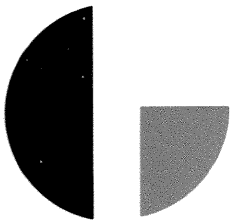

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PROGRAM

Parity Generator

TAPES

ASCII Source: 090-000037

ABSTRACT

This routine computes the even parity bit over a 16-bit number and returns the bit in Carry.

093-000033-00

1. REQUIREMENTS

1.1 Memory

1K or larger alterable memory

1.2 Equipment

NOVA central processor

1.3 External Subroutines

None

1.4 Other

None

2. OPERATING PROCEDURE

2.1 Calling Sequence

```
JSR  .PRTY
return
```

2.2 Input Format

A 16-bit number is passed in ACØ.

2.3 Output Format

The even parity bit over the contents of ACØ will be returned in Carry.

2.4 Error Returns

None

2.5 State of Active Registers upon Exit

ACØ, AC1, AC2 remain unchanged. AC3 and Carry are destroyed.

2.6 Cautions to User

None

3. DISCUSSION

3.1 Algorithms

The even parity bit is defined as zero if the input has an even number of 1's and one if the input has an odd number of 1's. The result can thus be accomodated using only Carry. Initially Carry is cleared and is complemented each time a one is found in the input. Its final state will reflect the even parity bit over the input.

If the input is zero, the algorithm terminates. Otherwise, the input is logically ANDed with the input -1 and Carry is complemented. This result eliminates a 1 from the original input and is used as the new input with the process repeated until the result is zero.

To prove that N $\wedge$ (N-1) eliminates a 1 from N observe the following:

a. If there are Ø's at the right of N, they will become 1's in N-1 up to the first 1 in N.

b. The first 1 in N will become Ø in N-1.

c. All bits to the left of the first 1 in N remain the same in N-1.

d. The logical AND of N and N-1 will eliminate the rightmost 1 in N but no others.

3.2 Limitations and Accuracy

The routine is exact for all 16-bit inputs.

3.3 Size and Timing

The routine is 16 (octal) words in length.

Execution time is

$$55.4 + 2Ø.Ø * I \ \mu\text{seconds}$$

where I is the number of 1's in the input. For example,

average execution time (I = 8) is

$$55.4 + 2\emptyset.\emptyset * 8 = 215.4 \ \mu\text{seconds}.$$

3.4 References

None

3.5 Flow Diagrams

None

4. EXAMPLES AND APPLICATIONS

Many data communications devices, such as teletypewriters and paper tape equipment, transmit and receive 8-bit bytes of information. Seven bits are sufficient for the transmission of the full ASCII character set, and the eighth bit is generally used as a parity bit over the other seven bits. If this bit is computed at one end of the bus, transmitted, and checked at the receiving end, any single bit error in the transmission can be detected.

The ASCII source of .PRTY is provided with the NOVA software. If a user routine requires parity computation, this tape should be edited into his source.

5. PROGRAM LISTING

A listing of .PRTY follows. No origin is given in the source, enabling the user to edit the tape anywhere within his routine.

```
                ; GENERATE PARITY

                ; INPUT:         A BINARY WORD IN AC0

                ; OUTPUT:        THE EVEN PARITY BIT OF THE WORD IN
                ;                CARRY

                ; CALLING SEQUENCE:
                ;       JSR     .PRTY
                ;       RETURN

                ; UNCHANGED:     AC0, AC1, AC2
                ; DESTROYED:     AC3, CARRY

00000 044014 .PRTY:  STA 1,.UA01      ; *SAVE AC1
00001 040013         STA 0,.UA00      ; *SAVE INPUT
00002 054015         STA 3,.UA03      ; SAVE RETURN
00003 176020         ADCZ 3,3         ; AC3 = -1, CARRY IS 0

00004 105000 .UA99:  MOV 0,1
00005 167060         ADDC 3,1         ; AC1 = N-1
00006 123464         ANDC 1,0,SZR     ; N .AND. N-1 ELIMINATES A "1"
00007 000004         JMP .UA99        ; NOT DONE IF ANY 1'S LEFT
00010 024014         LDA 1,.UA01      ; *RESTORE AC1
00011 020013         LDA 0,.UA00      ; *RESTORE INPUT
00012 002015         JMP @.UA03       ; RETURN


00013 000000 .UA00:  0                ; *SAVE INPUT
00014 000000 .UA01:  0                ; *SAVE AC1
00015 000000 .UA03:  0                ; SAVE AC3
```