happened in that run. A user can then, if he wishes, trace the past history of his job, either out of curiosity or if he is in doubt over any particular run. The programmer can also keep track of how the system is being used, and how long a magnetic tape lasts.

19. Future development

The Friend as described was developed under the Temporary Supervisor of Titan, and became obsolete when the Main Supervisor came into service. Titan now has an 8 million-word magnetic-disc file, and when the Friend is rewritten it is intended to use some of this to hold everything except the data and results which the user actually wants to remove from the computer. Thus a casual user with no permanent data on magnetic tape should be able to supply for a run only his preface and a "Job description" which can be as short as

> Cryst
> [Name of job]
> Terminator

It is anticipated that it will be increasingly easy to add arithmetic routines to the system, for two reasons. Firstly, input of its data has now been separated from an arithmetic routine; the routine is written assuming that all its data is present. For a new routine only those items of data which have not occurred before need to be catered for, and even these usually fall into categories such as "read one decimal number". Secondly, many subroutines useful to a new program will be found to exist already and be known to work.

Development of the Friend so far has been an effort to keep up with the demand for standard crystallographic programs in a fast-changing world. Once we have a workable system which can be left to deal with everyday requirements, we can build on the system, and, for example, experiment with new methods of refinement, and deal with the control of new automatic apparatus as it appears.

20. Acknowledgements

21. References

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Book Review

Handbook for Computing Elementary Functions, by L. A. Lyusternik, O. A. Chervonenkis and A. R. Yanpol'skii, 1966; 251 pages. (Oxford: *Pergamon Press*, 63s.)

Handbook of Mathematical Functions with Formulas, Graphs and Mathematical Tables, edited by M. Abramowitz and I. A. Stegun, 1965; 1046 pages. (New York: *Dover Publications Inc.*, 32s.)

The titles of these two books indicate that their intentions are not the same. Since the Soviet book limits itself to elementary functions one might expect its coverage of these to be more comprehensive, and sometimes this is so. Coefficients of approximation formulae for these functions are often given to suit a wider range of requirements of accuracy than in the American book. Occasionally one finds surprisingly more detail about a higher function in the first book, for example the Gudermannian Function discussed in an appendix. It is interesting to have details of algorithms used on Soviet computers but the descriptions waste space since the algorithms used with two machines are often the same.

In spite of the few reservations made above, the second book surely represents much better value for money. It is four times bigger, just by page numbers, and half the price. The tables are more elegantly displayed and easier to use with the five-digit separation. Graphical display of some functions is very useful, entirely missing in the first book. The collected formulae at the beginning of the sections are probably the greatest value of the book, but in making these comparisons one is again reminded of the titles of the books.

Where direct comparison of numerical values can be made, a number of checks fail to discover any discrepancies between them. This says a great deal for the care with which the books have been prepared. They are both valuable but I guess that the paperback construction of the Dover book will be severely tested by constant use, in spite of the claims made (on the back cover) for its durability.

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