A PROGRAM TO COUNT OPERATORS AND OPERANDS FOR ANSI-FORTRAN MODULES

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This paper describes a program which scans an arbitrary number of ANSI-FORTRAN modules, counting the basic software science parameters [Halstead 1972] for each module. There is no syntax checking code in the analyzer since conformance to the ANSI standard is easily verified by existing compilers. It is essential, therefore, that all input follow the standard for accurate results. Most of the analyzer itself is written in ANSI-FORTRAN, allowing not only portability, but also the ability to run the program on itself as a test procedure.

Only the following statements effect the counts of operands and operators:

- assignment
- ASSIGN
- CALL
- DO
- GO TO
- IF

Most counts are accumulated as described by [Bulut 1974a]:

- All arithmetic, boolean, and replacement operators are counted.
- Function (subroutine) names are operators.
- Each GO TO to a unique label is a unique operator.
The ASSIGN statement is counted as an assignment.

IF is an operator.

Statement labels in GO TO(L1,L2,L3 are counted as GO TO L1, GO TO L2, GO TO L3.

Bracketing is an operator occurring as parenthetical grouping or a (DO,DO-foot) pair.

Subscripting as indicated by parentheses is counted as such.

All commas are operators.

The implied EOS (end of statement) operator is counted.

The following differences (additions) are present:

- Parameters are treated as variables.
- No attempts are made at correcting impurities in the programs [Bulut 1974b]. Bulut had resolved local variable ambiguity and had detected certain common subexpressions related to array addressing.
- Each computed (assigned) GO TO counts as a unique "special" GO TO since there is a unique (implied) jump into a jump table.
- All constants are mapped into real numbers. The integers are handled trivially. The boolean constants .TRUE. and .FALSE. are mapped to 1.0 and 0.0 respectively. Hollerith constants are ignored since they are only permitted in DATA statements.
- Statement functions are ignored.

Input Format

Input to the analyzer consists of any number of ANSI-FORTRAN modules terminated by a card with an asterisk (*) in column one.

Transporting the Analyzer

Bringing up the analyzer on a new machine requires two things if that machine is not a 50-bit CDC machine:
- changing certain global parameters,
- rewriting certain machine dependent routines.

The analyzer consists of the following ANSI modules:

- **ANALYZE** - driver
- **CONSCH** - searches the constant table for a given value
- **DIMCHK** - scans dimensioning statements, recording array sizes
- **EXPR** - scans and counts an expression
- **GOTO** - searches goto-table for a given label
- **INITM** - initializes for a new module
- **INITP** - initializes program
- **NULINE** - increments lines-per-page count and pages on overflow
- **NUSTMT** - reads and packs one FORTRAN statement
- **PAGE** - performs page ejection and titling
- **PARSE** - determines statement type, counting everything except expressions
- **PMATCH** - searches input for a matching right parenthesis
- **PRSTAT** - prints out statistics at the end of a module
- **REALNO** - scans a number and returns its real value
- **SCAN** - scans one token from the input stream
- **SKIP** - skips blanks in source statement
- **SUMARY** - prints a summary of the statistics for each module in the run (provided that more than one module was scanned).

The constants that require changing are in INITP:

- **PDEPTH**, page depth (in lines)
- **SYSIN**, logical input unit number
- **SYSOUT**, logical output unit number
- **SYSSUM**, logical unit number for a scratch summary file.

The non-ANSI modules that may require rewriting are:

- **CODE** - converts a character to an integer on the range 0 to 63 according to the CDC internal representation (display code)
- **DIGIT** - returns true if its input is the character code for a digit
- **LETDIG** - returns true if its input is the character code for a letter or a digit
- **LETTER** - returns true if its input is the character code for a letter
- **LOOKUP** - searches the hash table for a given symbol
- **NUMCVT** - converts a numeric character string to its integer representation
- **WRTNAM** - writes the name of a symbol from the hash table and its frequency of occurrence.
Implementation Notes

Much of the slowness and awkwardness of the program is caused by the conformance to the ANSI-standard (specifically, the one character per word restriction). A P-register trace showed that most execution time was spent doing I/O and removing blanks from the input statements. If efficiency is not satisfactory, the loop in NUSTMT which handles blank removal might be coded in machine language.

The analyzer will stop with an informative message if any of the various tables should overflow. An alphabetic variable glossary in the source listing will aid in determining both the table name and the variable indicating its size. The size variables are set in INITP and should be changed to reflect any new dimensioning in the common blocks.
REFERENCES


NOTE: The program source is not included as part of this technical report any longer. It has been substantially modified since 1976. Contact the Software Metrics Research Group at Purdue for information about the current version and other counters.