THE INTERCAL PROGRAMMING LANGUAGE

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1. INTRODUCTION

The names you are about to ignore are true. However, the story has been changed significantly. Any resemblance of the programming language portrayed here to other programming languages, living or dead, is purely coincidental.

1.1 Origin and Purpose

The INTERCAL programming language was designed the morning of May 26, 1972 by Donald R. Woods and James M. Lyon, at Princeton University. Exactly when in the morning will become apparent in the course of this manual. It was inspired by one ambition: to have a compiler language which has nothing at all in common with any other major language. By 'major' was meant anything with which the authors were at all familiar, e.g., FORTRAN, BASIC, COBOL, ALGOL, SNOBOL, SPITBOL, FOCAL, SOLVE, TEACH, APL, LISP, and PL/I. For the most part, INTERCAL has remained true to this goal, sharing only the basic elements such as variables, arrays, and the ability to do I/O, and eschewing all conventional operations other than the assignment statement (FORTRAN "=").

1.2 Acronym

The full name of the compiler is "Compiler Language With No Pronounceable Acronym", which is, for obvious reasons, abbreviated "INTERCAL".

1.3 Acknowledgments

The authors are deeply indebted to Eric M. Van and Daniel J. Warmenhoven, without whose unwitting assistance this manual would still have been possible.

2. FUNDAMENTAL CONCEPTS

In this section an attempt is made to describe how and why INTERCAL may be used; i.e., what it is like and what it is good for.

2.1 Sample Program

Shown below is a relatively simple INTERCAL program which will read in 32-bit unsigned integers, treat them as signed, 2's-complement numbers, and print out their absolute values. The program exits if the absolute value is zero. Note in particular the inversion routine (statements 6 through 14), which could be greatly simplified if the subroutine library (see section) were used.

A more detailed analysis of a program is made in section
of this manual.

```
      DO (5) NEXT
(5)   DO FORGET #1
      PLEASE WRITE IN :1
      DO .1 <- '¬":1~'#32768¢#0'"¢#1'~#3
      DO (1) NEXT
      DO :1 <- "'¬":1~'#65535¢#0'"¢#65535'
            ~'#0¢#65535'"¢"'¬":1~'#0¢#65535'"
            ¢#65535'~'#0¢#65535'"
      DO :2 <- #1
      PLEASE DO (4) NEXT
(4)   DO FORGET #1
      DO .1 <- "¬':1~:2'¢#1"~#3
      DO :1 <- "'¬":1~'#65535¢#0'"¢":2~'#65535
            ¢#0'"'~'#0¢#65535'"¢"'¬":1~'#0
            ¢#65535'"¢":2~'#0¢#65535'"'~'#0¢#65535'"
      DO (1) NEXT
      DO :2 <- ":2~'#0¢#65535'"
            ¢"'":2~'#65535¢#0'"¢#0'~'#32767¢#1'"
      DO (4) NEXT
(2)   DO RESUME .1
(1)   PLEASE DO (2) NEXT
      PLEASE FORGET #1
      DO READ OUT :1
      PLEASE DO .1 <- '¬"':1~:1'~#1"¢#1'~#3
      DO (3) NEXT
      PLEASE DO (5) NEXT
(3)   DO (2) NEXT
      PLEASE GIVE UP
```

2.2 Uses for INTERCAL

INTERCAL's main advantage over other programming languages is its strict simplicity. It has few capabilities, and thus there are few restrictions to be kept in mind. Since it is an exceedingly easy language to learn, one might expect it would be a good language for initiating novice programmers. Perhaps surprising, then, is the fact that it would be more likely to initiate a novice into a search for another line of work. As it turns out, INTERCAL is more useful (which isn't saying much) as a challenge to professional programmers. Those who doubt this need only refer back to the sample program in section . This 23-statement program took somewhere from 15 to 30 minutes to write, whereas the same objectives can be achieved by single-statement programs in either SNOBOL;

```
PLEASE INPUT POS(0) ('-' ! '')
+ (SPAN('0123456789') $ OUTPUT)
+ *NE(OUTPUT) :S(PLEASE)F(END)
```

or APL;

```
[1] →0≠□←⍞□
```

Admittedly, neither of these is likely to appear more intelligible to anyone unfamiliar with the languages involved, but they took roughly 60 seconds and 15 seconds, respectively, to write. Such is the overwhelming power of INTERCAL!

The other major importance of INTERCAL lies in its seemingly inexhaustible capacity for amazing one's fellow programmers, confounding programming shop managers, winning friends, and influencing people. It is a well-known and oft-demonstrated fact that a person whose work is incomprehensible is held in high esteem. For example, if one were to state that the simplest way to store a value of 65536 in a 32-bit INTERCAL variable is:

```
DO :1 <- #0¢#256
```

any sensible programmer would say that that was absurd. Since this is indeed the simplest method, the programmer would be made to look foolish in front of his boss, who would of course happened to turn up, as bosses are wont to do. The effect would be no less devastating for the programmer having been correct.

3. DESCRIPTION

The examples of INTERCAL programming which have appeared in the preceding sections of this manual have probably seemed highly esoteric to the reader unfamiliar with the language. With the aim of making them more so, we present here a description of INTERCAL.

3.1 Variables

INTERCAL allows only 2 different types of variables, the **16-bit integer** and the **32-bit integer.** These are represented by a spot (.) or two-spot (:), respectively, followed by any number between 1 and 65535, inclusive. These variables may contain only non-negative numbers; thus they have the respective ranges of values: 0 to 65535 and 0 to 4294967295. Note: .123 and :123 are two distinct variables. On the other hand, .1 and .0001 are identical. Furthermore, the latter may *not* be written as 1E-3.

3.2 Constants

Constants are 16-bit values only and may range from 0 to 65535. They are prefixed by a mesh (#). Caution! Under no circumstances confuse the mesh with the interleave operator, except under confusing circumstances!

3.3 Arrays

Arrays are represented by a tail (,) for 16-bit values, or a hybrid (;) for 32-bit values, followed by a number between 1 and 65535, inclusive. The number is suffixed by the word SUB, followed by the subscripts, separated optionally by spaces. Subscripts may be any expressions, including those involving subscripted variables. This occasionally leads to ambiguous constructions, which are resolved as discussed in section . Definition of array dimensions will be discussed later in greater detail, since discussing it in less detail would be difficult. As before, ,123 and ;123 are distinct. In summary, .123, :123, #123, ,123, and ;123 are all distinct.

3.4 Operators

INTERCAL recognizes 5 operators -- 2 binary and 3 unary [1]. Please be kind to our operators: they may not be very intelligent, but they're all we've got. In a sense, all 5 operators are binary, as they are all bit-oriented, but it is not our purpose here to quibble about bits of trivia.

3.4.1 Binary Operators

The binary operators are **interleave** (also called **mingle**) and **select**, which are represented by a change (¢) and a sqiggle [sic] (~), respectively.

The interleave operator takes two 16-bit values and produces a 32-bit result by alternating the bits of the operands. Thus, #65535¢#0 has the 32-bit binary form 101010....10 or 2863311530 decimal, while #0¢#65535 = 0101....01 binary = 1431655765 decimal, and #255¢#255 is equivalent to #65535.

The select operator takes from the first operand whichever bits correspond to 1's in the second operand, and packs these bits to the right in the result. Both operands are automatically padded on the left with zeros to 32 bits before the selection takes place, so the variable types are unrestricted. If more than 16 bits are selected, the result is a 32-bit value, otherwise it is a 16-bit value. For example, #179~#201 (binary value 10110011~11001001) selects from the first argument the 8th, 7th, 4th, and 1st from last bits, namely, 1001, which = 9. But #201~#179 selects from binary 11001001 the 8th, 6th, 5th, 2nd, and 1st from last bits, giving 10001 = 17. #179~#179 has the value 31, while #201~#201 has the value 15.

Perhaps a simpler way of understanding the operation of the select operator would be to examine the logic diagram in Figure 1, which performs the select operation upon two 8-bit values, A and B. The gates used are Warmenhovian logic gates, which means the outputs have four possible values: low, high, undefined (value of an uninitialized flip-flop), and oscillating (output of a NOR gate with one input low and the other input connected to the output). These values are represented symbolically by '0', '1', '?', and '∅'. Note in particular that, while NOT-0 is 1 and NOT-1 is 0 as in two-valued logic, NOT-? is ? and NOT-∅ is ∅. The functions of the various gates are listed in Table 1.

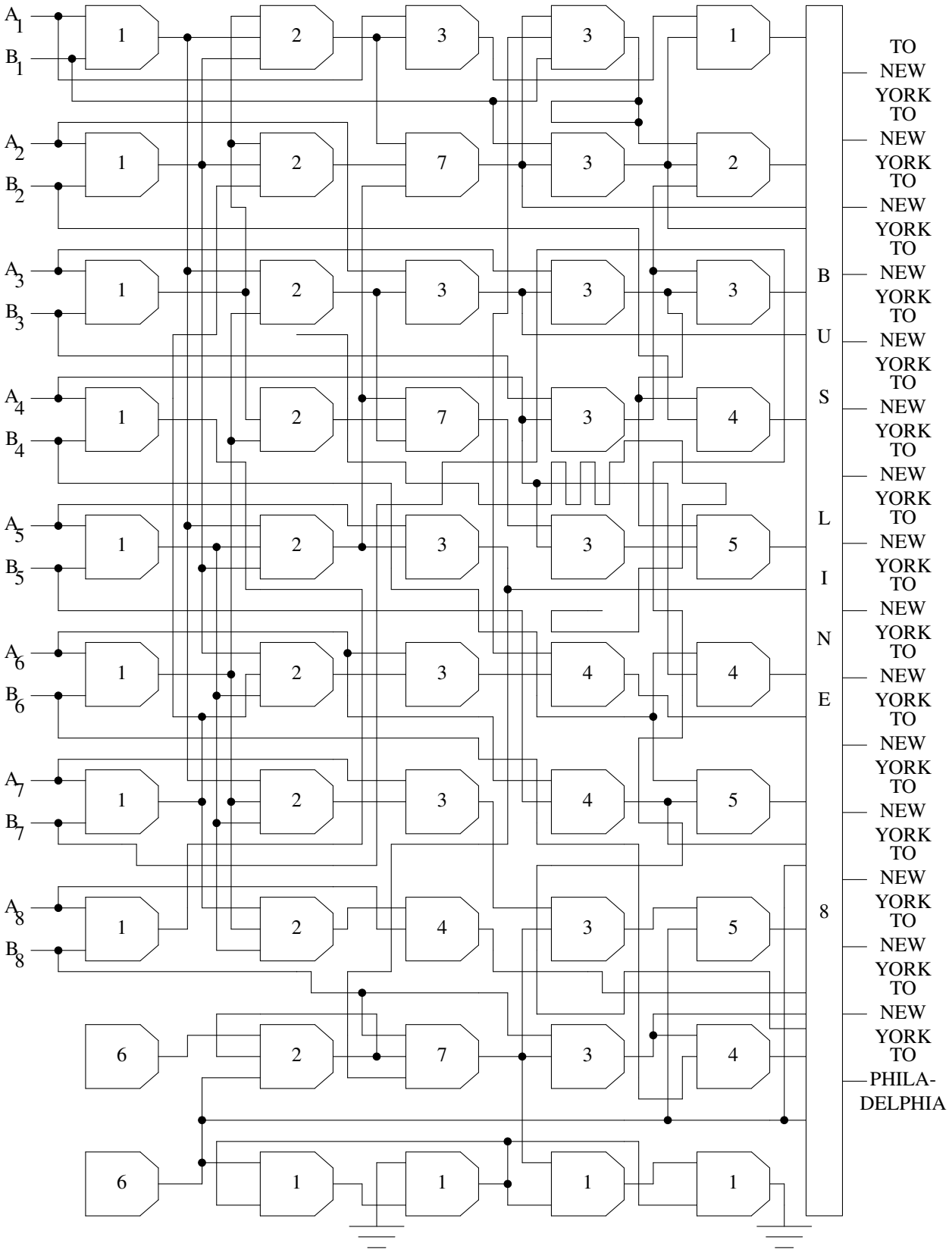


FIGURE 1. CIRCUITOUS DIAGRAM

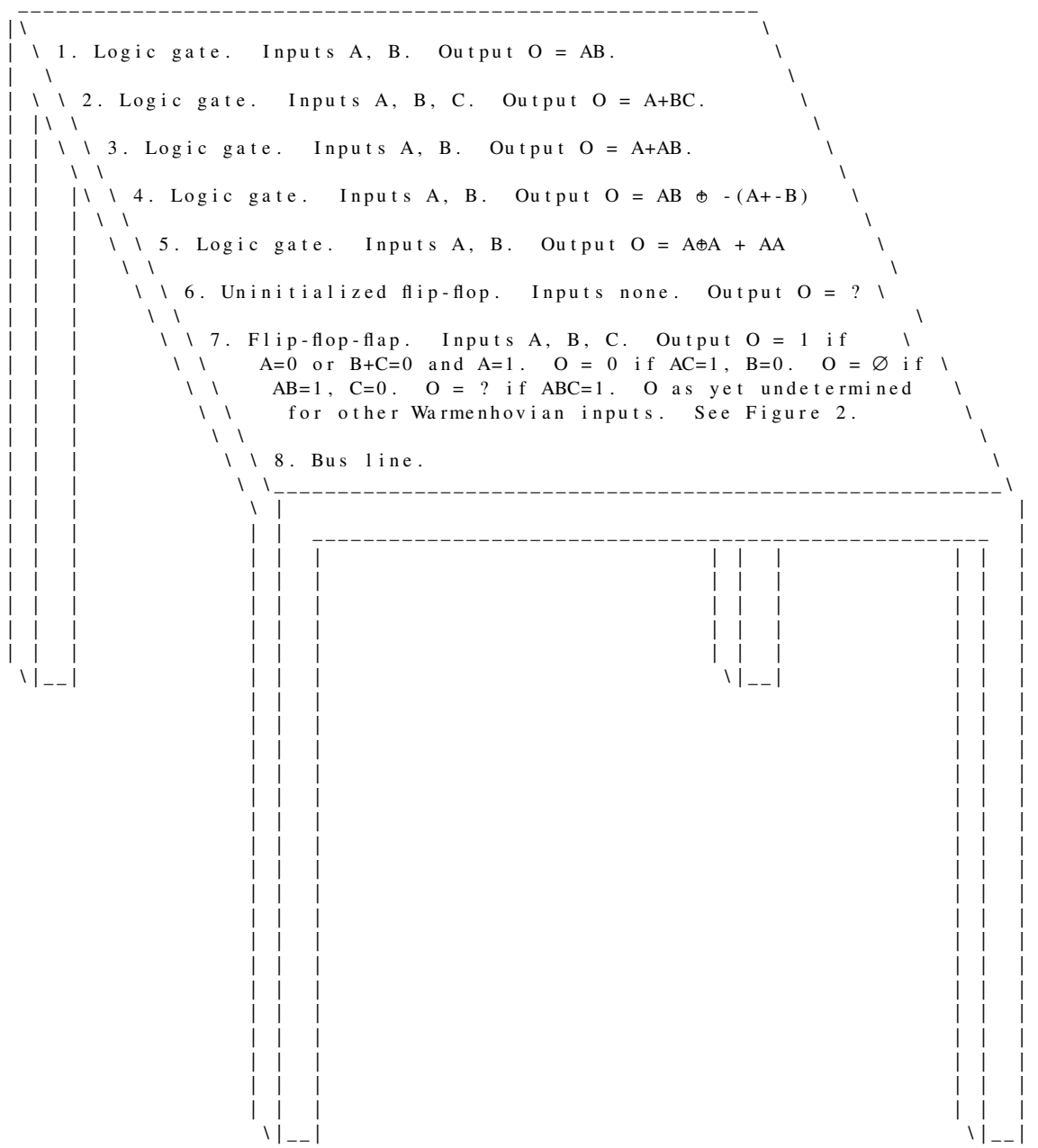


Table 1. Logical (and other) functions.

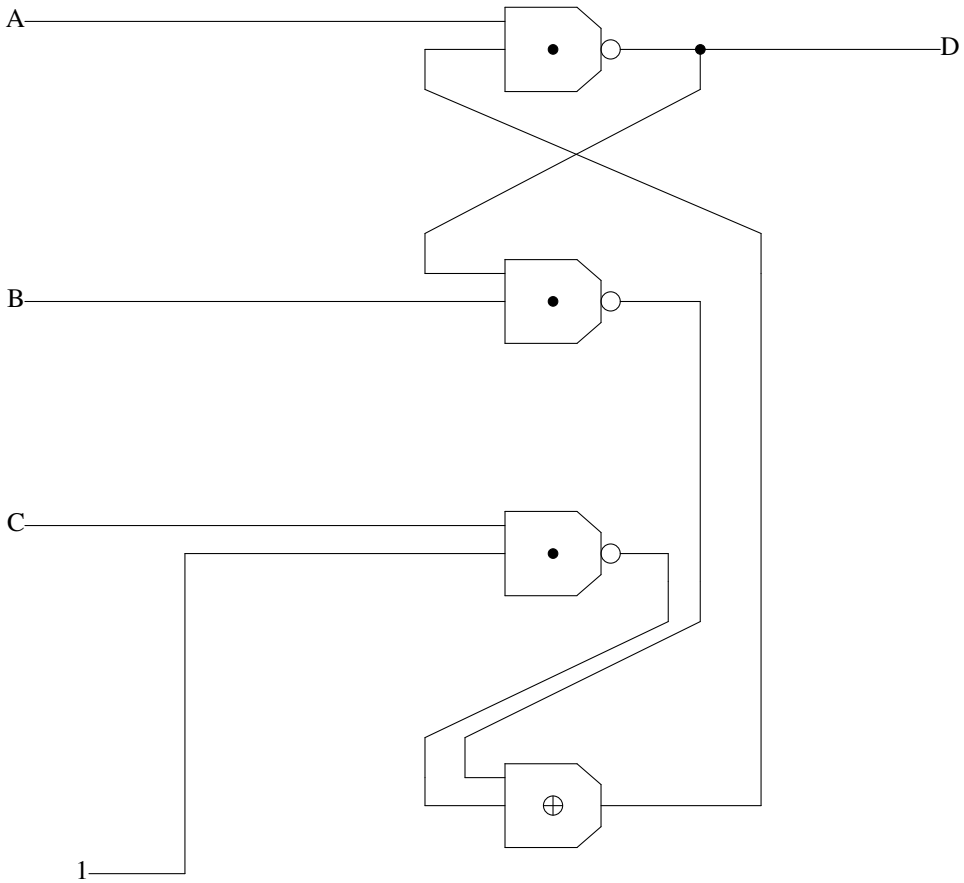
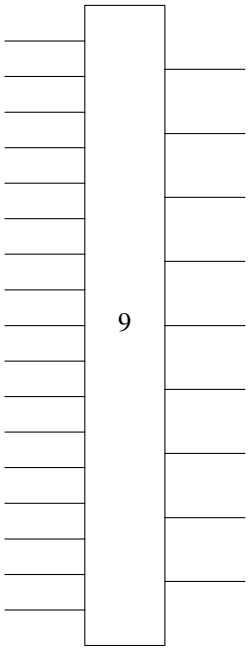


FIGURE 2. FLIP FLAP FLOP



GATE TYPE 9. BLACK BOX
INPUTS A1-8, B1-8.
OUTPUT O1-8 = A1-8~B1-8

FIGURE 1 (CONTINUED). NEW YORK

3.4.2 Unary Operators

The unary operators are & (logical **AND**), V (logical **OR**), and ∀ (logical **XOR**). This last character is obtained by overpunching a worm (–) on a V (V). The operator is inserted between the spot, two-spot, mesh, or what-have-you, and the integer, thus: .&123, #∀123. Multiple unary operators may not be concatenated, thus the form #∀&123 is invalid. This will be covered later when precedence is discussed. These operators perform their respective logical operations on all pairs of adjacent bits, the result from the first and last bits going into the first bit of the result. The effect is that of rotating the operand one place to the right and ANDing, ORing, or XORing with its initial value. Thus, #&77 (binary = 1001101) is binary 0000000000000100 = 4, #V77 is binary 1000000001101111 = 32879, and #∀77 is binary 1000000001101011 = 32875.

3.4.3 Precedence

Precedence of operators is as follows:

(The remainder of this page intentionally left blank)[2]

2. Keep in mind that the aim in designing INTERCAL was to have no precedents.

This precedence (or lack thereof) may be overruled by grouping expressions between pairs of sparks (') or rabbit-ears ("). Thus '#165¢#203'˜#358 (binary value '10100101¢11001011'˜101100110) has the value 15, but #165¢'#203˜#358' has the value 34915, and #165¢#203˜#358 is invalid syntax and is completely valueless (except perhaps as an educational tool to the programmer). A unary operator is applied to a sparked or rabbit-eared expression by inserting the operator immediately following the opening spark or ears. Thus, the invalid expression #∀&123, which was described earlier, could be coded as '∀#&123' or '∀"&#123"'. Note: In the interests of simplifying the sometimes overly-complex form of expressions, INTERCAL allows a spark-spot combination ('.) to be replaced with a wow (!). Thus '.1˜.2' is equivalent to !1˜.2', and 'V.1¢.2' is equivalent to "V!1¢.2'".

Combining a rabbit-ears with a spot to form a rabbit ('.') is not permitted, although the programmer is free to use it should he find an EBCDIC reader which will properly translate a 12-3-7-8 punch.

Sparks and/or rabbit-ears must also be used to distinguish among such otherwise ambiguous subscripted and multiply-subscripted expressions as:

```
,1 SUB #1 ˜ #2
,1 SUB ,2 SUB #1 #2 #3
,1 SUB " ,2 SUB " ,3 SUB #1 " #2 " " #3 "
```

The third case may be isolated into either of its possible interpretations by simply changing some pairs of rabbit-ears to sparks, instead of adding more ears (which would only confuse the issue further). Ambiguous cases are defined as those for which the compiler being used finds a legitimate interpretation which is different from that which the user had in mind. See also section .

4. STATEMENTS

In this section is described the format of INTERCAL statements.

4.1 General Format

Statements may be entered in 'free format'. That is, more than one statement may occur on a single card, and a statement may begin on one card and end on a later one. Note that if this is done, all intervening cards and portions thereof must be part of the same statement. That this restriction is necessary is immediately apparent from the following example of what might occur if statements could be interlaced.

```
DO .1 <- ".1¢'&:51~"#∀1c!12~;&75SUB"∀'V.1~
DO .2 <- '"!1¢"&';∀79SUB",&7SUB:173"'~!∀9¢
.2'¢,&1SUB:5~#33578"'"'"~'#65535¢"∀'V#&85'"'
#8196'"'~.1"¢.2'~'#&5¢"'#1279¢#4351'~#65535"'
```

The above statements are obviously meaningless. (For that matter, so are the statements

```
DO .1 <- ".1¢"&:51~"#∀1¢!12~;&75SUB"∀'V.1~
.2'¢,&1SUB:5~#333578"'"'"~#65535¢"∀'V#&85'"'
DO .2 <- '"!1¢"&';∀79SUB",&7SUB:173"'~!∀9¢
#8196'"'~.1"¢.2'~'#&5¢"'#1279¢#4351'~#65535"'
```

but this is not of interest here.)

Spaces may be used freely to enhance program legibility (or at least reduce program illegibility), with the restriction that no word of a statement identifier (see section) may contain any spaces.

4.2 Labels

A statement may begin with a **logical line label** enclosed in wax-wane pairs (()). A statement may not have more than one label, although it is possible to omit the label entirely. A line label is any integer from 1 to 65535, which must be unique within each program. The user is cautioned, however, that many line labels between 1000 and 1999 are used in the INTERCAL System Library functions.

4.3 Identifiers and Qualifiers

After the line label (if any), must follow one of the following statement identifiers: DO, PLEASE, or PLEASE DO. These may be used interchangeably to improve the aesthetics of the program. The identifier is then followed by either, neither, or both of the following optional parameters (qualifiers): (1) either of the character strings NOT or N'T, which causes the statement to be automatically abstained from (see section) when execution begins, and (2) a number between 0 and 100, preceded by a double-oh-seven (%), which causes the statement to have only the specified percent chance of being executed each time it is encountered in the course of execution.

4.4 Statements

Following the qualifiers (or, if none are used, the identifier) must occur one of the 13 valid operations. (Exception: see section .) These are described individually in sections
through .

4.4.1 Calculate

The INTERCAL equivalent of the half-mesh (=) in FORTRAN, BASIC, PL/I, and others, is represented by an angle (<) followed by a worm (-). This combination is read 'gets'. 32-bit variables may be assigned 16-bit values, which are padded on the left with 16 zero bits. 16-bit variables may be assigned 32-bit values only if the value is less than 65535. Thus, to invert the least significant bit of the first element of 16-bit 2-dimensional array number 1, one could write:

```
,1SUB#1#1 <- '∀",1SUB#1#1"¢#1'~'#0¢#65535'
```

Similarly to SNOBOL and SPITBOL, INTERCAL uses the angle-worm to define the dimensions of arrays. An example will probably best describe the format. To define 32-bit array number 7 as 3-dimensional, the

first dimension being seven, the second being the current value of 16-bit variable number seven, and the third being the current value of the seventh element of 16-bit array number seven (which is one-dimensional) mingled with the last three bits of 32-bit variable number seven, one would write (just before they came to take him away):

;7 <- #7 BY .7 BY ",7SUB#7"¢':7˜#7'

This is, of course, different from the statement:

;7 <- #7 BY .7 BY ,7SUB"#7¢':7˜#7'"

INTERCAL also permits the redefining of array dimensioning, which is done the same way as is the initial dimensioning. All values of items in an array are lost upon redimensioning, unless they have been STASHed (see section), in which case restoring them also restores the old dimensions.

4.4.2 NEXT

The NEXT statement is used both for subroutine calls and for unconditional transfers. This statement takes the form:

DO (label) NEXT

(or, of course,

PLEASE DO (label) NEXT

etc.), where (label) represents any logical line label which appears in the program. The effect of such a statement is to transfer control to the statement specified, and to store in a push down list (which is initially empty) the location from which the transfer takes place. Items may be removed from this list and may be discarded or used to return to the statement immediately following the NEXT statement. These operations are described in sections
and
respectively. The programmer is generally advised to discard any stack entries which he does not intend to utilize, since the stack has a maximum depth of 79 entries. A program's attempting to initiate an 80th level of NEXTing will result in the fatal error message, "PROGRAM HAS DISAPPEARED INTO THE BLACK LAGOON."

4.4.3 FORGET

The statement PLEASE FORGET exp, where exp represents any expression (except colloquial and facial expressions), causes the expression to be evaluated, and the specified number of entries to be removed from the NEXTing stack and discarded. An attempt to FORGET more levels of NEXTing than are currently stacked will cause the stack to be emptied, and no error condition is indicated. This is because the condition is not considered to be an error. As described in section , it is good programming practice to execute a DO FORGET #1 after using a NEXT statement as an unconditional transfer, so that the stack does not get cluttered up with unused entries:

```
            DO  (123)  NEXT
            .
            .
(123)  DO  FORGET  #1
```

4.4.4 RESUME

The statement PLEASE RESUME exp has the same effect as FORGET, except that program control is returned to the statement immediately following the NEXT statement which stored in the stack the last entry to be removed. Note that a rough equivalent of the FORTRAN computed GO TO and BASIC ON exp GO TO is performed by a sequence of the form:

```
      DO (1) NEXT
      .
      .
(1)   DO (2) NEXT
      PLEASE FORGET #1
      .
      .
(2)   DO RESUME .1
```

Unlike the FORGET statement, an attempt to RESUME more levels of NEXTing than has been stacked will cause program termination. See also section .

4.4.5 STASH

Since subroutines are not explicitly implemented in INTERCAL, the NEXT and RESUME statements must be used to execute common routines. However, as these routines might use the same variables as the main program, it is necessary for them to save the values of any variables whose values they alter, and later restore them. This process is simplified by the STASH statement, which has the form DO STASH list, where list represents a string of one or more variable or array names, separated by intersections (+). Thus

PLEASE STASH .123+:123+,123

stashes the values of two variables and one entire array. The values are left intact, and copies thereof are saved for later retrieval by (what else?) the RETRIEVE statement (see section). It is not possible to STASH single array items.

4.4.6 RETRIEVE

PLEASE RETRIEVE list restores the previously STASHed values of the variables and arrays named in the list. If a value has been stashed more than once, the most recently STASHed values are RETRIEVEd, and a second RETRIEVE will restore the second most recent values STASHed. Attempting to RETRIEVE a value which has not been STASHed will result in the error message, "THROW STICK BEFORE RETRIEVING."

4.4.7 IGNORE

The statement DO IGNORE list causes all subsequent statements to have no effect upon variables and/or arrays named in the list. Thus, for example, after the sequence

```
DO .1 <- #1
PLEASE IGNORE .1
DO .1 <- #0
```

16-bit variable number 1 would have the value 1, not 0. Inputting (see section) into an IGNOREd variable also has no effect. The condition is annulled via the REMEMBER statement (see section). Note that, when a variable is being IGNOREd, its value, though immutable, is still available for use in expressions and the like.

4.4.8 REMEMBER

PLEASE REMEMBER list terminates the effect of the IGNORE statement for all variables and/or arrays named in the list. It does not matter if a variable has been IGNOREd more than once, nor is it an error if the variable has not been IGNOREd at all.

4.4.9 ABSTAIN

INTERCAL contains no simple equivalent to an IF statement or computed GO TO, making it difficult to combine similar sections of code into a single routine which occasionally skips around certain statements. The IGNORE statement (see section) is helpful in some cases, but a more viable method is often required. In keeping with the goal of INTERCAL having nothing in common with any other language, this is made possible via the ABSTAIN statement.

This statement takes on one of two forms. It may not take on both at any one time. DO ABSTAIN FROM (label) causes the statement whose logical line label is (label) to be abstained from. PLEASE ABSTAIN FROM gerund list causes all statements of the specified type(s) to be abstained from, as in

PLEASE ABSTAIN FROM STASHING
PLEASE ABSTAIN FROM IGNORING + FORGETTING
PLEASE ABSTAIN FROM NEXTING
or PLEASE ABSTAIN FROM CALCULATING

Statements may also be automatically abstained from at the start of execution via the NOT or N'T parameter (see section).

If, in the course of execution, a statement is encountered which is being abstained from, it is ignored and control passes to the next statement in the program (unless it, too, is being abstained from).

The statement DO ABSTAIN FROM ABSTAINING is perfectly valid, as is DO ABSTAIN FROM REINSTATING (although this latter is not usually recommended). However, the statement DO ABSTAIN FROM GIVING UP is not accepted, even though DON'T GIVE UP is.

4.4.10 REINSTATE

The REINSTATE statement, like the ABSTAIN, takes as an argument either a line label or a gerund list. No other form of argument is permitted. For example, the following is an invalid argument:

Given: x≠0, y≠0, Prove: x+y=0
Since x≠0, then x+1≠1, x+a≠a, x+y≠y.
But what is y? y is anything but 0.
Thus x+y ≠ anything but 0.
Since x+y cannot equal anything but 0, x+y=0.
Q.E.D.

REINSTATEment nullifies the effects of an abstention. Either form of REINSTATEment can be used to "free" a statement, regardless of whether the statement was abstained from by gerund list, line label, or NOT. Thus, PLEASE REINSTATE REINSTATING is not necessarily an irrelevant statement, since it might free a DON'T REINSTATE command or a REINSTATE the line label of which was abstained from. However, DO REINSTATE GIVING UP is invalid, and attempting to REINSTATE a GIVE UP statement by line label will have no effect. Note that this insures that DON'T GIVE UP will always be a "do-nothing" statement.

4.4.11 GIVE UP

PLEASE GIVE UP is used to exit from a program. It has the effect of a PLEASE RESUME #80. DON'T GIVE UP, as noted in section , is effectively a null statement.

4.4.12 Input

Input is accomplished with the statement DO WRITE IN list, where list represents a string of variables and/or elements of arrays, separated by intersections. Numbers are represented on cards, each number on a separate card, by spelling out each digit (in English) and separating the digits with one or more spaces. A zero (0) may be spelled as either ZERO or OH. Thus the range of (32-bit) input values permissible extends from ZERO (or OH) through FOUR TWO NINE FOUR NINE SIX SEVEN TWO NINE FIVE.

Attempting to write in a value greater than or equal to SIX FIVE FIVE THREE SIX for a 16-bit variable will result in the error message, "DON'T BYTE OFF MORE THAN YOU CAN CHEW."

4.4.13 Output

Values may be output to the printer, one value per line, via the statement DO READ OUT list, where the list contains variables, array elements, and/or constants. Output is in the form of "extended" Roman numerals (also called "butchered" Roman numerals), with an overline ($\bar{}$) indicating the value below is "times 1000", and lower-case letters indicating "times 1000000". Zero is indicated by an overline with no character underneath. Thus, the range of (32-bit) output values possible is from $\bar{}$ through

$\overline{\text{i}}$vccxciv$\overline{\text{C}}\overline{\text{M}}\overline{\text{L}}\overline{\text{X}}\overline{\text{V}}\overline{\text{I}}\overline{\text{I}}$CCXCV. Note: For values whose residues modulo 1000000 are less than 4000, M is used to represent 1000; for values whose residues are 4000 or greater, $\overline{\text{I}}$ is used. Thus #3999 would read out as MMMCMXCIX [3] while #4000 would readout as $\overline{\text{I}}\overline{\text{V}}$. Similar rules apply to the use of $\overline{\text{M}}$ and i for 1000000, and to that of m and $\overline{\text{i}}$ for 1000000000.

4.5 Comments

Unrecognizable statements, as noted in section , are flagged with a splat (*) during compilation, and are not considered fatal errors unless they are encountered during execution, at which time the statement (as input at compilation time) is printed and execution is terminated. This allows for an interesting (and, by necessity, unique) means of including comments in an INTERCAL listing. For example, the statement:

```
*     PLEASE NOTE THAT THIS LINE HAS NO EFFECT
```

will be ignored during execution due to the inclusion of the NOT qualifier. User-supplied error messages are also easy to implement:

```
*     DO SOMETHING ABOUT OVERFLOW IN ;3
```

as are certain simple conditional errors:

```
* (123) DON'T YOU REALIZE THIS STATEMENT SHOULD ONLY BE ENCOUNTERED
                ONCE?
        PLEASE REINSTATE (123)
```

This pair of statements will cause an error exit the second time they are encountered. Caution!! The appearance of a statement identifier in an intended comment will be taken as the beginning of a new statement. Thus, the first comment example above could not have been:

```
*     PLEASE NOTE THAT THIS LINE DOES NOTHING
```

The third example, however, is valid, despite the appearance of two cases of D-space-O, since INTERCAL does not ignore extraneous spaces in statement identifiers.

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3. The original INTERCAL-72 manual claimed that #3999 should render as MMMIM, but the C-INTERCAL developers have been unable to find an algorithm that does this and is consistent with the rest of the rules.

5. SUBROUTINE LIBRARY

INTERCAL provides several built-in subroutines to which control can be transferred to perform various operations. These operations include many useful functions which are not easily representable in INTERCAL, such as addition, subtraction, etc.

5.1 Usage

In general, the operands are .1, .2, etc., or :1, :2, etc., and the result(s) are stored in what would have been the next operand(s). For instance, one routine adds .1 to .2 and stores the sum in .3, with .4 being used to indicate overflow. All variables not used for results are left unchanged.

5.2 Available Functions

At the time of this writing, only the most fundamental operations are offered in the library, as a more complete selection would require prohibitive time and core to implement. These functions, along with their corresponding entry points (entered via DO (entry) NEXT) are listed below.

```
(1000) .3 <- .1 plus .2, error exit on overflow
(1009) .3 <- .1 plus .2
       .4 <- #1 if no overflow, else .4 <- #2
(1010) .3 <- .1 minus .2, no action on overflow
(1020) .1 <- .1 plus #1, no action on overflow
(1030) .3 <- .1 times .2, error exit on overflow
(1039) .3 <- .1 times .2
       .4 <- #1 if no overflow, else .4 <- #2
(1040) .3 <- .1 divided by .2
       .3 <- #0 if .2 is #0
(1050) .2 <- :1 divided by .1, error exit on overflow
       .2 <- #0 if .1 is #0

(1500) :3 <- :1 plus :2, error exit on overflow
(1509) :3 <- :1 plus :2
       :4 <- #1 if no overflow, else :4 <- #2
(1510) :3 <- :1 minus :2, no action on overflow
(1520) :1 <- .1 concatenated with .2
(1525) This subroutine is intended solely for internal
       use within the subroutine library and is therefore
       not described here. Its effect is to shift .3
       logically 8 bits to the left.
(1530) :1 <- .1 times .2
(1540) :3 <- :1 times :2, error exit on overflow
(1549) :3 <- :1 times :2
       :4 <- #1 if no overflow, else :4 <- #2
(1550) :3 <- :1 divided by :2
       :3 <- #0 if :2 is #0

(1900) .1 <- uniform random no. from #0 to #65535
(1910) .2 <- normal random no. from #0 to .1, with
             standard deviation .1 divided by #12
```

6. PROGRAMMING HINTS

For the user looking to become more familiar with the INTERCAL language, we present in this section an analysis of a complex program, as well as some suggested projects for the ambitious programmer.

Considering the effort involved in writing an INTERCAL program, it was decided in putting together this manual to use an already existing program for instructive analysis. Since there was only one such program available, we have proceeded to use it. It is known as the "INTERCAL System Library."

6.1 Description

The program listing is in section . It is in the same format as would be produced by the Princeton INTERCAL compiler in FORMAT mode with WIDTH=62 (see section). For a description of the functions performed by the Library, see section .

6.2 Analysis

We shall not attempt to discuss here the algorithms used, but rather we shall point out some of the general techniques applicable to a wide range of problems.

Statements 10, 14, 15, and 26 make up a virtual "computed GO TO". When statement 10 is executed, control passes eventually to statement 16 or 11, depending on whether .5 contains #1 or #2, respectively. The value of .5 is determined in statement 9, which demonstrates another handy technique. To turn an expression, exp, with value #0 or #1, into #1 or #2 (for use in a "GO TO"), use "∀'exp'¢#1"˜#3. To reverse the condition (i.e., convert #0 to #2 and leave #1 alone) use "∀'exp'¢#2"˜#3.

Certain conditions are easily checked. For example, to test for zero, select the value from itself and select the bottom bit (see statement 54). To test for all bits being 1's, select the value from itself and select the top bit. The test for greater than, performed in statements 219 and 220 on 32-bit values, employs binary logical operations, which are performed as follows:

'∀.1¢.2'˜'#0¢#65535'

for 16-bit values or, for 32-bit values:

```
"'∀":1˜'#65535¢30'"¢":2˜'#65535¢#0'"'˜'#0
¢#65535'"¢"'∀":1˜'#0¢#65535'"¢":2˜'#0
¢#65535'"'˜'#0¢#65535'"
```

(The proofs are left as an exercise to the reader.)

Testing for greater-than with 16-bit values is somewhat simpler and is done with the pair of statements:

```
DO .C <- '∀.A¢.B'˜'#0¢#65535'
DO .C <- '&"'.A˜.C'˜'"∀'∀.C˜.C'¢#32768"
      ˜"#0¢#65535"'"¢".C˜.C"'˜#1
```

This sets .C (a dummy variable) to #1 if .A > .B, and #0 otherwise. The expression may be expanded as described above to instead set .C to #1 or #2.

Note also in statement 220 the occurrence of ˜"#65535¢#65535". Although these operations select the entire value, they are not extraneous, as they ensure that the forthcoming ∀s will be operating on 32-bit values.

In several virtual computed GO TOs the DO FORGET #1 (statement 15 in the earlier example) has been omitted, since the next transfer of control would be a DO RESUME #1. By making this a DO RESUME #2 instead, the FORGET may be forgotten.

In statement 64, note that .2 is STASHed twice by a single statement. This is perfectly legal.

Lastly, note in statements 243 and 214 respectively, expressions for shifting 16- and 32-bit variables logically one place to the left. Statement 231 demonstrates right-shifting for 32-bit variables.

6.3 Program Listing

```
      1           (1000)  PLEASE IGNORE .4
      2                   PLEASE ABSTAIN FROM (1005)
      3           (1009)  DO STASH .1 + .2 + .5 + .6
      4                   DO .4 <- #1
      5                   DO (1004) NEXT
      6           (1004)  PLEASE FORGET #1
      7                   DO .3 <- '∀.1¢.2'~'#0¢#65535'
      8                   DO .6 <- '&.1¢.2'~'#0¢#65535'
      9                   PLEASE DO .5 <- "∀!6~#32768'¢#1"~#3
     10                   DO (1002) NEXT
     11                   DO .4 <- #2
     12           (1005)  DO (1006) NEXT
*    13           (1999)  DOUBLE OR SINGLE PRECISION OVERFLOW
     14           (1002)  DO (1001) NEXT
     15           (1006)  PLEASE FORGET #1
     16                   DO .5 <- '∀"!6~.6'~#1"¢#1'~#3
     17                   DO (1003) NEXT
     18                   DO .1 <- .3
     19                   DO .2 <- !6¢#0'~'#32767¢#1'
     20                   DO (1004) NEXT
     21           (1003)  DO (1001) NEXT
     22                   DO REINSTATE (1005)
     23           (1007)  PLEASE RETRIEVE .1 + .2 + .5 + .6
     24                   DO REMEMBER .4
     25                   PLEASE RESUME #2
     26           (1001)  DO RESUME .5
     27           (1010)  DO STASH .1 + .2 + .4
     28                   DO .4 <- .1
     29                   DO .1 <- '∀.2¢#65535'~'#0¢#65535'
     30                   DO (1020) NEXT
     31                   PLEASE DO .2 <- .4
     32                   PLEASE DO (1009) NEXT
     33                   DO RETRIEVE .1 + .2 + .4
     34                   PLEASE RESUME #1
     35           (1020)  DO STASH .2 + .3
     36                   DO .2 <- #1
     37                   PLEASE DO (1021) NEXT
     38           (1021)  DO FORGET #1
     39                   DO .3 <- "∀!1~.2'¢#1"~#3
     40                   PLEASE DO .1 <- '∀.1¢.2'~'#0¢#65535'
     41                   DO (1022) NEXT
     42                   DO .2 <- !2¢#0'~'#32767¢#1'
     43                   DO (1021) NEXT
     44           (1023)  PLEASE RESUME .3
     45           (1022)  DO (1023) NEXT
     46                   PLEASE RETRIEVE .2 + .3
     47                   PLEASE RESUME #2
     48           (1030)  DO ABSTAIN FROM (1033)
     49                   PLEASE ABSTAIN FROM (1032)
     50           (1039)  DO STASH :1 + .5
     51                   DO (1530) NEXT
     52                   DO .3 <- :1~#65535
     53                   PLEASE DO .5 <- :1~'#65280¢#65280'
     54                   DO .5 <- '∀"!5~.5'~#1"¢#1'~#3
```

```
55                DO (1031) NEXT
56           (1032) DO (1033) NEXT
57                DO (1999) NEXT
58           (1031) DO (1001) NEXT
59           (1033) DO .4 <- .5
60                DO REINSTATE (1032)
61                PLEASE REINSTATE (1033)
62                DO RETRIEVE :1 + .5
63                PLEASE RESUME #2
64           (1040) PLEASE STASH .1 + .2 + .2 + :1 + :2 + :3
65                DO .2 <- #0
66                DO (1520) NEXT
67                DO STASH :1
68                PLEASE RETRIEVE .2
69                DO .1 <- .2
70                DO .2 <- #0
71                PLEASE DO (1520) NEXT
72                DO :2 <- :1
73                DO RETRIEVE .1 + .2 + :1
74                DO (1550) NEXT
75                PLEASE DO .3 <- :3
76                DO RETRIEVE :1 + :2 + :3
77                DO RESUME #1
78           (1050) PLEASE STASH :2 + :3 + .5
79                DO :2 <- .1
80                PLEASE DO (1550) NEXT
81                DO .5 <- :3~'#65280¢#65280'
82                DO .5 <- '∀"!5~.5'~#1"¢#1'~#3
83                DO (1051) NEXT
84                DO (1999) NEXT
85           (1051) DO (1001) NEXT
86                DO .2 <- :3
87                PLEASE RETRIEVE :2 + :3 + .5
88                DO RESUME #2
89           (1500) PLEASE ABSTAIN FROM (1502)
90                PLEASE ABSTAIN FROM (1506)
91           (1509) PLEASE STASH :1 + .1 + .2 + .3 + .4 + .5 + .6
92                DO .1 <- :1~#65535
93                PLEASE DO .2 <- :2~#65535
94                DO (1009) NEXT
95                DO .5 <- .3
96                PLEASE DO .6 <- .4
97                DO .1 <- :1~'#65280¢#65280'
98                DO .2 <- :2~'#65280¢#65280'
99                DO (1009) NEXT
100               DO .1 <- .3
101               PLEASE DO (1503) NEXT
102               DO .6 <- .4
103               DO .2 <- #1
104               DO (1009) NEXT
105               DO .1 <- .3
106               DO (1501) NEXT
107          (1504) PLEASE RESUME .6
108          (1503) DO (1504) NEXT
```

```
109           (1501)  DO .2 <- .5
110                   DO .5 <- '∀"'&.6¢.4'~#1"¢#2'~#3
111                   DO (1505) NEXT
112           (1506)  DO (1502) NEXT
113                   PLEASE DO (1999) NEXT
114           (1505)  DO (1001) NEXT
115           (1502)  DO :4 <- .5
116                   DO (1520) NEXT
117                   DO :3 <- :1
118                   PLEASE RETRIEVE :1 + .1 + .2 + .3 + .4 + .5 + .6
119                   DO REINSTATE (1502)
120                   DO REINSTATE (1506)
121                   PLEASE RESUME #3
122           (1510)  DO STASH :1 + :2 + :4
123                   DO :1 <- "'∀":2~'#65535¢#0'"¢#65535'
                          ~'#0¢#65535'"¢"'∀":2~'#0¢#65535'
                          "¢#65535'~'#0¢#65535'"
124                   DO :2 <- #1
125                   DO (1509) NEXT
126                   PLEASE RETRIEVE :1
127                   DO :2 <- :3
128                   PLEASE DO (1509) NEXT
129                   DO RETRIEVE :2 + :4
130                   PLEASE RESUME #1
131           (1520)  PLEASE STASH .3 + .4
132                   DO .3 <- .1~#43690
133                   DO (1525) NEXT
134                   PLEASE DO .4 <- 'V.3¢".2~#43690"'~'#0¢#65535'
135                   DO .3 <- .1~#21845
136                   PLEASE DO (1525) NEXT
137                   DO :1 <- .4¢"'V.3¢".2~#21845"'~'#0¢#65535'"
138                   PLEASE RETRIEVE .3 + .4
139                   DO RESUME #1
140           (1525)  DO .3 <- '"'"'"!3¢#0'~'#32767¢#1'"¢#0'
                          ~'#32767¢#1'"¢#0'~'#16383¢#3'"¢#0'
                          ~'#4095¢#15'
141                   PLEASE RESUME #1
142           (1530)  DO STASH :2 + :3 + .3 + .5
143                   DO :1 <- #0
144                   DO :2 <- .2
145                   DO .3 <- #1
146                   DO (1535) NEXT
147           (1535)  PLEASE FORGET #1
148                   DO .5 <- "∀!1~.3'¢#1"~#3
149                   DO (1531) NEXT
150                   DO (1500) NEXT
151                   DO :1 <- :3
152                   PLEASE DO (1533) NEXT
153           (1531)  PLEASE DO (1001) NEXT
154           (1533)  DO FORGET #1
155                   DO .3 <- !3¢#0'~'#32767¢#1'
156                   DO :2 <- ":2~'#0¢#65535'"¢"'":2~'#32767
                          ¢#0'"¢#0'~'#32767¢#1'"
157                   PLEASE DO .5 <- "∀!3~.3'¢#1"~#3
```

```
158                 DO (1532) NEXT
159                 DO (1535) NEXT
160           (1532)  DO (1001) NEXT
161                 PLEASE RETRIEVE :2 + :3 + .3 + .5
162                 DO RESUME #2
163           (1540)  PLEASE ABSTAIN FROM (1541)
164                 DO ABSTAIN FROM (1542)
165           (1549)  PLEASE STASH :1 + :2 + :4 + :5 + .1 + .2 + .5
166                 DO .1 <- :1~#65535
167                 PLEASE DO .2 <- :2~'#65280¢#65280'
168                 DO .5 <- :1~'#65280¢#65280'
169                 DO (1530) NEXT
170                 DO :3 <- :1
171                 DO .2 <- :2~#65535
172                 PLEASE DO (1530) NEXT
173                 DO :5 <- :1
174                 DO .1 <- .5
175                 DO (1530) NEXT
176                 DO :4 <- :1
177                 PLEASE DO :1 <- ":3~'#65280¢#65280'"
                        ¢":4~'#65280¢#65280'"
178                 DO .5 <- ':1~:1'~#1
179                 DO .2 <- :2~'#65280¢#65280'
180                 DO (1530) NEXT
181                 PLEASE DO .5 <- '"':1~:1'~#1"¢.5'~#3
182                 DO .1 <- :3~#65535
183                 DO .2 <- #0
184                 DO (1520) NEXT
185                 PLEASE DO :2 <- :1
186                 PLEASE DO .1 <- :4~#65535
187                 DO (1520) NEXT
188                 DO (1509) NEXT
189                 DO .5 <- !5¢":4~#3"'~#15
190                 DO :1 <- :3
191                 DO :2 <- :5
192                 DO (1509) NEXT
193                 PLEASE DO .5 <- !5¢":4~#3"'~#172
194                 DO .5 <- '∀"!5~.5'~#1"¢#1'~#3
195                 PLEASE RETRIEVE :4
196           (1541)  DO :4 <- .5
197                 DO (1543) NEXT
198           (1542)  DO (1544) NEXT
199                 PLEASE DO (1999) NEXT
200           (1543)  DO (1001) NEXT
201           (1544)  DO REINSTATE (1541)
202                 PLEASE REINSTATE (1542)
203                 PLEASE RETRIEVE :1 + :2 + :5 + .1 + .2 + .5
204                 DO RESUME #2
205           (1550)  DO STASH :1 + :4 + :5 + .5
206                 DO :3 <- #0
207                 DO .5 <- '∀"':2~:2'~#1"¢#1'~#3
208                 PLEASE DO (1551) NEXT
209                 DO :4 <- #1
210                 PLEASE DO (1553) NEXT
```

```
211             (1553)  DO FORGET #1
212                     DO .5 <- '∀":2~'#32768¢#0'"¢#2'~#3
213                     DO (1552) NEXT
214                     DO :2 <- ":2~'#0¢#65535'"¢"':2~'#32767
                            ¢#0'"¢#0'~'#32767¢#1'"
215                     PLEASE DO :4 <- ":4~'#0¢#65535'"¢"':4
                            ~'#32767¢#0'"¢#0'~'#32767¢#1'"
216                     DO (1553) NEXT
217             (1552)  DO (1001) NEXT
218             (1556)  PLEASE FORGET #1
219                     DO :5 <- "'∀":1~'#65535¢#0'"¢":2
                            ~'#65535¢#0'"'~'#0¢#65535'"¢"'
                            ∀":1~'#0¢#65535'"¢":2~'#0¢
                            #65535'"'~'#0¢#65535'"
220                     DO .5 <- '∀"'&"':2~:5'~'"'∀"'∀":5~:5
                            "~"#65535¢#65535"'~'#65535¢#0'"¢
                            #32768'~'#0¢#65535'"¢"'∀":5~:5"
                            ~"#65535¢#65535"'~'#0¢#65535'"'"¢"'
                            :5~:5'~#1"'~#1"¢#2'~#3
221                     DO (1554) NEXT
222                     DO :5 <- :3
223                     DO (1510) NEXT
224                     PLEASE DO :1 <- :3
225                     DO :3 <- "'V":4~'#65535¢#0'"¢":5~'#65535
                            ¢#0'"'~'#0¢#65535'"¢"'V":4~'#0
                            ¢#65535'"¢":5~'#0¢#65535'"'~'#0
                            ¢#65535'"
226                     DO (1555) NEXT
227             (1554)  PLEASE DO (1001) NEXT
228             (1555)  DO FORGET #1
229                     DO .5 <- "∀':4~#1'¢#2"~#3
230                     DO (1551) NEXT
231                     DO :2 <- ":2~'#0¢#65534'"¢":2~'#65535¢#0'"
232                     DO :4 <- ":4~'#0¢#65534'"¢":4~'#65535¢#0'"
233                     PLEASE DO (1556) NEXT
234             (1551)  DO (1001) NEXT
235                     PLEASE RETRIEVE :1 + :4 + :5 + .5
236                     PLEASE RESUME #2
237             (1900)  DO STASH .2 + .3 + .5
238                     DO .1 <- #0
239                     DO .2 <- #1
240                     PLEASE DO (1901) NEXT
241             (1901)  DO FORGET #1
242                     DO %50 .1 <- 'V.1¢.2'~'#0¢#65535'
243                     DO .2 <- !2¢#0'~'#32767¢#1'
244                     PLEASE DO .5 <- "∀!2~.2'¢#1"~#3
245                     DO (1902) NEXT
246                     DO (1901) NEXT
247             (1902)  DO (1001) NEXT
248                     DO RETRIEVE .2 + .3 + .5
249                     PLEASE RESUME #2
250             (1910)  PLEASE STASH .1 + .3 + .5 + :1 + :2 + :3
251                     DO .3 <- #65524
252                     DO :1 <- #6
```

```
    253                 DO (1911) NEXT
*   254                 PLEASE NOTE THAT YOU CAN'T GET THERE FROM HERE
    255           (1912)  DO (1001) NEXT
    256           (1911)  DO FORGET #1
    257                 PLEASE DO (1900) NEXT
    258                 DO :2 <- .1
    259                 DO (1500) NEXT
    260                 PLEASE DO :1 <- :3
    261                 DO .1 <- .3
    262                 DO (1020) NEXT
    263                 PLEASE DO .3 <- .1
    264                 DO .5 <- '∀"!3~.3'~#1"¢#2'~#3
    265                 DO (1912) NEXT
    266                 DO .1 <- #12
    267                 PLEASE DO (1050) NEXT
    268                 DO RETRIEVE .1
    269                 DO (1530) NEXT
    270                 DO :2 <- #32768
    271                 DO (1500) NEXT
    272                 PLEASE DO .2 <- :3~'#65280¢#65280'
    273                 PLEASE RETRIEVE .3 + .5 + :1 + :2 + :3
    274                 DO RESUME #1
```

6.4 Programming Suggestions

For the novice INTERCAL programmer, we provide here a list of suggested INTERCAL programming projects:

Write an integer exponentiation subroutine. :1 <- .1 raised to the .2 power.

Write a double-precision sorting subroutine. Given 32-bit array ;1 of size :1, sort the contents into numerically increasing order, leaving the results in ;1.

Generate a table of prime numbers.

Put together a floating-point library, using 32-bit variables to represent floating-point numbers (let the upper half be the mantissa and the lower half be the characteristic). The library should be capable of performing floating-point addition, subtraction, multiplication, and division, as well as the natural logarithm function.

Program a Fast Fourier Transform (FFT). This project would probably entail the writing of the floating-point library as well as sine and cosine functions.

Calculate, to :1 places, the value of pi.

7. ERROR MESSAGES

Due to INTERCAL's implementation of comment lines (see section 4.5), most error messages are produced during execution instead of during compilation. All errors except those not causing immediate termination of program execution are treated as fatal.

7.1 Format

All error messages appear in the following form:

```
ICLnnnI (error message)
    ON THE WAY TO STATEMENT nnnn
    CORRECT SOURCE AND RESUBMIT
```

The message varies depending upon the error involved. For undecodable statements the message is the statement itself. The second line tells which statement would have been executed next had the error not occurred. Note that if the error is due to 80 attempted levels of NEXTing, the statement which would have been executed next need not be anywhere near the statement causing the error.

7.2 Messages

Brief descriptions of the different error types are listed below according to message number.

000 An undecodable statement has been encountered in the course of execution. Note that keypunching errors can be slightly disastrous, since if 'FORGET' were misspelled F-O-R-G-E-R, the results would probably not be those desired. Extreme misspellings may have even more surprising consequences. For example, misspelling 'FORGET' R-E-S-U-M-E could have drastic results.

017 An expression contains a syntax error.

079 Improper use has been made of statement identifiers.

099 Improper use has been made of statement identifiers.

123 Program has attempted 80 levels of NEXTing.

129 Program has attempted to transfer to a non-existent line label.

139 An ABSTAIN or REINSTATE statement references a non-existent line label.

182 A line label has been multiply defined.

197 An invalid line label has been encountered.

200 An expression involves an unidentified variable.

240 An attempt has been made to give an array a dimension of zero.

241 Invalid dimensioning information was supplied in defining or using an array.

275 A 32-bit value has been assigned to a 16-bit variable.

436 A retrieval has been attempted for an unSTASHed value.

533 A WRITE IN statement or interleave (¢) operation has produced a value requiring over 32 bits to represent.

562 Insufficient data.

579 Input data is invalid.

621 The expression of a RESUME statement evaluated to #0.

632 Program execution was terminated via a RESUME statement instead of GIVE UP.

633 Execution has passed beyond the last statement of the program.

774 A compiler error has occurred (see section).

778 An unexplainable compiler error has occurred (see J. Lyon or D. Woods).

8. JCL

The information contained in the following section applies only to the Princeton compiler, run under OS/360.

8.1 The Princeton Compiler

The Princeton compiler, written in SPITBOL (a variant of SNOBOL), performs the compilation in two stages. First the INTERCAL source is converted into SPITBOL source, then the latter is compiled and executed.

It should be noted that the Princeton compiler fails to properly interpret certain multiply-subscripted expressions, such as:

```
",1SUB",2SUB#1"#2"
```

This is not a "bug". Being documented, it is merely a "restriction". Such cases may be resolved by alternating sparks and ears in various levels of expression nesting:

```
",1SUB',2SUB#1'#2"
```

which is advisable in any case, since INTERCAL expressions are unreadable enough as is.

Since there is currently no catalogued procedure for invoking the compiler, the user must include the in-line procedure shown in Figure 3 in his job before the compilation step. Copies of this in-line procedure may be obtained at any keypunch if the proper keys are struck.

The compiler is then executed in the usual manner:

```
// EXEC INTERCAL[,PARM='parameters']
//COMPILE.SYSIN DD *
{INTERCAL source deck}
/*
//EXECUTE.SYSWRITE DD *
{input data}
/*
```

The various parameters are described following the in-line procedure. At most one parameter from each set may apply to a given compilation; if more than one are specified, the results are undefined, and may vary depending upon the particular set of options. The default parameters are italicized.

```
//INTERCAL PROC
//COMPILE EXEC PGM=INTERCAL
//STEPLIB DD DSN=U.INTERCAL.LIBRARY,DISP=SHR
//          DD DSN=SYS1.FORTLIB,DISP=SHR
//SYSPRINT DD SYSOUT=A,DCB=(BLKSIZE=992,LRECL=137,RECFM=VBA)
//SYSPUNCH DD DUMMY
//SCRATCH DD DSN=&COMPSET,UNIT=SYSDA,SPACE=(CYL,(3,1)),DISP=(,PASS)
//EXECUTE EXEC PGM=EXECUTE,COND=(4,LT)
//SOURCES DD DSN=U.INTERCAL.SOURCES,DISP=SHR [4]
//STEPLIB DD DSN=U.INTERCAL.LIBRARY,DISP=SHR
//          DD DSN=SYS5.SPITLIB,DISP=SHR
//          DD DSN=SYS1.FORTLIB,DISP=SHR
//SYSIN DD DSN=&COMPSET,DISP=(OLD,DELETE)
//SYSOBJ DD SYSOUT=B,DCB=(BLKSIZE=80,LRECL=80,RECFM=F)
//SYSPRINT DD SYSOUT=A,DCB=(BLKSIZE=992,LRECL=137,RECFM=VBA)
//SYSPUNCH DD DUMMY
// PEND
```

Figure 3. Inline procedure for using INTERCAL.

OPT
NOOPT

In the default mode, the compiler will print a list of all options in effect, including the defaults for unspecified parameter groups and the effective option for those sets where one was specified. If NOOPT is requested, it causes the default mode to be assumed.

OPTSUB
NOOPTSUB
NOSUB

Unless 'NOOPTSUB' is requested, the System Library is optimized, resulting in much more rapid processing of function calls. Specifying NOOPTSUB causes the non-optimized INTERCAL code shown in section
to be used, whereas NOSUB requests that the System Library be omitted altogether.

IAMBIC
PROSE

The IAMBIC parameter permits the programmer to use poetic license and thus write in verse. If the reader does not believe it possible to write verse in INTERCAL, he should send the authors a stamped, self-addressed envelope, along with any INTERCAL program, and they will provide one which is verse.

FORMAT
NOFORMAT

In FORMAT mode, each statement printed is put on a separate line (or lines). In NOFORMAT mode, the free-format source is printed exactly as input. In this latter case, statement numbers are provided only for the first statement on a card, and they may be only approximate. Also, unrecognizable statements are not flagged.

SEQ
NOSEQ

If the source deck has sequence numbers in columns 73 through 80, specifying 'SEQ' will cause them to be ignored.

SOURCE
NOSOURCE

If NOSOURCE is selected, all source listing is suppressed.

LIST
NOLIST

If LIST is specified, the compiler will provide a list of statement numbers catalogued according to type of statement. The compiler uses this table to perform abstentions by gerund.

WIDTH=nn

This sets the width (in number of characters) of the output line for FORMAT mode output. The default is **132.**

---

4. Pending acquisition of SPITBOL release 3.0, the SOURCES DD card must be replaced by the five cards:

```
//NOOPTPFX DD DSN=U.INTERCAL.SOURCES(NOOPTPFX),DISP=SHR
//NOOPTSUB DD DSN=U.INTERCAL.SOURCES(NOOPTSUB),DISP=SHR
//OPTPFX DD DSN=U.INTERCAL.SOURCES(OPTPFX),DISP=SHR
//OPTSUB DD DSN=U.INTERCAL.SOURCES(OPTSUB),DISP=SHR
//PRELIM DD DSN=U.INTERCAL.SOURCES(PRELIM),DISP=SHR
```

CODE
NOCODE

Include 'CODE' in the parameter list to obtain a listing of the SPITBOL code produced for each INTERCAL statement.

LINES=nn

This determines the number of lines per page, during both compilation and execution. The default is **60.**

DECK
NODECK

Selecting 'DECK' will cause the compiler to punch out a SPITBOL object deck which may then be run without reinvoking the INTERCAL (or SPITBOL) compiler.

KIDDING
NOKIDDING

Select NOKIDDING to eliminate the snide remarks which ordinarily accompany INTERCAL error messages.

GO
NOGO

Specifying 'NOGO' will cause the program to be compiled but not executed. EXECUTE/NOEXECUTE may be substituted for GO/NOGO, but this will result in an error, and GO will be assumed.

BUG
NOBUG

Under the default, there is a fixed probability of a fatal compiler bug being worked at random into the program being compiled. Encountering this bug during execution results in error message 774 (see section). This probability is reduced to zero under 'NOBUG'. This does not affect the probability (presumably negligible) of error message 778.

8.2 Other INTERCAL Compilers

There are no other INTERCAL compilers. [5]

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5. This assertion in the INTERCAL-72 manual was blatantly contradicted by some notes on an Atari implementation included at the end of the manual. So, you expect compiler manuals to be consistent?

TONSIL A[6]

The Official INTERCAL Character Set

Tabulated next are all the characters used in INTERCAL, excepting letters and digits, along with their names and interpretations. Also included are several characters not used in INTERCAL, which are presented for completeness and to allow for future expansion.

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6. Since all other reference manuals have Appendices, it was decided that the INTERCAL manual should contain some other type of removable organ.

7. This footnote intentionally unreferenced.

Character	Name	Use (if any)
.	spot	identify 16-bit variable
:	two-spot	identify 32-bit variable
,	tail	identify 16-bit array
;	hybrid	identify 32-bit array
#	mesh	identify constant
=	half-mesh	
´	spark	grouper
‘	backspark	
!	wow	equivalent to spark-spot
?	what	*unary exclusive OR (ASCII)*
"	rabbit-ears	grouper
⁝	rabbit	equivalent to ears-spot
|	spike	
%	double-oh-seven	percentage qualifier
−	worm	used with angles
<	angle	used with worms
>	right angle	
(	wax	precedes line label
)	wane	follows line label
[	U turn	
]	U turn back	
{	embrace	
}	bracelet	
*	splat	flags invalid statements
&	ampersand [9]	unary logical AND
V	V (or book)	unary logical OR
∀	bookworm (or universal qualifier)	unary exclusive OR
$	big money	*binary mingle (ASCII)*
¢	change	binary mingle
~	sqiggle	binary select
=	flat worm overline	indicates "times 1000"
+	intersection	separates list items
/	slat	
\	backslat	
@	whirlpool	
¬	hookworm	
^	shark (or simply sharkfin)	
#	blotch	

Table 2 (top view). INTERCAL character set.

9. Got any better ideas?

TONSIL B

NOTES ON THE ATARI IMPLEMENTATION

The Atari implementation of INTERCAL differs from the original Princeton version primarily in the use of ASCII rather than EBCDIC. Since there is no "change" sign (¢) in ASCII, we have substituted the "big money" ($) as the mingle operator. We feel that this correctly represents the increasing cost of software in relation to hardware. (Consider that in 1970 one could get RUNOFF for free, to run on a $20K machine, whereas today a not quite as powerful formatter costs $99 and runs on a $75 machine.) We also feel that there should be no defensible contention that INTERCAL has any sense. Also, since overpunches are difficult to read on the average VDT, the exclusive-or operator may be written ?. This correctly expresses the average person's reaction on first encountering exclusive-or, especially on a PDP-11. Note that in both of these cases, the over-punched symbol may also be used if one is masochistic, or concerned with portability to the Princeton compiler. The correct over-punch for "change" is "c<backspace>/" and the correct over-punch for ∀ is "V<backspace>-". These codes will be properly printed if you have a proper printer, and the corresponding EBCDIC code will be produced by the /IBM option on the LIST command.