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PROGRAM

Single Precision Binary to ASCII Octal

TAPES

ASCII Source: 090-000032

ABSTRACT

This routine converts a 16-bit binary number to a string of ASCII characters representing the octal equivalent of the binary value.

1. REQUIREMENTS

1.1 Memory

1K or larger alterable memory

1.2 Equipment

NOVA central processor

1.3 External Subroutines

A user supplied subroutine for accepting the ASCII output characters (see 2.3)

1.4 Other

None

2. OPERATING PROCEDURE

2.1 Calling Sequence

```
JSR  .BINO
return
```

2.2 Input Format

A 16-bit binary number is passed in AC1.

2.3 Output Format

The output is an ASCII character string of the form:

000000(null).

The "0's" represent the ASCII octal characters. The user must provide a routine that accepts these output characters. The address of this routine must be stored in location 41 of page zero. The characters will be passed, one at a time, right adjusted (bit 8 = Ø) in ACØ. Seven characters will be passed; most significant digit, . . ., least significant digit, null (all zero). The user routine need not save any register (except AC3 if used) or Carry. Return should be made by a JMP Ø,3.

2.4 Error Returns

None

2.5 State of Active Registers upon Exit

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

2.6 Cautions to User

None

3. DISCUSSION

3.1 Algorithms

The principle of this routine is to determine the octal digits by successively subtacting the appropriate power of eight from the original value until the result is negative. Each subtraction that gives a result greater than or equal to zero causes octal 6Ø (ASCII Ø) to be incremented. When the result becomes negative, its previous value is restored, the ASCII digit is passed to the user, and the next lower power of eight is subtracted. After 8**Ø is used, the conversion is complete. Since the original value is 16-bits, the largest power of eight that can be contained is 8**5 (2**15). Therefore the conversion begins using this value.

3.2 Limitations and Accuracy

The routine is exact for all 16-bit binary numbers.

3.3 Size and Timing

The routine is 27 (octal) words in length.

Execution time is

$$367.6 + N * 2Ø.Ø\ \mu\text{seconds},$$

where N is the sum of the digits of the result (the sum expressed in decimal). For example, if the result is 1765Ø7, execution time is

$$367.6 + (1+7+6+5+Ø+7) * 2Ø.Ø = 887.6\ \mu\text{seconds}.$$

3.4 References

None

3.5 Flow Diagrams

None

4. EXAMPLES AND APPLICATIONS

The ASCII source of binary to octal convert is provided with the NOVA software. If a user routine requires .BINO, this tape should be edited into the user's source.

5. PROGRAM LISTING

A listing of .BINO follows. No origin is given in the source, enabling the tape to be edited anywhere within a user routine.

```
                  ; BINARY TO OCTAL ASCII CONVERT
                  ; CONVERTS A 16-BIT BINARY WORD TO AN OCTAL ASCII
                  ; CHARACTER STRING

                  ; INPUT:          N IN AC1

                  ; OUTPUT:         ASCII CHARACTER STRING, TERMINATED BY A
                  ;                 NULL CHARACTER
                  ;                 CHARACTERS PASSED RIGHT ADJUSTED IN ACØ
                  ;                 TO THE USER ROUTINE WHOSE ADDRESS
                  ;                 MUST BE STORED IN LOCATION 41 OF PAGE Ø

                  ;                 STRING OF FORM:
                  ;                 OOOOOO(NULL)
                  ;                 WHERE "O'S" REPRESENT OCTAL DIGITS

                  ; CALLING SEQUENCE:
                  ;       JSR      .BINO
                  ;       RETURN

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


ØØØØØ Ø54Ø24 .BINO:  STA 3,.EFØ3       ; SAVE RETURN
ØØØØ1 Ø5ØØ23         STA 2,.EFØ2       ; *SAVE AC2
ØØØØ2 152621         SUBZR 2,2,SKP     ; 1ØØØØØ TO AC2
ØØØØ3 1464Ø1 .EF99:  SUB 2,1,SKP       ; DECREASE CURRENT DIGIT BY 1
ØØØØ4 Ø2ØØ26 .EF98:  LDA Ø,.EF2Ø       ; GET OCTAL 57
ØØØØ5 1Ø14ØØ         INC Ø,Ø           ; FORM ASCII OUTPUT DIGIT
ØØØØ6 146533         SUBEL# 2,1,SNC    ; - IMPLIES DIGIT COMPLETE
ØØØØ7 ØØØØØ3         JMP .EF99         ; NOT DONE, SUBTRACT 1 FROM
                                       ; CURRENT DIGIT
ØØØ1Ø Ø5ØØ25         STA 2,.EF1Ø       ; SAVE SUBTRACT CONSTANT
ØØØ11 ØØ6Ø41         JSR @.EF4Ø        ; PUT OUT A DIGIT
ØØØ12 Ø3ØØ25         LDA 2,.EF1Ø       ; RESTORE SUBTRACT CONSTANT
ØØØ13 15122Ø         MOVER 2,2         ; POSITION "1" FOR NEXT OCTAL
                                       ; DIGIT
ØØØ14 15122Ø         MOVER 2,2
ØØØ15 151224         MOVER 2,2,SZR
ØØØ16 ØØØØØ4         JMP .EF98         ; NOT DONE
ØØØ17 141ØØØ         MOV 2,Ø
ØØØ2Ø ØØ6Ø41         JSR @.EF4Ø        ; PUT OUT NULL CHARACTER
ØØØ21 Ø3ØØ23         LDA 2,.EFØ2       ; *RESTORE AC2
ØØØ22 ØØ2Ø24         JMP @.EFØ3        ; RETURN

ØØØ23 ØØØØØØ .EFØ2:  Ø                 ; *SAVE AC2
ØØØ24 ØØØØØØ .EFØ3:  Ø                 ; SAVE RETURN

ØØØ25 ØØØØØØ .EF1Ø:  Ø                 ; SAVE LOCATION FOR SUBTRACT
                                       ; CONSTANT

ØØØ26 ØØØØ57 .EF2Ø:  57                ; ASCII CONSTANT

      ØØØØ41 .EF4Ø=41                  ; PAGE ZERO ADDRESS OF PUT
                                       ; CHARACTER ADDRESS
```