 GOSUB 0950
0047 CALL 1,T2
0050 GOSUB 9040
0100 PRINT "*";
0105 INPUT C$
0110 REM COMMAND STRING
```

LISTING OF FILE SM305.LL ON 9 / 27 / 1977
PAGE 2

```

0115 GOSUB 2000
0120 REM COMMAND STRING INTERPRETER
0130 LET M=M1
0135 IF M0>2 THEN LET M=M+N0
0140 ON M0+1 THEN GOSUB 0175, 5000, 5000, 6000, 7000, 9000, 5000, 3000
0143 REM M0 CODES ARE 0:ERROR,1:S W/B,2:S W/O BASE,3:C
0147 REM 4:B,5:R,6:U W/O B,7:U W/B
0150 IF M0=3 THEN GOTO 0100
0155 PRINT B
0165 PRINT
0170 GOTO 0100
0175 PRINT "BAD SYNTAX!"
0180 RETURN
0200 REM: FIRST READING AT EACH REPEAT IS BASELINE
0201 PRINT "SET-UP FOR BASELINE AND HIT RETURN"
0203 INPUT X$
0205 LET C$="B"
0210 LET M0=4
0212 LET M=0
0215 RETURN
0950 PRINT
0955 PRINT "OPERATOR'S NAME AND INSTRUMENT"
0960 INPUT Z2$
0965 PRINT "ELEMENT AND SAMPLE SOURCE"
0970 INPUT Z3$
1030 PRINT "MAX ID LENGTH, NO. OF SAMPLES";
1035 INPUT N3,N1
1045 PRINT "SAMPLE I. O. CODE"
1046 LET F2$="ID305.SM"
1047 LET F2=2
1048 OPEN FILE[F2,01,F2$
1050 FOR I=1 TO N1
1055 PRINT I;
1060 INPUT X$
1062 IF LEN(X$)>N3 THEN GOSUB 6500

```

```
1066 GOSUB 6600
1072 WRITE FILE(F2,1),XS
1073 NEXT I
1074 INPUT "CORRECTIONS Y/N ? ",CS
1076 IF CS(1,1)="Y" THEN GOTO 1080
1077 IF CS(1,1)="N" THEN GOTO 1093
1078 IF CS(1,1)<>"N" THEN GOTO 1074
1080 INPUT "NO. OF I.D. CORRECTIONS ? ",X1
1082 IF X1=0 THEN GOTO 1093
1084 FOR J=1 TO X1
1085 INPUT "NO. AND I.D. OF SAMPLE ? ",I,XS
1086 IF LEN(XS)>N3 THEN GOSUB 6500
1088 GOSUB 6600
1091 WRITE FILE(F2,1),XS
1092 NEXT J
1093 INPUT "INSTRUMENT CONDITIONS ",Z4$
1135 PRINT "BASELINE LIMIT"
1140 INPUT B9
1145 PRINT "UNITS"
1150 INPUT Z7$
1175 PRINT "INTEG. TIME IN SECONDS"
1180 INPUT L(6)
1183 LET L(6)=INT(L(6)*15/2)
1184 PRINT L(6),"POINTS"
1185 PRINT "PAUSE TIME IN SECONDS"
1190 INPUT T2
1193 LET T2=INT(60*T2)
1200 LET F1$="V305.SM"
1205 LET F1=1
1210 OPEN FILE(F1,0),F1$
1215 INPUT "NO. OF STDS ",N0
1220 PRINT "CONC:"
1225 FOR I=1 TO N0
1230 PRINT I;
1235 INPUT C(1)
```

```

1240 LET S(I)=0
1245 WRITE FILE(F1,I),C(I),S(I)
1250 NEXT I
1260 INPUT "NO. OF SPIKES ",E5
1265 IF E5=0 THEN GOTO 1310
1270 LET Z9=19
1275 FOR J=1 TO E5
1280 LET Z9=Z9+1
1285 PRINT "SPIKE NO. ",J," "
1290 INPUT "VALUE ",L(Z9)
1300 WRITE FILE(F1,N0+1+J),L(Z9)
1305 NEXT J
1310 WRITE FILE(F1,P2),N0,N1,E5,Z28,Z38,Z48,Z78,89,L(6),T2
1312 WRITE FILE(F1,P2+1),R,M1
1313 WRITE FILE(F1,P2+2),0,0,0,0,C9
1314 WRITE FILE(F1,P2+3),F38,F28,F18,F48
1320 FOR I=1 TO N1
1325 FOR J=1 TO 10
1330 LET A(I,J)=0
1335 NEXT J
1340 NEXT I
1350 FOR I=1 TO N1
1355 WRITE FILE(F2,N1+I),A(1,I),A(2,I),A(3,I),A(4,I),A(5,I),A(6,I),A(7,I),A(8,I),A(9,I),A(10,I)
1360 NEXT I
1365 RETURN
2000 IF C3(1,1) < "A" THEN GOTO 2130
2002 IF C3="A" THEN LET M0=5
2005 IF C3="R" THEN RETURN
2010 IF C3="B" THEN LET M0=4
2015 IF C3="D" THEN RETURN
2020 IF C3(1,1) < "C" THEN GOTO 2060
2030 LET M0=3
2035 IF C3="CI" THEN LET M1=0
2037 IF C3="CI" THEN RETURN
2038 IF C3="CA" THEN LET M1=4

```

```

2039 IF CS="CA" THEN RETURN
2040 REM M1 CODES CALC TYPE
2045 REM 0:1,>0,DEGREE FIT
2050 GOTO 2150
2060 IF CS[LEN(CS)-1]<>"IB" THEN GOTO 2090
2065 REM SKIP IF B NOT SPECIFIED
2070 LET K=1
2075 LET CS=CS[1,LEN(CS)-2]
2090 IF CS[1,1]="S" THEN LET M0=2-K
2100 IF CS[1,1]="S" THEN GOTO 2150
2110 IF CS[1,1]="U" THEN LET M0=6+K
2120 IF CS[1,1]="U" THEN GOTO 2150
2130 LET M0=0
2140 RETURN
2150 IF CS[2,2]<="0" THEN GOTO 2180
2155 IF CS[2,2]>=":" THEN GOTO 2180
2157 IF CS[3,3]=" " THEN GOTO 2165
2160 IF CS[3,3]<="/" THEN GOTO 2180
2163 IF CS[3,3]>=":" THEN GOTO 2180
2165 LET M1=VAL(CS[2])
2170 RETURN
2180 LET M0=0
2185 RETURN
5000 REM GET WHEEL POSITION AND READ
5005 IF M0>2 THEN GOTO 5010
5007 IF M>N0 THEN GOSUB 0175
5008 IF M>N0 THEN RETURN
5010 GOSUB 8500
5020 GOSUB 8000
5030 LET L[2]=L[1]
5035 LET B1=B
5037 LET B2=B
5040 IF INT(M0/2)=M0/2 THEN GOTO 5100
5045 REM ODD M0; IB WAS SPECIFIED
5047 PRINT "SET-UP FOR BASELINE AND HIT RETURN"

```

```

5048 INPUT X$
5050 GOSUB 7000
5055 LET K=0
5080 LET B2=(B+B1)/2
5100 LET S[M]=LOG(L12)/LOG(10)
5105 REM ABS=LOG(10)(100XT/XT)
5107 LET S[M]=S[M]-B2
5108 PRINT "ABS= ",S[M]
5110 RETURN
6000 REM: SET-UP 10 CHAIN TO LSD PROG
6005 FOR I=1 TO N0
6010 READ FILE(F1,I),C[I]
6015 WRITE FILE(F1,I),C[I],S[I]
6020 NEXT I
6030 READ FILE(F1,P2+1),R
6040 WRITE FILE(F1,P2+1),R,M1,L[11]
6044 IF M1=0 THEN PRINT "INTERPOLATION"
6048 IF M1=0 THEN RETURN
6050 SAVE "SM305.LL"
6060 CHAIN "LSD.AA"
6070 RETURN
6500 PRINT
6505 PRINT N3," CHARACTERS ONLY"
6510 PRINT "INPUT SAMPLE ID FOR ";I;" AGAIN";
6515 INPUT X$
6520 RETURN
6600 LET A=N3-LEN(X$)
6605 FOR X3=1 TO A
6610 LET X$=X$,"."
6615 NEXT X3
6620 RETURN
7000 PRINT "READ A BASELINE"
7010 LET X1=M
7020 LET M=0
7030 GOSUB 8500

```

LISTING OF FILE SM305.LL ON 9 / 27 / 1977
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```

7035 REM POSITION WHEEL AND REINITIALIZE TO ZERO
7037 CALL 21,D1,M
7040 GOSUB 8000
7045 REM: TAKE A READING; RETURN AS ABSORBANCE FOR BASELINE
7050 LET M=X1
7055 LET S=LOG(L[1])/LOG(10)
7060 LET B=S
7070 LET X1=B
7074 REM: B9=MAX ABSORBANCE ALLOWED FOR BASE SAY 0.05
7076 REM: B=ABSORBANCE OF BASELINE (BLANK)
7080 IF B<B9 THEN RETURN
7082 IF L[3]=0 THEN RETURN
7085 LET L[15]=40
7090 FOR I=1 TO 5
7093   PRINT "<7>";
7095   CALL 1,L[15]
7097 NEXT I
7100 PRINT "BASELINE OUT OF RANGE"
7110 RETURN
8000 REM: READ ADC; RETURN AS L(1)
8010 PRINT "TAKE A READING"
8018 GOTO 8025
8019 LET L[8]=10000
8020 INPUT " SAMPLE ",L[7]
8021 PRINT "%ABS= ",100*(L[8]-L[7])/L[8]
8022 GOTO 8030
8025 CALL 11,L[4],L[6],L[8],L[5],L[7]
8027 LET L[8]=L[8]-L[3]
8030 LET L[1]=L[8]/L[7]
8035 RETURN
8500 REM: POSITION THE WHEEL
8503 PRINT "POSITION";M
8505 CALL 21,D1,L[10]
8507 LET L[16]=M+1
8510 CALL 22,D1,L[16]

```


LISTING OF FILE SM305.LL ON 9 / 27 / 1977
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```

8520 CALL 1,T2
8535 RETURN
9000 REM: CHAIN TO INTERIM REPORT PROGRAM
9001 FOR I=1 TO N0
9002   WRITE FILE(F1,I),C(I),S(I)
9003 NEXT I
9004 READ FILE(F1,P2+1),R,M1,L(11)
9006 WRITE FILE(F1,P2+1),R,M1,L(11)
9008 FOR I=1 TO N1
9010   LET P1=I+N0
9012   READ FILE(F2,I),XS,S(D(I)),V(I),J
9013   WRITE FILE(F2,I),XS,S(P1),D(I),V(I),J
9014 NEXT I
9015 SAVE "SM305.LL"
9020 CHAIN "INT.ME"
9030 RETURN
9040 FOR I=1 TO N1
9041   LET P1=I+N0
9042   READ FILE(F2,I),XS,S(P1),D(I),V(I),J
9044   LET S(P1)=0
9046   WRITE FILE(F2,I),XS,S(P1),D(I),V(I),J
9048 NEXT I
9049 GOSUB 0200
9050 LET L(3)=0
9052 GOSUB 7000
9054 LET L(3)=L(8)-L(7)
9056 PRINT "BEAM DIFF(REF-SMPL)= ";L(8);" - ";L(7);" = ";L(3)
9057 LET L(1)=(L(8)-L(3))/L(7)
9060 LET S=LOG(L(1))/LOG(10)
9061 LET B=S
9062 PRINT B
9063 LET X1=B
9067 RETURN

```

REFERENCES AND SYMBOLS IN SM305.LL

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PAGE 1

0100 IS REFERENCED ON LINES:

0150 0170

0175 IS REFERENCED ON LINES:

0140 5007

0200 IS REFERENCED ON LINES:

9049

0950 IS REFERENCED ON LINES:

0045

1000 IS REFERENCED ON LINES:

0022 8019

1074 IS REFERENCED ON LINES:

1078

1080 IS REFERENCED ON LINES:

1076

1093 IS REFERENCED ON LINES:

1077 1082

1310 IS REFERENCED ON LINES:

1265

2000 IS REFERENCED ON LINES:

0115

2060 IS REFERENCED ON LINES:

2020

2090 IS REFERENCED ON LINES:

2060

REFERENCES AND SYMBOLS IN SM305.LL

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2130 IS REFERENCED ON LINES:
2000

2150 IS REFERENCED ON LINES:
2050 2100 2120

2165 IS REFERENCED ON LINES:
2157

2180 IS REFERENCED ON LINES:
2150 2155 2160 2163

5000 IS REFERENCED ON LINES:
0140

5010 IS REFERENCED ON LINES:
5005

5100 IS REFERENCED ON LINES:
5040

6000 IS REFERENCED ON LINES:
0140

6500 IS REFERENCED ON LINES:
1062 1086

6600 IS REFERENCED ON LINES:
1066 1088

7000 IS REFERENCED ON LINES:
0140 5050 9052

8000 IS REFERENCED ON LINES:
5020 7040

REFERENCES AND SYMBOLS IN SM305.LL

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8025 IS REFERENCED ON LINES:
8018

8030 IS REFERENCED ON LINES:
8022

8500 IS REFERENCED ON LINES:
5010 7030

9000 IS REFERENCED ON LINES:
0140

9040 IS REFERENCED ON LINES:
0050

A OCCURS ON LINES:
6600 6605

A1 OCCURS ON LINES:
0009 1330 1355

B OCCURS ON LINES:
0155 5035 5037 5080 7060
7070 7080 9061 9062 9063

B1 OCCURS ON LINES:
5035 5080

B2 OCCURS ON LINES:
5037 5080 5107

B9 OCCURS ON LINES:
1140 1310 7080

B1 OCCURS ON LINES:
0014

REFERENCES AND SYMBOLS IN SM305.LL

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C8 OCCURS ON LINES:

0011	0105	0205	1074	1076
1077	1078	2000	2002	2005
2010	2015	2020	2035	2037
2038	2039	2060	2075	2090
2100	2110	2120	2150	2155
2157	2160	2163	2165	

C9 OCCURS ON LINES:

0022 1313

C1 OCCURS ON LINES:

0009 1235 1245 6010 6015
9002

D1 OCCURS ON LINES:

0020

D1 OCCURS ON LINES:

0014 9012 9013 9042 9046

E5 OCCURS ON LINES:

1260 1265 1275 1310

E1 OCCURS ON LINES:

0009

F1 OCCURS ON LINES:

1205	1210	1245	1300	1310
1312	1313	1314	6010	6015
6030	6040	9002	9004	9006

F15 OCCURS ON LINES:

0011 1200 1210 1314

F2 OCCURS ON LINES:

1047	1048	1072	1091	1355
9012	9013	9042	9046	

REFERENCES AND SYMBOLS IN SM305.LL

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F2\$ OCCURS ON LINES:

0011 1046 1048 1314

F3\$ OCCURS ON LINES:

0011 0017 1314

F4\$ OCCURS ON LINES:

0012 0018 1314

I OCCURS ON LINES:

1050	1055	1072	1073	1085
1091	1225	1230	1235	1240
1245	1250	1320	1330	1340
1350	1355	1360	6005	6010
6015	6020	6510	7090	7097
9001	9002	9003	9008	9010
9012	9013	9014	9040	9041
9042	9046	9048		

J OCCURS ON LINES:

1084	1092	1275	1285	1305
1325	1330	1335	9012	9013
9042	9046			

K OCCURS ON LINES:

0019 2070 5055

LI OCCURS ON LINES:

0013	0025	0035	0036	0037
0043	1180	1183	1184	1290
1300	1310	5030	5100	6040
7055	7082	7085	8019	8020
8021	8025	8027	8030	8505
8507	8510	9004	9006	9050
9054	9056	9057	9060	

REFERENCES AND SYMBOLS IN SM305.LL

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M OCCURS ON LINES:

0130	0135	0212	5007	5008
5100	5107	5108	7010	7020
7037	7050	8503	8507	

M0 OCCURS ON LINES:

0135	0140	0150	0210	2002
2010	2030	2090	2110	2130
2180	5005	5040		

M1 OCCURS ON LINES:

0015	0026	0130	1512	2035
2038	2165	6040	6044	6048
9004	9006			

N0 OCCURS ON LINES:

0135	1215	1225	1300	1310
5007	5008	6005	9001	9010
9041				

N1 OCCURS ON LINES:

1035	1050	1310	1320	1350
1355	9008	9040		

N3 OCCURS ON LINES:

1035	1062	1086	6505	6600
------	------	------	------	------

O1 OCCURS ON LINES:

0014

P1 OCCURS ON LINES:

9010	9013	9001	9042	9044
9046				

P2 OCCURS ON LINES:

0042	1310	1312	1313	1314
6030	6040	9004	9006	

REFERENCES AND SYMBOLS IN SM305.LL
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R OCCURS ON LINES:
 0024 1312 6030 6040 9004
 9006

S OCCURS ON LINES:
 7055 7060 9012 9060 9061

SI OCCURS ON LINES:
 0009 1240 1245 5100 5107
 5108 6015 9002 9013 9042
 9044 9046

I2 OCCURS ON LINES:
 1190 1193 1310

VI OCCURS ON LINES:
 0014 9012 9013 9042 9046

XS OCCURS ON LINES:
 0009 0203 1060 1062 1072
 1085 1086 1091 5048 6515
 6600 6610 9012 9013 9042
 9046

X1 OCCURS ON LINES:
 0016 1080 1082 1084 7010
 7050 7070 9063

X3 OCCURS ON LINES:
 6605 6615

Z2\$ OCCURS ON LINES:
 0005 0960 1310

Z3\$ OCCURS ON LINES:
 0005 0970 1310

REFERENCES AND SYMBOLS IN SM305.LL

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24\$ OCCURS ON LINES:
0005 1093 1310

27\$ OCCURS ON LINES:
0005 1150 1310

29 OCCURS ON LINES:
1270 1280 1290 1300

LISTING WAS TAKEN FROM FILE SM305.LL

SYMBOL TABLE WAS IN FILE SM305.ST

118 SYMBOL SPACES WERE USED

0 OVERFLOWS OCCURRED

NEXT TIME SET ARRAYS TO 118

FOR MORE COPIES SET

US=SM305.LL

NS=SM305.ST

RUN 3240 (OR THEREABOUTS)

```

0002 REM: LLL:"RS305.LL";WALTER BOYLE;PROGRAM FOR SEQUENTIAL/RANDOM SAMPLING
0003 REM: BINARY FILE; "V305.RS" FOR VARIABLES AND "ID305.RS" FOR SAMPLE ID
0004 REM: WRITTEN FOR USE ON PE 305 DOUBLE BEAM INSTRUMENT
0005 DIM Z2$(72),Z3$(72),Z4$(72),Z5$(72),Z7$(72)
0006 DIM C$(25),F1$(20),F2$(20),F3$(20)
0008 DIM U(10,1),F4$(10)
0009 DIM XS(15),E(10),A(10,50),C(10),S(60)
0013 DIM L(50)
0014 DIM D(50),V(50),O(50),B(50)
0017 LET F3$="RS305.LL"
0019 LET M9=0
0020 LET M5=0
0021 LET L(11)=0
0022 LET C9=1000
0023 LET P2=20
0024 LET H=1
0026 CALL 9,M9
0027 REM: INITIALIZE SAMPLE LOCATION AS ZERO
0028 REM:*****SET PROPER CHANNEL NUMBERS*****
0030 REM: L(4) IS CHAN 8 REF; L(5) IS CHAN 7 SAMPLE
0031 REM: L(8) IS FOR REF DATA; L(7) IS SAMPLE DATA
0032 REM: L(6) NO. OF POINTS (TIME); L(3) IS CORRECTOR
0035 LET L(4)=8
0036 LET L(5)=7
0037 LET L(3)=0
0038 LET L(10)=1
0039 GOSUB 0950
0040 IF H=1 THEN GOSUB 0100
0045 IF H=1 THEN GOSUB 0200
0047 WRITE FILE(F1,P2+3),F3$,F2$,F1$,F4$
0050 IF F4$(1,1)="R" THEN GOTO 3000
0055 IF F4$(1,1)="S" THEN GOTO 3500
0100 PRINT "BASELINE AVERAGE; Y/N ?"
0105 INPUT X$
0110 IF X$="Y" THEN LET L(11)=-1

```

LISTING OF FILE HS305.LL ON 9 / 28 / 1977
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```

0115 IF XS(1,1)="Y" THEN GOTO 0155
0125 IF XS="N" THEN GOTO 0150
0130 PRINT "SYNTAX ERROR"
0135 GOTO 0100
0150 INPUT "FREQUENCY OF BASELINE ? ",L(11)
0155 WRITE FILE(F1,P2+1),R,MS,L(11)
0160 RETURN
0200 INPUT "RANDOM OR SEQUENTIAL ? ",F4$
0210 IF F4$(1,1)="R" THEN RETURN
0215 IF F4$(1,1)="S" THEN RETURN
0220 PRINT "TRY AGAIN"
0225 GOTO 0200
0950 PRINT
0955 PRINT "OPERATOR'S NAME AND INSTRUMENT"
0960 INPUT Z$
0965 PRINT "ELEMENT AND SAMPLE SOURCE"
0970 INPUT Z$
1030 PRINT "MAX ID LENGTH, NO. OF SAMPLES";
1035 INPUT N3,N1
1045 PRINT "SAMPLE I. O. CODE"
1046 LET F2$="I0305.HS"
1047 LET F2=2
1048 OPEN FILE(F2,0),F2$
1050 FOR I=1 TO N1
1055   PRINT I;
1060   INPUT X$
1062   IF LEN(X$)>N3 THEN GOSUB 6500
1066   GOSUB 6600
1072   WRITE FILE(F2,I),X$
1073 NEXT I
1074 INPUT "CORRECTIONS Y/N ? ",CS
1076 IF CS(1,1)="Y" THEN GOTO 1080
1077 IF CS(1,1)="N" THEN GOTO 1093
1078 IF CS(1,1)<>"N" THEN GOTO 1074
1080 INPUT "NO. OF I.O. CORRECTIONS ? ",X1

```

```
1082 IF X1=0 THEN GOTO 1093
1084 FOR J=1 TO X1
1085     INPUT "NO. AND I.D. OF SAMPLE ? ",I,X$
1086     IF LEN(X$)>N3 THEN GOSUB 6500
1088     GOSUB 6600
1091     WRITE FILE(F2,I),X$
1092 NEXT J
1093 INPUT "INSTRUMENT CONDITIONS ",Z4$
1135 PRINT "BASELINE LIMIT"
1140 INPUT B9
1145 PRINT "UNITS"
1150 INPUT Z7$
1175 PRINT "INTEG. TIME IN SECONDS"
1180 INPUT L(6)
1183 LET L(6)=INT(L(6)*15/2)
1184 PRINT L(6),"POINTS"
1185 PRINT "PAUSE TIME IN SECONDS"
1190 INPUT T2
1193 LET T2=INT(60*T2)
1200 LET F1$="V305.RS"
1205 LET F1=1
1210 OPEN FILE(F1,0),F1$
1215 INPUT "NO. OF STDS ",NO
1220 PRINT "CONC:"
1225 FOR I=1 TO NO
1230     PRINT I;
1235     INPUT C(I)
1240     LET S(I)=0
1245     WRITE FILE(F1,I),C(I),S(I)
1250 NEXT I
1260 INPUT "NO. OF SPIKES ",E5
1265 IF E5=0 THEN GOTO 1310
1270 LET Z9=19
1275 FOR J=1 TO E5
1280     LET Z9=Z9+1
```

LISTING OF FILE R8305.LL ON 9 / 28 / 1977
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```

1285 PRINT "SPIKE NO. ";J;" ";
1290 INPUT "VALUE ",L(Z9)
1300 WRITE FILE(F1,N0+1+J),L(Z9)
1305 NEXT J
1310 WRITE FILE(F1,P2),N0,N1,E5,Z28,Z38,Z48,Z78,B9,L(6),T2
1313 WRITE FILE(F1,P2+2),0,0,0,0,C9
1320 FOR I=1 TO N1
1325   FOR J=1 TO 10
1330     LET A(J,I)=0
1335   NEXT J
1340 NEXT I
1350 FOR I=1 TO N1
1355   WRITE FILE(F2,N1+I),A(1,I),A(2,I),A(3,I),A(4,I),A(5,I),A(6,I),A(7,I),A(8,I),A(9,I),A(10,I)
1360 NEXT I
1365 RETURN
2000 REM: PICK CALCULATION FIRST ROUND ONLY
2050 PRINT "CALCULATE C1,C1,C2,C3, OR CA"
2055 INPUT M$
2060 IF M$="C1" THEN LET M5=0
2065 IF M$="C1" THEN RETURN
2070 IF M$="C1" THEN LET M5=1
2075 IF M$="C1" THEN RETURN
2080 IF M$="C2" THEN LET M5=2
2085 IF M$="C2" THEN RETURN
2090 IF M$="C3" THEN LET M5=3
2095 IF M$="C3" THEN RETURN
2097 IF M$="CA" THEN LET M5=4
2098 IF M$="CA" THEN RETURN
2100 PRINT "SYNTAX ERROR"
2105 GOTO 2050
3000 REM: ROUTINE FOR RANDOM SAMPLING OF WHEEL
3005 FOR I=1 TO N1+N0
3010   LET E(I)=0
3015 NEXT I
3050 RANDOMIZE

```

LISTING OF FILE RS305.LL ON 9 / 28 / 1977
PAGE 5

```

3055 LET B5=0
3060 GOSUB 5050
3063 REM: FIRST BASELINE BALANCES BEAMS
3065 LET M9=INT((N0+N1)*RND(0)+1)
3070 IF E(M9)>0 THEN GOTO 3065
3075 LET E(M9)=1
3080 GOSUB 5000
3083 IF L(11)=-1 THEN GOTO 3105
3084 REM: L(11)=-1 MEANS BASELINE AVERAGED AFTER EACH READING
3085 LET B5=B5+1
3090 IF B5<L(11) THEN GOTO 3105
3095 GOSUB 7000
3100 LET B5=0
3105 FOR I=1 TO N0+N1
3110 IF E(I)=0 THEN GOTO 3065
3115 NEXT I
3200 GOTO 3552
3500 REM: ROUTINE FOR SEQ SAMPLING OF WHEEL
3505 LET B5=0
3510 LET M9=0
3515 GOSUB 9050
3520 LET M9=M9+1
3525 GOSUB 5000
3527 IF L(11)=-1 THEN GOTO 3550
3530 LET B5=B5+1
3535 IF B5<L(11) THEN GOTO 3550
3540 GOSUB 7000
3545 LET B5=0
3550 IF M9<N0+N1 THEN GOTO 3520
3552 LET M9=0
3553 GOSUB 8500
3555 IF R=1 THEN GOSUB 2000
3560 GOSUB 6000
3565 GOTO 9000
4000 FOR I=1 TO N0

```

```
4010 WRITE FILE(F1,I),C(I)
4020 NEXT I
4030 END
5000 REM GET WHEEL POSITION AND READ
5010 GOSUB 8500
5020 GOSUB 8000
5030 LET L(2)=L(1)
5035 LET B1=B
5037 LET B2=B
5040 IF L(1) <> -1 THEN GOTO 5100
5045 REM: MINUS L(1) BASELINE AVERAGE WAS SPECIFIED
5050 GOSUB 7000
5055 LET K=0
5080 LET B2=(B+B1)/2
5100 LET S(M9)=LOG(L(2))/LOG(10)
5105 REM ABS=LOG(10)(100X/X1)
5107 LET S(M9)=S(M9)-B2
5108 PRINT "ABS= ";S(M9)
5110 RETURN
6000 REM: SET-UP TO CHAIN TO LSG PROG
6005 FOR I=1 TO N0
6010 READ FILE(F1,I),C(I)
6015 WRITE FILE(F1,I),C(I),S(I)
6020 NEXT I
6030 READ FILE(F1,P2+1),R
6040 WRITE FILE(F1,P2+1),R,M5,L(1)
6044 IF M5=0 THEN PRINT "INTERPOLATION"
6048 IF M5=0 THEN RETURN
6050 SAVE "RS305.LL"
6060 CHAIN "LSQ.AA"
6070 RETURN
6500 PRINT
6505 PRINT N3," CHARACTERS ONLY"
6510 PRINT "INPUT SAMPLE ID FOR ";I;" AGAIN";
6515 INPUT X$
```

LISTING OF FILE RS305.LL ON 9 / 28 / 1977
PAGE 7

```

6520 RETURN
6600 LET A=N3-LEN(X$)
6605 FOR X3=1 TO A
6610   LET XS=XS,X3,"."
6615 NEXT X3
6620 RETURN
7000 PRINT "READ A BASELINE"
7010 LET K=M9
7020 LET M9=0
7030 GOSUB 8500
7035 REM POSITION WHEEL
7037 CALL 9,M9
7038 REM: REINITIALIZE EACH ZERO POSITION
7040 GOSUB 8000
7045 REM: TAKE A READING; RETURN AS L(1) COUNTS FOR BASELINE
7055 LET S=LOG(L(1))/LOG(10)
7060 LET B=S
7065 LET M9=K
7070 PRINT B
7080 IF B<B9 THEN RETURN
7082 IF L3=0 THEN RETURN
7085 LET L(15)=30
7090 FOR I=1 TO 10
7095   PRINT "<7>";
7095   CALL 1,L(15)
7097 NEXT I
7100 PRINT "BASELINE OUT OF RANGE"
7110 RETURN
8000 REM: READ ADC; RETURN AS L(1)
8010 PRINT "TAKE A READING"
8015 REM*****INPUT "READY ?",XS*****FOR HAND OPERATION
8018 REM*****PLACE GOTO 8025 HERE FOR ON-LINE OPERATION
8019 LET L(8)=10000
8020 INPUT " SAMPLE ",L(7)
8021 PRINT "%ABS= ",100*(L(8)-L(7))/L(8)

```



```

8022 GOTO 8030
8025 CALL 11,L[4],L[6],L[8],L[5],L[7]
8027 LET L[8]=L[8]-L[3]
8030 LET L[11]=L[8]/L[7]
8035 RETURN
8500 REM: POSITION THE WHEEL
8503 PRINT "POSITION ",M9
8505 CALL 9,L[10]
8507 LET L[16]=M9+1
8510 CALL 10,L[16]
8520 CALL 1,T2
8535 RETURN
9000 REM: CHAIN TO INTERIM REPORT PROGRAM
9004 READ FILE[F1,P2+1],R,M5,L[11]
9006 WRITE FILE[F1,P2+1],R,M5,L[11]
9008 FOR I=1 TO N1
9010     LET P1=I+N0
9012     READ FILE[F2,I],XS,S,D[I],V[I],J
9013     WRITE FILE[F2,I],XS,S[P1],D[I],V[I],J
9014 NEXT I
9015 SAVE "RS305.LL"
9020 CHAIN "INT.ME"
9030 GOTO 3555
9040 FOR I=1 TO N1
9041     LET P1=I+N0
9042     READ FILE[F2,I],XS,S[P1],D[I],V[I],J
9044     LET S[P1]=0
9046     WRITE FILE[F2,I],XS,S[P1],D[I],V[I],J
9047 NEXT I
9048 READ FILE[F1,P2+1],R,M5,L[11]
9049 GOTO 0050
9050 LET L[3]=0
9052 GOSUB 7000
9054 LET L[3]=L[8]-L[7]
9056 INT "BEAM DIFF(REF-SMPL)=" ;L[8];" - ";L[7];" = ";L[3]
9057 LET L[11]=(L[8]-L[3])/L[7]
9060 LET S=LOG(L[11])/LOG(10)
9061 LET R=S
9062 PRINT R
9067 RETURN

```

REFERENCES AND SYMBOLS IN RS305.LL

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PAGE 1

0050 IS REFERENCED ON LINES:
9049

0100 IS REFERENCED ON LINES:
0040 0135

0150 IS REFERENCED ON LINES:
0125

0155 IS REFERENCED ON LINES:
0115

0200 IS REFERENCED ON LINES:
0045 0225

0950 IS REFERENCED ON LINES:
0039

1000 IS REFERENCED ON LINES:
0022 8019

1074 IS REFERENCED ON LINES:
1078

1080 IS REFERENCED ON LINES:
1076

1093 IS REFERENCED ON LINES:
1077 1082

1310 IS REFERENCED ON LINES:
1265

2000 IS REFERENCED ON LINES:
3555

REFERENCES AND SYMBOLS IN RS305.LL

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2050 IS REFERENCED ON LINES:
2105

3000 IS REFERENCED ON LINES:
0050

3065 IS REFERENCED ON LINES:
3070 3110

3105 IS REFERENCED ON LINES:
3083 3090

3500 IS REFERENCED ON LINES:
0055

3520 IS REFERENCED ON LINES:
3550

3550 IS REFERENCED ON LINES:
3527 3535

3552 IS REFERENCED ON LINES:
3200

3555 IS REFERENCED ON LINES:
9030

5000 IS REFERENCED ON LINES:
3080 3525

5100 IS REFERENCED ON LINES:
5040

6000 IS REFERENCED ON LINES:
3560

REFERENCES AND SYMBOLS IN RS305.LL

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6500 IS REFERENCED ON LINES:
1062 1086

6600 IS REFERENCED ON LINES:
1066 1088

7000 IS REFERENCED ON LINES:
3095 3540 5050 9052

8000 IS REFERENCED ON LINES:
5020 7040

8030 IS REFERENCED ON LINES:
8022

8500 IS REFERENCED ON LINES:
3553 5010 7030

9000 IS REFERENCED ON LINES:
3565

9050 IS REFERENCED ON LINES:
3060 3515

A OCCURS ON LINES:
6600 6605

A1 OCCURS ON LINES:
0009 1330 1355

B OCCURS ON LINES:
5035 5037 5080 7060 7070
7080 9061 9062

B1 OCCURS ON LINES:
5035 5080

REFERENCES AND SYMBOLS IN RS305.LL

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B2 OCCURS ON LINES:
5037 5080 5107

B5 OCCURS ON LINES:
3055 3085 3090 3100 3505
3530 3535 3545

B9 OCCURS ON LINES:
1140 1310 7080

B1 OCCURS ON LINES:
0014

C3 OCCURS ON LINES:
0006 1074 1076 1077 1078

C9 OCCURS ON LINES:
0022 1313

C1 OCCURS ON LINES:
0009 1235 1245 4010 6010
6015

D1 OCCURS ON LINES:
0014 9012 9013 9042 9046

E5 OCCURS ON LINES:
1260 1265 1275 1310

E1 OCCURS ON LINES:
0009 3010 3070 3075 3110

F1 OCCURS ON LINES:
0047 0155 1205 1210 1245
1300 1310 1313 4010 6010
6015 6030 6040 9004 9006
9048

REFERENCES AND SYMBOLS IN RS305.LL

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F1\$ OCCURS ON LINES:

0006 0047 1200 1210

F2 OCCURS ON LINES:

1047 1048 1072 1091 1355
9012 9013 9042 9046

F2\$ OCCURS ON LINES:

0006 0047 1046 1048

F3\$ OCCURS ON LINES:

0006 0017 0047

F4\$ OCCURS ON LINES:

0008 0047 0050 0055 0200
0210 0215

I OCCURS ON LINES:

1050 1055 1072 1073 1085
1091 1225 1230 1235 1240
1245 1250 1320 1330 1340
1350 1355 1360 3005 3010
3015 3105 3110 3115 4000
4010 4020 6005 6010 6015
6020 6510 7090 7097 9008
9010 9012 9013 9014 9040
9041 9042 9046 9047

J OCCURS ON LINES:

1084 1092 1275 1285 1305
1325 1330 1335 9012 9013
9042 9046

K OCCURS ON LINES:

5055 7010 7065

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L3 OCCURS ON LINES:
7082

L1 OCCURS ON LINES:
0013 0021 0035 0036 0037
0038 0110 0150 0155 1180
1183 1184 1290 1300 1310
3083 3090 3527 3535 5030
5040 5100 6040 7055 7085
8019 8020 8021 8025 8027
8030 8507 9004 9006 9048
9050 9054 9056 9057 9060

M5 OCCURS ON LINES:
0020 0155 2060 2070 2080
2090 2097 6040 6044 6048
9004 9006 9048

M9 OCCURS ON LINES:
0019 3065 3070 3075 5510
3520 3550 3552 5100 5107
5108 7010 7020 7065 8503
8507

N0 OCCURS ON LINES:
1215 1225 1300 1310 3005
3065 3105 3550 4000 6005
9010 9041

N1 OCCURS ON LINES:
1035 1050 1310 1320 1350
1355 3005 3065 3105 3550
9008 9040

N3 OCCURS ON LINES:
1035 1062 1086 6505 6600

REFERENCES AND SYMBOLS IN RS305.LL

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00 OCCURS ON LINES:

0014

P1 OCCURS ON LINES:

9010 9013 9041 9042 9044
9046

P2 OCCURS ON LINES:

0023 0047 0155 1310 1313
6030 6040 9004 9006 9048

R OCCURS ON LINES:

0024 0040, 0045 0155 3555
6030 6040 9004 9006 9048

S OCCURS ON LINES:

7055 7060 9012 9060 9061

S1 OCCURS ON LINES:

0009 1240 1245 5100 5107
5108 6015 9013 9042 9044
9046

12 OCCURS ON LINES:

1190 1193 1310

U1 OCCURS ON LINES:

0008

V1 OCCURS ON LINES:

0014 9012 9013 9042 9046

X5 OCCURS ON LINES:

0009 0105 0110 0115 0125
1060 1062 1072 1085 1086
1091 2055 2060 2065 2070
2075 2080 2085 2090 2095
2097 2098 6515 6600 6610
9012 9013 9042 9046

REFERENCES AND SYMBOLS IN RS305.LL

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X1 OCCURS ON LINES:

1080 1082 1084

X5 OCCURS ON LINES:

6609 6615

Z25 OCCURS ON LINES:

0005 0960 1310

Z35 OCCURS ON LINES:

0005 0970 1310

Z45 OCCURS ON LINES:

0005 1093 1310

Z55 OCCURS ON LINES:

0005

Z75 OCCURS ON LINES:

0005 1150 1310

Z9 OCCURS ON LINES:

1270 1280 1290 1300

LISTING WAS TAKEN FROM FILE RS305.LL

SYMBOL TABLE WAS IN FILE RS305.ST

124 SYMBOL SPACES WERE USED

0 OVERFLOWS OCCURRED

NEXT TIME SET ARRAYS TO

124

FOR MORE COPIES SET

US=RS305.LL

NS=RS305.ST

RUN 3240 (OR THEREABOUTS)

LISTING OF FILE BRASH1.LL ON 9 / 28 / 1977
PAGE 1

```

0002 REM: LLL;"BRASH1.LL"; WALTER BOYLE; PROGRAM TO BRACKET SAMPLES
0003 REM: ASCII FILES; INTERIM "INASH1.BR"; FINAL "FNASH1.BR"
0004 REM: WRITTEN FOR USE ON JARRELL ASH SINGLE BEAM INSTRUMENT
0005 DIM Z$(72),Z3$(72),Z4$(72),Z5$(72),Z7$(72)
0006 DIM C$(5)
0007 DIM I$(400)
0009 DIM X$(100),A(10,50),C(10),S(60)
0010 DIM L(50),T(50)
0011 DIM F2$(20),F3$(120)
0014 DIM O(50),V(50)
0017 LET U5=4
0018 REM: NO. OF UNITS PAST DECIMAL POINT.
0019 LET M9=0
0020 LET L(30)=3
0021 LET L(33)=3
0022 LET L(32)=1
0023 LET U1=1
0024 LET N=1
0025 LET F1=1
0026 REM: INTERIM FILE NO
0027 LET F2$="INASH1.BR"
0028 DEF FNQ(X)=INT(X*10^U5+.5)/10^U5
0030 CALL 21,U1,M1
0031 REM: INITIALIZE SAMPLER LOCATION AS ZERO
0034 LET L(10)=1
0035 GOSUB 1000
0037 LET L(4)=1
0038 REM: CHANNEL NUMBER OF JARREL-ASH SINGLE BEAM
0040 GOSUB 0100
0045 GOTO 3500
0100 PRINT "BASELINE AVERAGE; Y/N ?"
0105 INPUT X$
0110 IF X$="Y" THEN LET M0=1
0115 IF X$="Y" THEN GOTO 0140
0120 IF X$="N" THEN LET M0=2

```

LISTING OF FILE BRASH1.LL ON 9 / 28 / 1977
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```

0125 IF XS="N" THEN GOTO 0140
0130 PRINT "SYNTAX ERROR"
0135 GOTO 0100
0140 IF XS="Y" THEN LET L(11)=1
0145 IF XS="Y" THEN RETURN
0150 PRINT "FREQUENCY OF BASELINE ?"
0155 INPUT L(11)
0160 RETURN
1000 PRINT
1010 PRINT "DATE, TIME OF DAY, OPERATOR'S NAME, AND INSTRUMENT"
1015 INPUT Z2$
1020 PRINT "SAMPLE TITLE"
1025 INPUT Z3$
1030 PRINT "MAX ID LENGTH, NO. OF SAMPLES";
1035 INPUT N3,N1
1040 LET TS=""
1045 PRINT "SAMPLE I. D. CODE"
1050 FOR I=1 TO N1
1055   PRINT I;
1060   INPUT XS
1062   IF LEN(XS)>N3 THEN GOTO 9500
1064   LET A=N3-LEN(XS)
1066   FOR J=1 TO A
1068     LET XS=XS, "."
1070   NEXT J
1072   LET TS=TS,XS
1073 NEXT I
1075 PRINT "INSTRUMENT CONDITIONS"
1080 INPUT Z4$
1085 PRINT "STDS SRC"
1090 INPUT Z5$
1095 PRINT "NO. OF STDS"
1100 INPUT NO
1105 PRINT "CONC:"
1110 FOR I=1 TO NO

```

LISTING OF FILE BRASH1.LL ON 9 / 28 / 1977
PAGE 3

```

1115 PRINT I;
1120 INPUT C(1)
1125 LET S(1)=0
1130 NEXT I
1135 PRINT "BASELINE LIMIT"
1140 INPUT B9
1145 PRINT "UNITS"
1150 INPUT Z75
1160 PRINT "RELATIVE STANDARD DEVIATION LIMIT";
1165 INPUT L(31)
1175 PRINT "INTEG. TIME IN SECONDS"
1180 INPUT L(6)
1183 LET L(6)=INT(L(6)*15/2)
1184 PRINT L(6),"POINTS"
1185 PRINT "PAUSE TIME IN SECONDS"
1190 INPUT T2
1193 LET T2=INT(60*T2)
1210 PRINT "COVER SLIT, HIT RETURN WHEN READY"
1215 INPUT X5
1220 GOSUB 8000
1222 LET Q=L(1)
1225 PRINT "DARK CURRENT= ";Q
1230 RETURN
3500 REM: ROUTINE FOR RUNNING STANDARDS FIRST TIME
3505 LET B5=0
3510 LET M9=0
3515 GOSUB 7000
3520 LET M9=M9+1
3525 GOSUB 5000
3527 IF M9=1 THEN GOTO 3550
3530 LET B5=B5+1
3535 IF B5<L(11) THEN GOTO 3550
3540 GOSUB 7000
3545 LET B5=0
3550 IF M9<N9 THEN GOTO 3520

```

LISTING OF FILE BRASH1.LL ON 9 / 28 / 1977
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```

4000 REM: GET THE UNKNOWN AND BRACKETING STANDARDS
4025 OPEN FILE(F1,1),F2$
4026 REM: F1 IS FILE NUMBER, F2$ FILE NAME
4095 LET J=NO+1
4097 LET P1=1
4100 LET M9=J
4101 LET R=1
4102 GOSUB 4200
4103 FOR I=1 TO NO
4105   IF S(I)>=S(J) THEN GOTO 4125
4110 NEXT I
4115 GOSUB 4800
4120 REM: PRINT WARNING LAST STD TOO LOW
4123 GOTO 4145
4125 IF (I-1)=0 THEN GOSUB 4830
4130 REM: PRINT WARNING FIRST STD TOO HIGH
4135 IF (I-1)=0 THEN GOTO 4145
4140 GOSUB 4400
4145 LET J=J+1
4147 LET P1=J-NO
4150 IF J<=N1+NO THEN GOTO 4100
4155 PRINT "ALL DONE"
4157 CLOSE FILE(F1)
4160 GOTO 9000
4200 REM: SUBROUTINE TO READ STDs AND SAMPLES AND
4201 REM: TO KEEP TRACK OF BASELINE READINGS
4230 GOSUB 5000
4235 IF M0=1 THEN GOTO 4260
4240 LET B5=B5+1
4245 IF B5<L111J THEN GOTO 4260
4250 GOSUB 7000
4255 LET B5=0
4260 RETURN
4400 REM: ROUTINE FOR RUNNING BRACKET
4410 LET R=1

```

```

4425 LET M9=I-1
4430 GOSUB 4200
4440 LET M9=I
4445 GOSUB 4200
4470 GOSUB 4600
4475 LET R=M+1
4480 LET M9=I-1
4485 GOSUB 4200
4490 LET M9=J
4495 GOSUB 4200
4500 LET M9=I
4505 GOSUB 4200
4510 GOSUB 4600
4520 IF R<L[30] THEN GOTO 4475
4525 RETURN
4600 REM: INTERPOLATION AND STATISTICAL SUBROUTINE
4610 LET P1=NQ
4615 LET Y(P1)=L[32]
4620 LET Y0=(C[I]-C[I-1])/S(I)-S(I-1)
4630 LET A(R,P1)=Y0*(S(I)-S(I-1))+C[I-1]
4640 IF R=1 THEN LET D(P1)=A(I,P1)
4650 IF R=1 THEN LET V(P1)=0
4660 IF R=1 THEN LET V1=0
4670 IF R=1 THEN LET D4=0
4675 IF R=1 THEN GOTO 4712
4680 LET D(P1)=D(P1)*(R-1)/R+A(R,P1)/R
4690 LET V(P1)=V(P1)*(R-1)/R+((D(P1)-A(R,P1))^2)/(R-1)
4700 LET V1=V(P1)+R/(R-1)
4710 LET D4=SGR(V1)*100/D(P1)
4712 PRINT
4713 PRINT
4714 PRINT "RUN";R;"UNK";P1;FNG(A(I,P1));Z78;" AVG";FNG(D(P1));Z78;" RSD";FNG(D4);"X";" TRIAL";Y(P1)
4715 PRINT
4717 PRINT FILE(F1)
4718 PRINT FILE(F1),"RUN";R;"UNK";P1;FNG(A(R,P1));Z78;" AVG";FNG(D(P1));Z78;" RSD";FNG(D4);"X";" TRIAL";Y(P1)

```

LISTING OF FILE GRASH1.LL ON 9 / 28 / 1977
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```

4719 PRINT FILE(F1)
4720 IF N<L(30) THEN RETURN
4730 IF D<=L(31) THEN LET L(32)=1
4735 IF D<=L(31) THEN RETURN
4740 LET J=J+1
4750 LET L(32)=L(32)+1
4760 IF L(32)<=L(33) THEN RETURN
4770 LET L(32)=L(32)-1
4765 REM: L(31) IS RELATIVE STD DEV LIMIT
4766 REM: L(33) IS ATTEMPT NO. (3); L(30) IS NUMBER OF RUNS
4767 REM: L(32) IS COUNTER FOR NO. OF ATTEMPTS
4768 PRINT "*****"
4770 PRINT "UNK #";P1;" TRIED";L(32);"TIMES AND RSD IS";FNQ(D4);" WHICH IS >";L(31)
4772 PRINT "*****"
4775 PRINT FILE(F1)
4776 PRINT FILE(F1),"UNK #";P1;" TRIED";L(32);"TIMES AND RSD IS";FNQ(D4);" WHICH IS >";L(31)
4777 PRINT FILE(F1)
4778 LET T(P1)=L(32)
4780 LET L(32)=1
4785 LET J=J+1
4790 RETURN
4800 PRINT "UNKNOWN NO.";P1;"LAST STANDARD TOO LOW"
4802 PRINT FILE(F1),"UNKNOWN NO.";P1;"LAST STANDARD TOO LOW"
4805 LET TO=(C(N0)-C(N0-1))/(S(N0)-S(N0-1))
4810 LET A(R,P1)=TO*(S(J)-S(N0))+C(N0)
4815 LET T(P1)=0
4817 LET L(32)=1
4820 PRINT "APPROXIMATE CONC=";FNQ(A(R,P1))
4825 PRINT FILE(F1),"APPROXIMATE CONC=";FNQ(A(R,P1))
4826 PRINT FILE(F1)
4827 RETURN
4830 PRINT "UNKNOWN NO.";P1;"FIRST STANDARD TOO HIGH"
4832 PRINT FILE(F1),"UNKNOWN NO.";P1;"FIRST STANDARD TOO HIGH"
4835 LET TO=(C(2)-C(1))/(S(2)-S(1))
4840 LET A(R,P1)=TO*(S(J)-S(1))+C(1)

```

```
4845 LET T(P1)=-1
4847 LET L(32)=1
4850 PRINT "APPROXIMATE CONC=";A(R,P1)
4855 PRINT FILE(F1),"APPROXIMATE CONC=";A(R,P1)
4857 PRINT FILE(F1)
4860 RETURN
5000 REM GET WHEEL POSITION AND READ
5010 GOSUB 8500
5020 GOSUB 8000
5030 LET L(2)=L(1)
5035 LET B1=B
5037 LET B2=B
5040 IF INT(M0/2)=M0/2 THEN GOTO 5100
5045 REM QDO M0; B WAS SPECIFIED
5050 GOSUB 7000
5055 LET K=0
5060 LET B2=(B+B1)/2
5100 LET S(M9)=LOG((B2-Q)/(L(2)-Q))/LOG(10)
5105 REM ABS=LOG(10)(100*T/%T)
5108 PRINT "ABS= ";S(M9)
5110 RETURN
7000 PRINT "READ A BASELINE"
7010 LET K=M9
7020 LET M9=0
7030 GOSUB 8500
7035 REM POSITION WHEEL
7037 CALL Z1,D1,M9
7038 REM: REINITIALIZE EACH ZERO POSITION
7040 GOSUB 8000
7045 REM TAKE A READING; RETURN AS L(1)
7060 LET B=L(1)
7065 LET M9=K
7070 PRINT B
7075 LET L(15)=40
7080 IF B<B9 THEN RETURN
```


LISTING OF FILE BRASH1.LL ON 9 / 28 / 1977
PAGE 8

```

7090 FOR E=1 TO 5
7093 PRINT "<7>"
7095 CALL 1,L(15)
7097 NEXT E
7100 IF B>B9 THEN PRINT "BASELINE OUT OF RANGE"
7110 RETURN
8000 REM: READ ADC; RETURN AS L(1)
8010 PRINT "TAKE A READING"
8018 GOTO 8025
8020 INPUT "SAMPLE ",L(1)
8022 GOTO 8035
8025 CALL 6,L(4),L(6),L(1)
8030 REM: L(4) IS CHANNEL NO., L(6) IS NO. OF POINTS, L(1) IS AVERAGE
8035 RETURN
8500 REM POSITION THE WHEEL
8503 PRINT "POSITION";M9
8505 CALL 21,D1,L(10)
8507 LET L(16)=M9+1
8510 CALL 22,D1,L(16)
8520 CALL 1,T2
8535 RETURN
9000 REM: CALCULATE AND STORE ANSWERS, AVERAGE,SD,AND RSD
9001 REM: FOR EACH RUN
9002 REM: OPEN FILES FOR PRINTING OPTION
9003 REM: F1 IS FILE NO.,F2$ IS FILE NAME;F3$ IS DUMMY VARIABLE
9288 PRINT "HARD COPY OF RUN REPORT (Y/N) ";
9290 INPUT X$
9291 IF X$(1,1)="N" THEN GOTO 9600
9292 IF X$(1,1)="Y" THEN GOTO 9550
9294 IF X$(1,1) <> "Y" THEN GOTO 9288
9550 OPEN FILE(0,1),"SLPT"
9555 OPEN FILE(F1,3),F2$
9560 INPUT FILE:F1,F3$
9565 IF EOF(F1) THEN GOTO 9580
9570 PRINT FILE(0),F3$

```

```

9575 GOTO 9560
9580 CLOSE FILE(O)
9581 CLOSE FILE(F1)
9585 PRINT "ALL DONE"
9590 GOTO 9288
9600 LET F1=1
9605 LET F28="PHASH1.BR"
9608 LET RML(30)
9610 OPEN FILE(F1,1),F28
9615 PRINT FILE(F1)
9620 PRINT FILE(F1),"
ANALYSIS REPORT"
9625 PRINT FILE(F1)
9630 PRINT FILE(F1)
9635 PRINT FILE(F1),Z38
9640 PRINT FILE(F1)
9645 PRINT FILE(F1),Z28
9650 PRINT FILE(F1)
9655 PRINT FILE(F1)
9657 LET D5=3
9660 PRINT FILE(F1),"SAMPLE NO.      "; TAB(30);"AVERAGE(";Z78;");"; TAB(47);"SD"; TAB(57);"RSD"; TAB(63);"TRIALS"
9665 FOR I=1 TO N1
9667   LET X8=TS(N3=(I-1)*I,N3=I)
9668   PRINT FILE(F1)
9669   IF T(I)=0 THEN GOTO 9686
9671   IF T(I)=1 THEN GOTO 9684
9678   LET V1=V(I)*R/(R-1)
9679   LET D4=SQRT(V1)*100/D(I)
9680   PRINT FILE(F1),"NO.      ";I;"      ";X8; TAB(29);FNG(D(I)); TAB(44);FNG(SQR(V1)); TAB(54);FNG(D4); TAB(65);T(I)
9682   IF D4>L(I) THEN PRINT FILE(F1),"EXCEEDED STANDARD DEV. LIMIT OF";L(I);" %"
9683   GOTO 9689
9684   PRINT FILE(F1),"NO.      ";I;"      ";X8;"FIRST STANDARD TOO HIGH--APPROX CONC=";FNG(A(I,I))
9685   GOTO 9689
9686   PRINT FILE(F1),"NO.      ";I;"      ";X8;"LAST STANDARD TOO LOW--APPROX CONC=";FNG(A(I,I))
9689   NEXT I
9690 PRINT FILE(F1)

```

```

9698 PRINT FILE(F1)
9700 PRINT FILE(F1),R1" RUNS MADE FOR EACH TRY AND"L(33)" TRIES ARE MADE BEFORE GIVING UP"
9703 PRINT FILE(F1)
9705 FOR I=1 TO N0
9710 PRINT FILE(F1),C(I)
9713 NEXT I
9720 PRINT FILE(F1),Z70;" FROM "Z358
9725 PRINT FILE(F1)
9735 PRINT FILE(F1)
9750 PRINT FILE(F1),Z40
9755 CLOSE
9762 OPEN FILE(D,3),"SLPT"
9763 OPEN FILE(F1,3),F20
9764 INPUT FILE(F1),F30
9765 IF EOF(F1) THEN GOTO 9766
9766 PRINT FILE(D),F30
9767 GOTO 9764
9768 CLOSE FILE(D)
9769 CLOSE FILE(F1)
9790 PRINT "ANOTHER COPY (Y/N) ?"
9793 INPUT X0
9800 IF X0(1,1)~"Y" THEN GOTO 9782
9805 IF X0(1,1)~"N" THEN GOTO 9825
9810 IF X0(1,1)~"N" THEN GOTO 9790
9825 LET M9=0
9830 GOSUB 0500
9835 END

```

REFERENCES AND SYMBOLS IN BRASHI.LL

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PAGE 1

0100 IS REFERENCED ON LINES:
0040 0135

0140 IS REFERENCED ON LINES:
0115 0125

1000 IS REFERENCED ON LINES:
0035

3500 IS REFERENCED ON LINES:
0045

3520 IS REFERENCED ON LINES:
3550

3550 IS REFERENCED ON LINES:
3527 3535

4100 IS REFERENCED ON LINES:
4150

4125 IS REFERENCED ON LINES:
4105

4145 IS REFERENCED ON LINES:
4125 4135

4200 IS REFERENCED ON LINES:
4102 4430 4465 4485 4495
4505

4260 IS REFERENCED ON LINES:
4235 4245

4400 IS REFERENCED ON LINES:
4140

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4475 IS REFERENCED ON LINES:
4520

4600 IS REFERENCED ON LINES:
4470 4510

4712 IS REFERENCED ON LINES:
4675

4800 IS REFERENCED ON LINES:
4115

4830 IS REFERENCED ON LINES:
4125

5000 IS REFERENCED ON LINES:
3525 4230

5100 IS REFERENCED ON LINES:
5040

7000 IS REFERENCED ON LINES:
3515 3540 4250 5050

8000 IS REFERENCED ON LINES:
1220 5020 7040

8025 IS REFERENCED ON LINES:
8018

8035 IS REFERENCED ON LINES:
8022

8500 IS REFERENCED ON LINES:
5010 7030 9830

REFERENCES AND SYMBOLS IN BRASH1.LL

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9000 IS REFERENCED ON LINES:
4160

9288 IS REFERENCED ON LINES:
9294 9590

9500 IS REFERENCED ON LINES:
1062

9550 IS REFERENCED ON LINES:
9292

9560 IS REFERENCED ON LINES:
9575

9580 IS REFERENCED ON LINES:
9565

9600 IS REFERENCED ON LINES:
9291

9684 IS REFERENCED ON LINES:
9671

9686 IS REFERENCED ON LINES:
9669

9689 IS REFERENCED ON LINES:
9683 9685

9762 IS REFERENCED ON LINES:
9800

9784 IS REFERENCED ON LINES:
9787

REFERENCES AND SYMBOLS IN BRASH1.LL

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9788 IS REFERENCED ON LINES:
9785

9790 IS REFERENCED ON LINES:
9810

9825 IS REFERENCED ON LINES:
9805

A OCCURS ON LINES:
1064 1066

A1 OCCURS ON LINES:
0009 4630 4640 4680 4690
4714 4716 4810 4820 4825
4840 4850 4855 9684 9686

B OCCURS ON LINES:
5035 5037 5080 7060 7070
7080 7100

B1 OCCURS ON LINES:
5035 5080

B2 OCCURS ON LINES:
5037 5080 5100

B5 OCCURS ON LINES:
3505 3530 3535 3545 4240
4245 4255

B9 OCCURS ON LINES:
1140 7080 7100

C5 OCCURS ON LINES:
0006

[illegible]

REFERENCES AND SYMBOLS IN BRASH1.LL

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F3\$ OCCURS ON LINES:

0011 9560 9570 9784 9786

I OCCURS ON LINES:

1050	1055	1073	1110	1115
1120	1125	1130	4103	4105
4110	4125	4135	4425	4460
4480	4500	4620	4630	9665
9667	9669	9671	9678	9679
9680	9684	9686	9689	9705
9710	9715			

J OCCURS ON LINES:

1066	1070	4095	4100	4105
4145	4147	4150	4490	4610
4630	4740	4785	4810	4840

K OCCURS ON LINES:

5055 7010 7065

L1 OCCURS ON LINES:

0010	0020	0021	0022	0034
0037	0140	0155	1165	1180
1183	1184	1222	3535	4245
4520	4615	4720	4730	4735
4750	4760	4762	4770	4776
4778	4780	4817	4847	5030
5100	7060	7075	8020	8025
8505	8507	8510	9608	9682
9700				

M0 OCCURS ON LINES:

0110 0120 3527 4235 5040

M1 OCCURS ON LINES:

0030

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M9 OCCURS ON LINES:

0019	3510	3520	3550	4100
4425	4460	4480	4490	4500
5100	5108	7010	7020	7037
7065	8503	8507	9825	

N0 OCCURS ON LINES:

1100	1110	3550	4095	4103
4147	4150	4610	4805	4810
9705				

N1 OCCURS ON LINES:

1035	1050	4150	9665
------	------	------	------

N3 OCCURS ON LINES:

1035	1062	1064	9667
------	------	------	------

P1 OCCURS ON LINES:

4097	4147	4610	4615	4630
4640	4650	4680	4690	4700
4710	4714	4718	4770	4776
4778	4800	4802	4810	4815
4820	4825	4830	4832	4840
4845	4850	4855		

Q OCCURS ON LINES:

1222	1225	5100
------	------	------

R OCCURS ON LINES:

0024	4101	4410	4475	4520
4630	4640	4650	4660	4670
4675	4680	4690	4700	4714
4718	4720	4810	4820	4825
4840	4850	4855	9608	9678
9700				

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SI OCCURS ON LINES:

0009 1125 4105 4620 4630
4805 4810 4835 4840 5100
5108

TS OCCURS ON LINES:

0007 1040 1072 9667

T0 OCCURS ON LINES:

4620 4630 4805 4810 4835
4840

T2 OCCURS ON LINES:

1190 1193

T1 OCCURS ON LINES:

0010 4615 4714 4718 4778
4815 4845 9669 9671 9680

V1 OCCURS ON LINES:

4660 4700 4710 9678 9679
9680

VI OCCURS ON LINES:

0014 4650 4690 4700 9678

X OCCURS ON LINES:

0028

XS OCCURS ON LINES:

0009 0105 0110 0115 0120
0125 0140 0145 1060 1062
1064 1068 1072 1215 9290
9291 9292 9294 9667 9680
9684 9686 9793 9800 9805
9810

REFERENCES AND SYMBOLS IN BRASH1.LL

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Z2\$ OCCURS ON LINES:
0005 1015 9645

Z3\$ OCCURS ON LINES:
0005 1025 9635

Z4\$ OCCURS ON LINES:
0005 1080 9750

Z5\$ OCCURS ON LINES:
0005 1090 9720

Z7\$ OCCURS ON LINES:
0005 1150 4714 4718 9660
9720

LISTING WAS TAKEN FROM FILE BRASH1.LL

SYMBOL TABLE WAS IN FILE BRASH1.ST

144 SYMBOL SPACES WERE USED

0 OVERFLOWS OCCURRED

NEXT TIME SET ARRAYS TO 144

FOR MORE COPIES SET

OS=BRASH1.LL

NS=BRASH1.ST

RUN 3240 (OK THEREABOUTS)

LISTING OF FILE BR305.LL ON 9 / 28 / 1977
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```

0002 REM: LLL;"BR305.LL";WALTER BOYLE; PROGRAM TO BRACKET SAMPLES
0003 REM: ASCII FILES; INTERIM "IN305.BR"; FINAL "FN305.BR"
0004 REM: WRITTEN FOR USE ON PE 305 DOUBLE BEAM INSTRUMENT
0005 DIM Z2$(72),Z3$(72),Z4$(72),Z5$(72),Z7$(72)
0006 DIM C$(5)
0007 DIM T$(400)
0009 DIM X$(100),A(10,50),C(10),S(60)
0010 DIM L(50),I(50)
0011 DIM F2$(20),F3$(120)
0014 DIM D(50),V(50)
0017 LET D5=4
0018 REM: NO. OF UNITS PAST DECIMAL POINT.
0019 LET M9=0
0020 LET L(30)=3
0021 LET L(33)=3
0022 LET L(32)=1
0023 LET D1=1
0024 LET R=1
0025 LET F1=1
0026 REM: INTERIM FILE NO
0027 LET F2$="IN305.BR"
0028 DEF FNG(X)=INT(X*10*D5+.5)/10*D5
0030 CALL 21,D1,M1
0031 REM: INITIALIZE SAMPLER LOCATION AS ZERO
0034 LET L(10)=1
0035 GOSUB 1000
0036 LET L(5)=7
0037 LET L(4)=8
0039 LET L(3)=0
0040 GOSUB 0100
0041 REM: GET CORRECTOR L(3) FOR BEAM BALANCE
0042 INPUT "SET-UP FOR BASELINE AND HIT RETURN",X$
0043 LET L(6)=15
0045 CALL 11,L(4),L(6),L(8),L(5),L(7)
0047 LET L(3)=L(8)-L(7)

```

```

0050 PRINT "BEAM DIFF (REF-SMPL)= ";L[8];" - ";L[7];" = ";L[3]
0055 GOTO 3500
0060 REM: L(4) IS CHAN 20 REF.; L(5) IS CHAN 19 SAMPLE
0061 REM: L(8) IS FOR REF DATA; L(7) IS SAMPLE DATA
0062 REM: L(6) IS NO. OF POINTS (TIME); L(3) IS CORRECTOR
0100 PRINT "BASELINE AVERAGE; Y/N ?"
0105 INPUT XS
0110 IF XS="Y" THEN LET M0=1
0115 IF XS="Y" THEN GOTO 0140
0120 IF XS="N" THEN LET M0=2
0125 IF XS="N" THEN GOTO 0140
0130 PRINT "SYNTAX ERROR"
0135 GOTO 0100
0140 IF XS="Y" THEN LET L[11]=1
0145 IF XS="Y" THEN RETURN
0150 PRINT "FREQUENCY OF BASELINE ?"
0155 INPUT L[11]
0160 RETURN
1000 PRINT
1010 PRINT "DATE, TIME OF DAY, OPERATOR'S NAME, AND INSTRUMENT"
1015 INPUT Z2$
1020 PRINT "SAMPLE TITLE"
1025 INPUT Z3$
1030 PRINT "MAX ID LENGTH, NO. OF SAMPLES";
1035 INPUT N3,N1
1040 LET TS=""
1045 PRINT "SAMPLE I. D. CODE"
1050 FOR I=1 TO N1
1055 PRINT I;
1060 INPUT XS
1062 IF LEN(XS)>N3 THEN GOTO 9500
1064 LET A=N3-LEN(XS)
1066 FOR J=1 TO A
1068 LET XS=XS,"."
1070 NEXT J

```

```
1072 LET TS=TS,XS
1073 NEXT I
1075 PRINT "INSTRUMENT CONDITIONS"
1080 INPUT Z4$
1085 PRINT "STDS SRC"
1090 INPUT Z5$
1095 PRINT "NO. OF STDS"
1100 INPUT NO
1105 PRINT "CONC:"
1110 FOR I=1 TO NO
1115 PRINT I;
1120 INPUT C(I)
1125 LET S(I)=0
1130 NEXT I
1135 PRINT "BASELINE LIMIT"
1140 INPUT B9
1145 PRINT "UNITS"
1150 INPUT Z7$
1160 PRINT "RELATIVE STANDARD DEVIATION LIMIT";
1165 INPUT L(11)
1175 PRINT "INTEG. TIME IN SECONDS"
1180 INPUT L(6)
1183 LET L(6)=INT(L(6)*15/2)
1184 PRINT L(6),"POINTS"
1185 PRINT "PAUSE TIME IN SECONDS"
1190 INPUT T2
1193 LET T2=INT(60*T2)
1195 RETURN
3500 REM: ROUTINE FOR RUNNING STANDARDS FIRST TIME
3505 LET B5=0
3510 LET M9=0
3515 GOSUB 7000
3520 LET M9=M9+1
3525 GOSUB 5000
3527 IF M9=1 THEN GOTO 3550
```

LISTING OF FILE BR305.LL ON 9 / 28 / 1977
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```

3530 LET B5=B5+1
3535 IF B5<L(11) THEN GOTO 3550
3540 GOSUB 7000
3545 LET B5=0
3550 IF M9<N0 THEN GOTO 3520
4000 REM: GET THE UNKNOWN AND BRACKETING STANDARDS
4025 OPEN FILE(F1,1),F2$
4026 REM: F1 IS FILE NUMBER, F2$ FILE NAME
4095 LET J=N0+1
4097 LET P1=1
4100 LET M9=J
4101 LET R=1
4102 GOSUB 4200
4103 FOR I=1 TO N0
4105     IF S(I)>=S(J) THEN GOTO 4125
4110 NEXT I
4115 GOSUB 4800
4120 REM: PRINT WARNING LAST STD TOO LOW
4125 GOTO 4145
4125 IF (I-1)=0 THEN GOSUB 4830
4130 REM: PRINT WARNING FIRST STD TOO HIGH
4135 IF (I-1)=0 THEN GOTO 4145
4140 GOSUB 4400
4145 LET J=J+1
4147 LET P1=J-N0
4150 IF J<=N1+N0 THEN GOTO 4100
4155 PRINT "ALL DONE"
4157 CLOSE FILE(F1)
4160 GOTO 9000
4200 REM: SUBROUTINE TO READ STDs AND SAMPLES AND
4201 REM: TO KEEP TRACK OF BASELINE READINGS
4230 GOSUB 5000
4235 IF M0=1 THEN GOTO 4260
4240 LET B5=B5+1
4245 IF B5<L(11) THEN GOTO 4260

```


LISTING OF FILE BR305.LL ON 9 / 28 / 1977
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```

4250 GOSUB 7000
4255 LET B5=0
4260 RETURN
4400 REM: ROUTINE FOR RUNNING BRACKET
4410 LET R=1
4425 LET M9=I-1
4430 GOSUB 4200
4460 LET M9=I
4465 GOSUB 4200
4470 GOSUB 4600
4475 LET R=R+1
4480 LET M9=I-1
4485 GOSUB 4200
4490 LET M9=J
4495 GOSUB 4200
4500 LET M9=I
4505 GOSUB 4200
4510 GOSUB 4600
4520 IF R<L(30) THEN GOTO 4475
4525 RETURN
4600 REM: INTERPOLATION AND STATISTICAL SUBROUTINE
4610 LET P1=J-NO
4615 LET T(P1)=L(32)
4620 LET T0=(C(I)-C(I-1))/(S(I)-S(I-1))
4630 LET A(R,P1)=T0*(S(J)-S(I-1))+C(I-1)
4640 IF R=1 THEN LET D(P1)=A(1,P1)
4650 IF R=1 THEN LET V(P1)=0
4660 IF R=1 THEN LET V1=0
4670 IF R=1 THEN LET D4=0
4675 IF R=1 THEN GOTO 4712
4680 LET D(P1)=D(P1)*(R-1)/R+A(R,P1)/R
4690 LET V(P1)=V(P1)*(R-1)/R+((D(P1)-A(R,P1))^2)/(R-1)
4700 LET V1=V(P1)*R/(R-1)
4710 LET D4=SGR(V1)*100/D(P1)
4712 PRINT

```

```

4713 PRINT
4714 PRINT "RUN";R;"UNK";P1;FNG(A(R,P1));Z78;" AVG";FNG(D(P1));Z78;" RSD";FNG(D4);"X";" TRIAL";T(P1)
4715 PRINT
4717 PRINT FILE(F1)
4718 PRINT FILE(F1),"RUN";R;"UNK";P1;FNG(A(R,P1));Z78;" AVG";FNG(D(P1));Z78;" RSD";FNG(D4);"X";" TRIAL";T(P1)
4719 PRINT FILE(F1)
4720 IF R4=L(30) THEN RETURN
4730 IF 04=L(31) THEN LET L(32)=1
4735 IF 04=L(31) THEN RETURN
4740 LET J4=1
4750 LET L(32)=L(32)+1
4760 IF L(32)=L(33) THEN RETURN
4762 LET L(32)=L(32)+1
4765 REM L(31) IS RELATIVE NO. DEV LIMIT
4766 REM L(33) IS ATTEMPT NO. (3)/L(30) IS NUMBER OF RUNS
4767 REM L(32) IS COUNTER FOR NO. OF ATTEMPTS
4768 PRINT "*****"
4770 PRINT "UNK ";P1;" TRIED";L(32);" TIMES AND RSD IS";FNG(D4);" WHICH IS ">L(31)
4772 PRINT "*****"
4775 PRINT FILE(F1)
4776 PRINT FILE(F1),"UNK ";P1;" TRIED";L(32);" TIMES AND RSD IS";FNG(D4);" WHICH IS ">L(31)
4777 PRINT FILE(F1)
4778 LET T(P1)=L(32)
4780 LET L(32)=1
4785 LET J4=1
4790 RETURN
4800 PRINT "UNKNOWN NO. ";P1;" LAST STANDARD TOO LOW"
4802 PRINT FILE(F1),"UNKNOWN NO. ";P1;" LAST STANDARD TOO LOW"
4805 LET TO=(C(NO)-C(NO-1))/(S(NO)-S(NO-1))
4810 LET A(S,P1)=TO*(S(1)-S(NO))+C(NO)
4815 LET T(P1)=0
4817 LET L(32)=1
4820 PRINT "APPROXIMATE CONC";FNG(A(R,P1))
4825 PRINT FILE(F1),"APPROXIMATE CONC";FNG(A(R,P1))
4826 PRINT FILE(F1)

```

LISTING OF FILE BR305.LL ON 9 / 28 / 1977
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```

4827 RETURN
4830 PRINT "UNKNOWN NO.";P1;"FIRST STANDARD TOO HIGH"
4832 PRINT FILE(F1),"UNKNOWN NO.";P1;"FIRST STANDARD TOO HIGH"
4835 LET T0=(C(2)-C(1))/(S(2)-S(1))
4840 LET A(R,P1)=T0*(S(1)-S(1))+C(1)
4845 LET T(P1)=-1
4847 LET L(32)=1
4850 PRINT "APPROXIMATE CONC=";A(R,P1)
4855 PRINT FILE(F1),"APPROXIMATE CONC=";A(R,P1)
4857 PRINT FILE(F1)
4860 RETURN
5000 REM GET WHEEL POSITION AND READ
5010 GOSUB 8500
5020 GOSUB 8000
5030 LET L(2)=L(1)
5035 LET B1=B
5037 LET B2=B
5040 IF INT(M0/2)=M0/2 THEN GOTO 5100
5045 REM ODD M0; 1B WAS SPECIFIED
5050 GOSUB 7000
5055 LET K=0
5080 LET B2=(B+B1)/2
5100 LET S(M9)=LOG(L(2))/LOG(10)
5105 REM ABS=LOG(10)(100%T/XT)
5107 LET S(M9)=S(M9)-B2
5108 PRINT "ABS=";S(M9)
5110 RETURN
7000 PRINT "READ A BASELINE"
7010 LET K=M9
7020 LET M9=0
7030 GOSUB 8500
7035 REM POSITION WHEEL
7037 CALL 21,D1,M9
7038 REM: REINITIALIZE EACH ZERO POSITION
7040 GOSUB 8000

```

LISTING OF FILE BR305.LL ON 9 / 28 / 1977
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```

7045 REM: TAKE A READING; RETURN AS ABSORBANCE FOR BASELINE
7055 LET S=LOG(L[1])/LOG(10)
7060 LET B=S
7065 LET M9=K
7070 PRINT B
7075 LET L[15]=40
7080 IF B<89 THEN RETURN
7090 FOR E=1 TO 5
7095 PRINT "<7>"
7095 CALL 1,L[15]
7097 NEXT E
7100 IF B>89 THEN PRINT "BASELINE OUT OF RANGE"
7110 RETURN
8000 REM: READ ADC; RETURN AS L[1]
8010 PRINT "TAKE A READING"
8015 INPUT "READY ?",XS
8018 GOTO 8025
8019 LET L[8]=10000
8020 INPUT "SAMPLE ",L[7]
8021 PRINT "%ABS= ",100*(L[8]-L[7])/L[8]
8022 GOTO 8030
8025 CALL 11,L[4],L[6],L[8],L[5],L[7]
8030 LET L[1]=(L[8]-L[3])/L[7]
8035 RETURN
8500 REM POSITION THE WHEEL
8503 PRINT "POSITION";M9
8505 CALL 21,01,L[10]
8507 LET L[16]=M9+1
8510 CALL 22,01,L[16]
8520 CALL 1,T2
8535 RETURN
9000 REM: CALCULATE AND STORE ANSWERS, AVERAGE,SD,AND RSD
9001 REM: FOR EACH RUN
9002 REM: OPEN FILES FOR PRINTING OPTION
9003 REM: F1 IS FILE NO.;F2$ IS FILE NAME;F3$ IS DUMMY VARIABLE

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9288 PRINT "HARD COPY OF RUN REPORT (Y/N) ";
9290 INPUT X8
9291 IF X8(1,1)="#N" THEN GOTO 9600
9292 IF X8(1,1)="#Y" THEN GOTO 9350
9294 IF X8(1,1)="#?" THEN GOTO 9288
9350 OPEN FILE(0,1),"BLPT"
9355 OPEN FILE(F1,1),F28
9360 INPUT FILE(F1),F38
9365 IF EOP(F1) THEN GOTO 9580
9370 PRINT FILE(0),F38
9375 GOTO 9560
9580 CLOSE FILE(0)
9581 CLOSE FILE(F1)
9585 PRINT "ALL DONE"
9590 GOTO 9288
9600 LET F1=1
9605 LET F28="FN305.SR"
9608 LET R=1301
9610 OPEN FILE(F1,1),F28
9615 PRINT FILE(F1)
9620 PRINT FILE(F1),"
ANALYSIS REPORT"
9625 PRINT FILE(F1)
9630 PRINT FILE(F1)
9635 PRINT FILE(F1),Z38
9640 PRINT FILE(F1)
9645 PRINT FILE(F1),Z28
9650 PRINT FILE(F1)
9655 PRINT FILE(F1)
9657 LET D583
9660 PRINT FILE(F1),"SAMPLE NO. "; TAB(30);"AVERAGE("Z78;");"; TAB(47);"80"; TAB(37);"R8D"; TAB(43);"TRIAL8"
9665 FOR I=1 TO N1
9667 LET N8PT8(N8*(I-1)+1,N8*I)
9668 PRINT FILE(F1)
9669 IF T111=0 THEN GOTO 9686
9671 IF T111=1 THEN GOTO 9684

```

```

9678 LET V=I/(R/(N-1))
9679 LET D4=SR(V1)=100/D111
9680 PRINT FILE(F1),"NO. "I;" "X8; TAB(29);FNG(D111); TAB(44);FNG(SR(V1)); TAB(54);FNG(D4); TAB(63);V111
9682 IF D4<131 THEN PRINT FILE(F1),"EXCEEDD STANDARD DEV. LIMIT OF",L131;" "X
9683 GOTO 9689
9684 PRINT FILE(F1),"NO. "I;" "X8;"FIRST STANDARD TOO HIGH--APPROX CONC="FNG(A11,13)
9685 GOTO 9689
9686 PRINT FILE(F1),"NO. "I;" "X8;"LAST STANDARD TOO LOW--APPROX CONC="FNG(A11,13)
9687 NEXT I
9698 PRINT FILE(F1)
9699 PRINT FILE(F1)
9700 PRINT FILE(F1);R;"- RUNS MADE FOR EACH TRY AND",L131;" TRIES ARE MADE BEFORE GIVING UP"
9703 PRINT FILE(F1)
9705 FOR I=1 TO N0
9710 PRINT FILE(F1),C111
9715 NEXT I
9720 PRINT FILE(F1),Z78;" FROM ",Z58
9725 PRINT FILE(F1)
9743 PRINT FILE(F1)
9750 PRINT FILE(F1),Z48
9755 CLOSE
9782 OPEN FILE(I1),"BLPT"
9783 OPEN FILE(F1,3),F28
9784 INPUT FILE(F1),F33
9785 IF EOP(F1) THEN GOTO 9788
9786 PRINT FILE(I1),F38
9787 GOTO 9784
9788 CLOSE FILE(I1)
9789 CLOSE FILE(F1)
9790 PRINT "ANOTHER COPY (Y/N) ?"
9793 INPUT X8
9800 IF X8(1,1)="Y" THEN GOTO 9782
9805 IF X8(1,1)="N" THEN GOTO 9825
9810 IF X8(1,1)!="Y" THEN GOTO 9790
9825 LET M9=0
9830 GDSUB 8500
9835 END

```

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PAGE 1

0100 IS REFERENCED ON LINES:

0040 0135

0140 IS REFERENCED ON LINES:

0115 0125

1000 IS REFERENCED ON LINES:

0035 8019

3500 IS REFERENCED ON LINES:

0055

3520 IS REFERENCED ON LINES:

3550

3550 IS REFERENCED ON LINES:

3527 3535

4100 IS REFERENCED ON LINES:

4150

4125 IS REFERENCED ON LINES:

4105

4145 IS REFERENCED ON LINES:

4123 4135

4200 IS REFERENCED ON LINES:

4102 4430 4465 4485 4495
4505

4260 IS REFERENCED ON LINES:

4235 4245

4400 IS REFERENCED ON LINES:

4140

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4475 IS REFERENCED ON LINES:
4520

4600 IS REFERENCED ON LINES:
4470 4510

4712 IS REFERENCED ON LINES:
4675

4800 IS REFERENCED ON LINES:
4115

4830 IS REFERENCED ON LINES:
4125

5000 IS REFERENCED ON LINES:
5525 4230

5100 IS REFERENCED ON LINES:
5040

7000 IS REFERENCED ON LINES:
3515 3540 4250 5050

8000 IS REFERENCED ON LINES:
5020 7040

8025 IS REFERENCED ON LINES:
8018

8030 IS REFERENCED ON LINES:
8022

8500 IS REFERENCED ON LINES:
5010 7030 9830

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9000 IS REFERENCED ON LINES:

4160

9288 IS REFERENCED ON LINES:

9294 9590

9500 IS REFERENCED ON LINES:

1062

9550 IS REFERENCED ON LINES:

9292

9560 IS REFERENCED ON LINES:

9575

9580 IS REFERENCED ON LINES:

9565

9600 IS REFERENCED ON LINES:

9291

9684 IS REFERENCED ON LINES:

9671

9686 IS REFERENCED ON LINES:

9669

9689 IS REFERENCED ON LINES:

9683 9685

9782 IS REFERENCED ON LINES:

9800

9784 IS REFERENCED ON LINES:

9787

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9788 IS REFERENCED ON LINES:

9785

9790 IS REFERENCED ON LINES:

9810

9825 IS REFERENCED ON LINES:

9805

A OCCURS ON LINES:

1064 1066

A1 OCCURS ON LINES:

0009 4630 4640 4680 4690

4714 4718 4810 4820 4825

4640 4850 4855 9684 9686

B OCCURS ON LINES:

5035 5037 5080 7060 7070

7080 7100

B1 OCCURS ON LINES:

5035 5080

B2 OCCURS ON LINES:

5037 5080 5107

B5 OCCURS ON LINES:

3505 3530 3535 3545 4240

4245 4255

B9 OCCURS ON LINES:

1140 7080 7100

C5 OCCURS ON LINES:

0006

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C1 OCCURS ON LINES:

0009	1120	4620	4630	4805
4810	4835	4840	9710	

D1 OCCURS ON LINES:

0023

D4 OCCURS ON LINES:

4670	4710	4714	4718	4730
4735	4770	4776	9679	9680
9682				

D5 OCCURS ON LINES:

0017 9657

D1 OCCURS ON LINES:

0014	4640	4680	4690	4714
4718	9680			

E OCCURS ON LINES:

7090 7097

F1 OCCURS ON LINES:

0025	4025	4157	4717	4718
4719	4775	4776	4777	4802
4825	4826	4832	4855	4857
9555	9560	9565	9581	9600
9610	9615	9620	9625	9630
9635	9640	9645	9650	9655
9660	9668	9680	9682	9684
9686	9690	9695	9700	9703
9710	9720	9725	9745	9750
9783	9784	9785	9789	

F25 OCCURS ON LINES:

0011	0027	4025	9555	9605
9610	9783			

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F35 OCCURS ON LINES:

0011 9560 9570 9784 9786

I OCCURS ON LINES:

1050 1055 1075 1110 1115
1120 1125 1130 4103 4105
4110 4125 4135 4425 4460
4480 4500 4620 4630 9665
9667 9669 9671 9678 9679
9680 9684 9686 9689 9705
9710 9715

J OCCURS ON LINES:

1066 1070 4095 4100 4105
4145 4147 4150 4490 4610
4630 4740 4785 4810 4840

K OCCURS ON LINES:

5055 7010 7065

LI OCCURS ON LINES:

0010 0020 0021 0022 0034
0036 0037 0039 0043 0045
0047 0050 0140 0155 1165
1180 1183 1184 3535 4245
4520 4615 4720 4730 4735
4750 4760 4762 4770 4776
4778 4780 4817 4847 5030
5100 7055 7075 8019 8020
8021 8025 8030 8505 8507
8510 9608 9682 9700

M0 OCCURS ON LINES:

0110 0120 3527 4235 5040

M1 OCCURS ON LINES:

0030

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M9 OCCURS ON LINES:
 0019 3510 3520 3550 4100
 4425 4460 4480 4490 4500
 5100 5107 5108 7010 7020
 7037 7065 8503 8507 9825

N0 OCCURS ON LINES:
 1100 1110 3550 4095 4103
 4147 4150 4610 4805 4810
 9705

N1 OCCURS ON LINES:
 1035 1050 4150 9665

N3 OCCURS ON LINES:
 1035 1062 1064 9667

P1 OCCURS ON LINES:
 4097 4147 4610 4615 4630
 4640 4650 4680 4690 4700
 4710 4714 4718 4770 4776
 4778 4800 4802 4810 4815
 4820 4825 4830 4832 4840
 4845 4850 4855

R OCCURS ON LINES:
 0024 4101 4410 4475 4520
 4630 4640 4650 4660 4670
 4675 4680 4690 4700 4714
 4718 4720 4810 4820 4825
 4840 4850 4855 9608 9678
 9700

S OCCURS ON LINES:
 7055 7060

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S1 OCCURS ON LINES:

0009 1125 4105 4620 4630
4805 4810 4835 4840 5100
5107 5108

T5 OCCURS ON LINES:

0007 1040 1072 9667

T0 OCCURS ON LINES:

4620 4630 4805 4810 4835
4840

T2 OCCURS ON LINES:

1190 1193

T1 OCCURS ON LINES:

0010 4615 4714 4718 4778
4815 4845 9669 9671 9680

V1 OCCURS ON LINES:

4660 4700 4710 9678 9679
9680

V0 OCCURS ON LINES:

0014 4650 4690 4700 9678

X OCCURS ON LINES:

0028

XS OCCURS ON LINES:

0009 0042 0105 0110 0115
0120 0125 0140 0145 1060
1062 1064 1068 1072 8015
9290 9291 9292 9294 9667
9680 9684 9686 9793 9800
9805 9810

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Z2\$ OCCURS ON LINES:
0005 1015 9645

Z3\$ OCCURS ON LINES:
0005 1025 9655

Z4\$ OCCURS ON LINES:
0005 1080 9750

Z5\$ OCCURS ON LINES:
0005 1090 9720

Z7\$ OCCURS ON LINES:
0005 1150 4714 4718 9660
9720

LISTING WAS TAKEN FROM FILE BR305.LL

SYMBOL TABLE WAS IN FILE BR305.ST

145 SYMBOL SPACES WERE USED

0 OVERFLOWS OCCURRED
NEXT TIME SET ARRAYS TO 145
FOR MORE COPIES SET

DS=BR305.LL

NS=BR305.ST

RUN 3240 (OR THEREABOUTS)