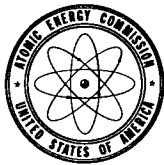


May 1969

Brief 69-10157



AEC-NASA TECH BRIEF



AEC-NASA Tech Briefs describe innovations resulting from the research and development program of the U.S. AEC or from AEC-NASA interagency efforts. They are issued to encourage commercial application. Tech Briefs are published by NASA and may be purchased, at 15 cents each, from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

Performance Statistics of the FORTRAN IV (H) Library for the IBM System/360

A report describing testing procedures and results for accuracy and timing tests of the basic IBM 360/50 FORTRAN IV (H) subroutine library has been presented. The testing was undertaken to verify performance capability and as a prelude to providing some replacement routines of improved performance.

All certification runs were made under the standard operating system, OS/360, on a Model 50 computer. The tests were divided into three categories: accuracy, timing and error returns.

The greatest effort was directed toward the accuracy tests. Consider the testing of a single-precision function subroutine. First the domain of the routine is divided into several subdomains; the subdomains usually correspond to subdomains used internally in the routine under test. Next, several thousand uniformly distributed pseudo-random, single-precision, floating-point numbers, together with their identically valued double-precision counter-parts, are generated for each subdomain. The single precision numbers are used as arguments for the routine being tested; the double-precision numbers are used as arguments for the corresponding double precision subroutine. The results of the double-precision computation are considered as "correct." The single-precision results are then converted to double precision and the maximum relative error and the root-mean-square of the relative error are computed in double precision. In addition, the single-precision results are compared against the results of the double-precision computation correctly rounded to single precision, and the frequency of the errors in units of the last bit of the mantissa is tabulated. Similar tests were performed on the double-precision subroutines.

Timing tests were performed by invoking the routine under test up to 10,000 times, with either a fixed argument or random arguments, in a loop. The "overhead" of the looping instructions was timed in each case by repeating the same loop with a dummy subroutine whose only executable instruction was a jump back to the calling program. Because of the coarseness of the internal clock, the indicated timings varied by as much as 5μ sec. from run to run on a given test.

The tests of error returns consisted in supplying arguments outside the domain of the subroutine under test. Without exception, this resulted in termination of the job.

The report includes tabular summaries of the above tests, a listing of the decimal equivalents of selected inverse powers of 2, and a typical test program.

Notes:

1. The report is entitled "Performance Statistics of the FORTRAN IV (H) Library for the IBM System/360," ANL-7321, May 1967. This report is available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151. The printed copy is \$3.00 (microfiche copies, \$0.65). Additional details will be made available in "Performance Testing of Function Subroutines" by W. J. Cody, Jr., Proc. 1969, S.J.C.C. Paper to be presented at Spring Joint Computer Conference, Boston, May 16, 1969.
2. Inquiries may be directed to:
Office of Industrial Cooperation
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439
Reference: B69-10157

(continued overleaf)

Source: N. A. Clark, W. J. Cody, Jr.,
K. E. Hillstrom, and E. A. Thieleker
Applied Mathematics Division
(ARG-10299)

Patent status:

Inquiries concerning rights for commercial use of
this innovation may be made to:

Mr. George H. Lee, Chief
Chicago Patent Group
U.S. Atomic Energy Commission
Chicago Operations Office
9800 South Cass Avenue
Argonne, Illinois 60439