WORKSHOP.

WORKSHOP is an interactive calculator written by Mr H Beilby of the Department of Transportation and Environment at the University of Birmingham and distributed by Elliotts as a binary program along with a short booklet describing the facilities available.

WORKSHOP comes in two versions. The "online" version is for use with a teletype for the input of commands and output of results. The "offline" version presumes input from paper tape and output to paper tape, and a copy of the input program is included in the output.

Since the WORKSHOP booklet is in the documents archive only a summary is given here.

Basic Facilities.

A session starts with a reference code on a line by itself, consisting of a \ followed by an alphanumeric code, e.g.,:

```
\AJH001
```

The reference code is followed by commands, each starting on a new line. The main commands are WHERE, CALCULATE, PRINT and RUN.

WHERE is used to set a variable to a value, e.g.,

```
WHERE X = 1.0
```

CALCULATE is used to set a variable to the result of a calculated formula, e.g.,

```
CALCULATE Y = 2 * A + B + 5
```

PRINT is used to output the value of a variable or a formula, e.g.,

```
PRINT A
PRINT A ; B ; C+D
```

Note use of ; to group multiple items - the previous line is equivalent to:

```
PRINT A
PRINT B
PRINT C+D
```

WHERE, CALCULATE and PRINT commands are stored until a RUN command is given. WORKSHOP then evaluates the assignments and calculations printing the results as required. If necessary the WHERE and CALCULATE commands will be reordered to enable evaluation. Thus the following two sequences are equivalent:

```
WHERE A = 1           CALCULATE B = A * 2
CALCULATE B = A * 2   WHERE A = 1
PRINT A               PRINT A
RUN                   RUN
```

A WHERE or a CALCULATE command that refers to the same variable as an earlier WHERE or CALCULATE command replaces the original.

After a RUN previous CALCULATE and PRINT commands are forgotten on entry of a subsequent CALCULATE or PRINT unless preceded by a REPEAT command.

Formulae can uses the normal mathematical operators ^, /, *, +, - and parenthesis (). Numbers can be integer or real in the same formats used by Elliott Algol. The following mathematical functions are provided:

```
Q         the constant pi
QSQT x    square root of x
QLNE x    natural logarithm of x
QEXP x    exponential x
QCOS x    cosine x (in radians)
QSIN x    sine x (in radians)
QATN x    arctangent of x (result in radians)
QINT x    integer part of x
QMOD x    modulus (absolute value) of x
QDEL x    delta x - 0 if x is 0, 1 otherwise
QSGN x    sign of x (-1, 0, +1)
QFAC x    x!
```

Variable names consist of one or two letters. The first letter can be any of ABCDEFGHIJKLMNOPRSTUVWXYZ (i.e., not Q) and the second any of ABCDEFGHOPRSTUVXWYZ (i.e., not I-M or Q).

Matrix facilities.

WORKSHOP allows calculations on vectors and matrices. These use the letters I-M to indicate indices. Thus a vector of 5 elements can be set up by e.g.,

```
   WHERE AI = 1 2 3 4 5
```

a 3 * 2 array by, e.g.,

```
   WHERE BIJ = 1 2 3
   4 5 6
```

and a 2 * 3 * 4 array by, e.g.,

```
   WHERE CIJ = 1 2 3 4
   5 6 7 8
   9 10 11 12
   13 14 15 16
   17 18 19 20
   21 22 23 25
   26 27 28 29.
```

C[2,3,4] = 29

The following functions are provided for matrices:

QSUM	Calculate sum of elements of matrix
QPRD	Calculate product of elements of matrix
QMAX	Find maximum element of matrix
QCNT	Count number of elements in matrix
QMIN	Inverse of non-singular matrix (2 dimensional matrices only)

CALCULATE and PRINT can each perform matrix calculations, e.g.,

```
   CALCULATE AIJ = BIJ+CIJ*DIJ
```

In matrix calculations WORKSHOP iterates over indices in the order I, J, K, L, M. Thus the following:

```
   CALCULATE EIJ = DJI
```

Makes the rows of D equal to the columns of E.

Matrix dimensions can be contracted out as in e.g.,

```
   CALCULATE GI = H2J
```

that makes the vector G equal to the section row of H.

Matrix elements can be referenced as in P[X,Y] and subsets of matrices can be selected using ^^ as in

```
   CALCULATE UIJ = QDEL (I-J) [I = 0^^3, J=0^^3]
```

that assigns a 4*4 unity matrix to U.

For more examples, see DEMO3.

When using matrices it is easy to run out of store: the FORGET command can be used to delete a matrix by name, as in:

```
   FORGET B
```

Iteration.

The ITERATE command enables calculations to be iterated: it is basically a version of CALCULATE that assigns a new value to a variable. An ITERATE command must immediately follow the sequence of WHERE, PRINT and CALCULATE statements to be iterated. Iterations can be nested.

As an example:

```
WHERE A = 4
CALCULATE B = 2 * A
PRINT B
ITERATE A = B
RUN
RUN
RUN
RUN
```

Will produce as output 8, 16, 32 and 64.

Demonstration Programs.

DEMO1.DAT: Illustrates the basic facilities of WORKSHOP using examples from the WORKSHOP booklet.

DEMO2.DAT: Illustrates the matrix facilities of WORKSHOP using examples from the WORKSHOP booklet.

DEMO3.DAT: Illustrates the iteration facilities of WORKSHOP using examples from the WORKSHOP booklet.

DEMO4.DAT: Illustrates the use of workshop in "offline" mode.

SYSTEM FILES

ONLINE.BIN "WORKSHOP SYSTEM ONLINE VERSION ISS1".

OFFLINE.BIN "WORKSHOP SYSTEM OFFLINE VERSION ISS1".

Both from Terry Froggatt's paper tape collection.