TAD 207

```
/STEX -- STORAGE EXCHANGE PROGRAM
/ALAN BEALE

/THIS PROGRAM GRABS AND FREES BLOCKS OF STORAGE SPECIFIED BY THE USER, TO TAKE
/PROGRAM IS PASSED IN X1 A NUMERIC ELEMENT, WITH ALL ADDRESS FIELDS ALREADY SET
/FOR THE LOCATION FIELD, AND THE PROVISION THAT THE LENGTH FIELD CONTAINS THE L
/NOT THAT LENGTH - 1.
/TO FREE STORAGE THE PROGRAM IS PASSED IN X1 AN ADDRESS ELEMENT POINTING INTO T
/BE FREED. THE PROGRAM WILL FIND AND FREE THE BLOCK (IF IT IS FREEABLE), AND MA
/ADDRESSES IN THE CALLING PROCESS POINTING INTO THAT BLOCK.

/STEP 1 -- SAVE ALL REGISTERS BUT X0 AND X15 ON THE STACK.

          SMD   0                    DISABLE INTERRUPTS
     X4   STO   X0
     X6   STO   X0
     X7   STO   X0
     X8   STO   X0
     X9   STO   X0
     X10  STO   X0
     X12  STO   X0

/THE PRECEDING REGISTERS ARE USED BY THE PROGRAM, AND SO MUST BE SAVED. THE OTH
/ARE SAVED SO THAT IN THE FREE PROGRAM, A SPECIAL SCAN OF THE REGISTERS FOR BAD
/DOES NOT NEED TO BE MADE. SEE THE FREE PROGAM FOR GREATER DETAIL.

     X2   STO   X0
     X3   STO   X0
     X5   STO   X0
     X11  STO   X0
     X13  STO   X0
     X14  STO   X0

/TEST TAG ON X1 TO DETERMINE PROGRAM FUNCTION -- GRAB IF TAG 0, FREE IF TAG 2,

     X1   CPY   X1
     AT   JCC   FREE
     CT   JCC   PSEUDOF              IF CONTROL, CONVERT TO ADDRESS
     X10  DATA  0

/STEP 2 -- FIND ADDRESS OF NEXT AVAILABLE BLOCK OF STORAGE, AND INSERT INTO THE
/OF THE ARGUMENT.
/REGISTER USAGE IN THIS STEP IS --
/X4 -- THE USER*S PARAMETER AND/OR RETURNED VALUE
/X6 -- THE REQUESTED LENGTH
/X7 -- POINTER TO WORD 28 OF THE PROCESS BASE, WHICH POINTS TO THE BLOCK OF FRE
/X8 -- POINTER TO WORD 25 OF THE PROCESS BASE, WHICH CONTAINS THE NUMBER OF UNI
/(BOTH RELATIVE TO THE PROCESS STORAGE POOL, OF COURSE)
/X9 -- POINTER TO THE END OF CORE IN USE BY THIS PROCESS
/X10 -- INDICATES WHETHER REORGANIZATION HAS TAKEN PLACE
/X12 -- POINTER TO WORD 23 OF THE PROCESS BASE, WHICH POINTS TO THE BEGINNING

/SET UP THE PROCESS BASE POINTERS

GRAB X7   CPY   X15                X15 POINTS TO THE CURRENT PROCI
     X7   MOD   23                 TO POINT TO CORE BEGINNING
     X12  CPY   X7
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                X7      MOD     5               TO POINT TO FREE STORE
                X9      LD      X7                                      75
                                                                        76
/SET UP X4 TO BE RETURNED TO THE USER AS A POINTER TO HIS BLOCK OF STORAGE.
/ITS LOCN FIELD WILL BE ONE GREATER THAN THAT POINTED TO BY X9 (SINCE THAT LOCA
/A HEADER WORD), AND ITS LNGTH FIELD WILL BE ONE LESS THAN WHEN PASSED BY THE U
                                                                        102
                X4      CPY     X1                                      103
                LOCN    XF      X9+c37777       NEXT AVAILABLE LOCATION
                X1      LD      X1+1            INCREASE BY 1   105
                LOCN    RF      X4              MAKE X4 POINT THERE
                X4      TAG     2               MAKE IT AN ADDRESS ELEMENT
                LNGTH   XF      X4+c37777       GET THE REQUESTED LENGTH
                X4      LIM     X1-1            REDUCE SIZE BY 1
                                                                        112
/CHECK TO SEE IF THERE IS ENOUGH CORE TO SATISFY THE REQUEST. IF NOT, PRINT AN
/MESSAGE AND LEAVE.                                                     114
                                                                        115
                X8      CPY     X12                                     116
                X8      MOD     2               POINTS TO NUMBER OF FREE WORDS
                X6      CPY     X1              SAVE LENGTH IN X6
                X1      LD      X1+1            NUMBER OF FREE WORDS USED UP
                        BUS     X8              COMPUTE THE UPDATED FREE WORD C
                        TEST    0               IF NEGATIVE, GRAB CANNOT BE MAD
                GT      JCC     NOERR9                                  124
                X1      DATA    9               NUMBER OF ERROR MESSAGE
                        TOM     c224            ERROR PRINTER   126
                        TOM     c23             EXIT            127
NOERR9                  LDR     X1              SAVE THE FREE CORE COUNT IN R
                                                                        131
/SET UP THE HEADER WORD FOR THE NEW BLOCK, AND CREATE A NEW HEADER FOR THE REST
/AT THE FIRST FREE WORD POINTED TO BY X9, WILL BE A HEADER WORD WITH A 2 IN THE
/INDICATE THAT ITS STORAGE IS NOT IN USE. ITS LENGTH IS THAT OF THE REMAINDER O
/STORAGE POOL.                                                          135
/X8 IS NOW USED AS A WORK REGISTER FOR CONSTRUCTION OF THE NEW HEADERS.
                                                                        137
                X8      LD      X9              OLD HEADER      140
                LNGTH   XF      X8+c37777       AMOUNT OF CONTIGUOUS STORAGE LE
                        TEST    X6              IS THIS ENOUGH
                GE      JCC     NOREORG         IF SO, NO REORGAINIZATION NECES
                                                                        144
/SEE IF REORGANIZATION HAS ALREADY TAKEN PLACE. IF IT HAS, THEN PRINT AN ERROR
/OTHERWISE, REORGANIZE.                                                 146
                                                                        147
                        CLA     X10                                     150
                ZE      JCC     REORG           X10 WILL BE ONE IF REORGANIZATI
                X1      DATA    11                                      152
                        TOM     c224                                    153
                        TOM     c23                                     154
REORG           1       SYS     c223            REORGANIZE      155
                X10     DATA    1               SET X10         156
                X1      CPY     X6                                      157
                LNGTH   RF      X4+c37777                               160
                X1      CPY     X4              RECREATE THE PARAMETER PASSED I
                X1      TAG     0               TAG IT NUMERIC
                        J       GRAB            TRY AGAIN       163
                                                                        164
/NOW FIX PTAG IN THE HEADER WORD. PTAG CAN BE 0, 1, OR 2.               165
/A PTAG OF 2 SIGNIFIES A FREE BLOCK. A PTAG OF ZERO SIGNIFIES A BLOCK IN USE.
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/A PTAG OF 1 IS  A SPECIAL CONVENTION THAT DECLARES A BLOCK IN USE AND UNFREEABL
/TO REQUEST AN UNFREEABLE BLOCK, HAVE THE ARGUMENT IN X1 HAVE A PTAG OF 1. OTHE
/GIVE IT A PTAG OF ZERO.                                                    171
                                                                            172
NOREORG         STR     X10             UPDATE THE FREE CORE COUNT
                X10     STO     X15+25                                      174
                X8      LIM     X6      LIM BLOCK TO NECESSARY LENGTH
                PTAG    XF      X4+c37777       REPLACE PTAG OF X8 WITH THAT OF
                PTAG    RF      X8+c37777                                   177
                ITAG    XF      X4+c37777       PUT ITAG OF X4 ON X8
                ITAG    RF      X8+c37777                                   201
                X8      STO     X9              STORE AS HEADER WORD.
                                                                            203
/BEFORE ANY STORAGE IS USED IN THE STORAGE POOL, WORD 23 POINTS TO A  BLOCK EXTE
/LENGTH OF THE POOL.  THE FOLLOWING CODE WILL CHANGE THIS, IF NECESSARY TO HAVE
/LENGTH OF THE FIRST BLOCK IN ITS LNGTH FIELD, FOR THE USE OF THE FREE PROGRAM.
                                                                            207
                X10     LD      X12             ADDRESS OF POOL BEGINNING
                X10     MEM     X9              ARE WE TAKING STORAGE FROM THE
                IR      JCC     NOCREC          IF NOT, GO TO NOCREC
                LOCN    XF      X8+c37777       EXTRACT LOCATION OF BLOCK
                        SUB     1               GO BACK ONE TO INCLUDE HEADER W
                LOCN    RF      X8+c37777       REPLACE IN X8   215
                X1      LD      X6+1            INCREASE LNGTH BY 1
                LNGTH   RF      X8+c37777       IN SUM, MOD X8 BY -1
                X8      STO     X12             UPDATE WORD 23
                                                                            221
/NOW PRODUCE A NEW AVAILABLE STORAGE HEADER, AND HIDE IT IN THE LAST WORD OF TH
/THE BLOCK IS ONE LONGER THAN THE PROGRAMMER THINKS, SO HE NEVER NOTICES THIS A
                                                                            224
NOCREC          X10     LD      X7                                          225
                X1      LD      X12+1                                       226
                X1      MEM     X10             SEE IF THE NEW BLOCK IS AT THE
                ZE      J       1               IF SO, SET UP TO UPDATE WORD 24
                X1      DATA    1               SIGNAL TO NOT UPDATE
                X9      MOD     X6+1            MOD THE REST OF STORAGE SO AS N
/                                               THE NEW BLOCK   233
                X10     CPY     X9              SAVE IN X10     234
                X9      MOD     1               X10 POINTS TO THE LAST WORD OF
/                                               X9 TO THE FIRST WORD OF WHAT*S
                X9      STO     X10             STORE IN PROPER PLACE
                        TEST    0               DO WORDS 28 AND 24 AGREE
                NZ      J       1                                           241
                X10     STO     X15+24          IF SO, UPDATE WORD 24
                X10     STO     X7              ALSO, UPDATE WORD 28
                X10     CPY     X4                                          244
                X1      DATA    0                                           245
                I0      RF      X10+c37777      MAKE INITIAL INDEX ZERO FOR INI
                X4      REX     X1              LOAD X1 WITH RETURN PARAMETER
                X10     REX     X4              PUT 0 IN X10, UPDATED ADDRESS I
ZERO            X10     STO     X4              ZERO OUT THE TAKEN BLOCK
                X4      JNL     ZERO                                        252
                                                                            253
/RESTORE THE REGISTERS AND RETURN                                           254
                                                                            255
THRU            X14     LD      X0                                          256
                X13     LD      X0                                          257
                X11     LD      X0                                          260
                X5      LD      X0                                          261
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          X3      LD      X0                                          262
          X2      LD      X0                                          263
          X12     LD      X0                                          264
          X10     LD      X0                                          265
          X9      LD      X0                                          266
          X8      LD      X0                                          267
          X7      LD      X0                                          270
          X6      LD      X0                                          271
          X4      LD      X0                                          272
                  RET     1                                           273
                                                                      274
/IF ROUTINE IS PASSED A CONTROL ELEMENT, A DUMMY ADDRESS IS CONSTRUCTED FROM IT
/THIS FACILITY ALLOWS PROGRAMS TO BE FREED.                           276
                                                                      277
PSEUDOF   X4      CPY     X1                                          300
          X10     DATA    0                                           301
          LOCN    XF      X4                                          302
          LOCN    RF      X10                                         303
          X1      DATA    1                                           304
          ITAG    RF      X10                                         305
          X1      CPY     X10                                         306
          X1      TAG     2                                           307
                                                                      310
/FREE ROUTINE                                                         311
                                                                      312
/THIS PART OF THE PROGRAM MUST FIND THE REGION POINTED INTO BY THE ARGUMENT IN
/MARK THIS BLOCK AS UNUSED, AND MAKE INVALID ALL ADDRESSES IN THIS PROCESS POIN
/INTO THE FREED AREA. THIS HALF OF THE PROGRAM MAY PERFORM OTHER SPECIAL FUNCTI
/ARE EXPLAINED IN CONTEXT.                                            316
                                                                      317
/STEP 1 -- FIND THE DESIGNATED BLOCK TO BE FREED.                     320
/REGISTER USAGE IN THIS PHASE IS --                                   321
/X4 -- THE ARGUMENT PASSED IN X1                                      322
/X6 -- POINTER TO THE END OF STORAGE IN USE                           323
/X7 -- POINTER TO THE BLOCK OF STORAGE UNDER CONSIDERATION            324
/X8 -- POINTER TO THE LAST WORD OF THE BLOCK UNDER CONSIDERATION, I.E., TO THE
/X9 -- WORK REGISTER                                                  326
/X10 -- WORK REGISTER                                                 327
/X12 -- POINTER TO THE FIRST WORD OF THE BLOCK UNDER CONSIDERATION
                                                                      331
FREE      X7      CPY     X15     PROCESS BASE POINTER
          X7      MOD     23      STORAGE POOL POINTER
          X9      LD      X7      SET UP X9 FOR NXTBLK
          X7      MOD     1       USED STORE END POINTER
          X6      LD      X7                                          336
          X4      CPY     X1                                          337
                                                                      340
/BEGIN THE SEARCH HERE. AT THIS POINT X9 WILL CONTAIN A POINTER TO THE NEXT BLC
/SET UP A NEW SET OF X7,X8,X9, AND X12.                               342
                                                                      343
NXTBLK    X7      CPY     X9      PUT POINTER TO NEXT BLOCK IN X7
          X10     LD      X7      HAS END OF STORAGE BEEN REACHED
          X10     MEM     X6                                          346
          GE      JCC     BADFREE IF SO, X4 DOES NOT POINT TO AN
/                                 JUMP TO BADFREE TO PRINT AN ERR
/                                 AND LEAVE.                          351
          X8      LD      X9      PUT FIRST WORD OF BLOCK IN X8
          X1      DATA    2       GIVE X8 MIXED ITAG TO PREVENT T
          ITAG    RF      X8+c37777                                   354
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LNGTH   XF      X9              GET LENGTH OF NEXT BLOCK
X12     CPY     X8              X12 ALSO CONTAINS FIRST WORD OF
X8      MOD     X1              NOW X8 POINTS TO THE LAST WORD
X10     CPY     X4                                          360
X10     MEM     X12             DOES X4 POINT INTO THIS BLOCK
GE      JCC     FOUND           IF SO, THIS IS THE BLOCK TO BE
X9      CPY     X8              SET UP X9 FOR NXTBLK
        J       NXTBLK          GET THE NEXT BLOCK
                                                            365
/CHECK TO SEE THAT THE BLOCK IS FREEABLE, AND IF IT ISN*T, PRINT AN ERROR MESSA
                                                            367
FOUND   PTAG    XF      X7      X7 NOW POINTS TO THE HEADER WOR
/                               FREED                       371
        TEST    1               IS IT FREEABLE
        ZE      JCC     BADFREE IF NOT, ERROR               373
                                                            374
/NOW UPDATE WORD 25 OF THE PROCESS BASE, THE NUMBER OF FREE WORDS. FOR THIS PHA
/USED AS FOLLOWS-->                                         376
/X4 --> POINTER TO THE BEGINNING OF THE STORAGE POOL        377
/X6 --> POINTER TO THE END OF STORAGE IN USE                400
/X7 --> POINTER TO THE HEADER WORD OF THE BLOCK RO BE FREED 401
/X12 --> POINTER TO WORD 25 OF THE PROC BASE, THE FREE CORE COUNT
                                                            403
        X6      CPY     X15     SET UP X6 AND X4
        X6      MOD     23                                  405
        X4      CPY     X6                                  406
        X6      MOD     1                                   407
        LNGTH   XF      X7      GET NUMBER OF WORDS TO BE RELEA
        X1      LD      X1+1                                411
        X12     CPY     X6      SET UP X12                  412
        X12     MOD     1                                   413
                ADD*    X12     UPDATE THE CORE COUNT WITH THE
                                                            415
/NOW CHECK TO SEE IF THE BLOCK FREED PRECEDES THE FREE STORE ADDRESSED BY WORD
/BASE, IF SO, COMBINE THE BLOCKS AND UPDATE WORD 28.        417
                                                            420
        X1      DATA    2       GIVE OUT-OF-USE PTAG
        PTAG    RF      X7                                  422
        X12     LD      X15+28                              423
        X12     LD      X12     X12 IS NOW A WORK REGISTER
        X10     LD      X8      X8 STILL POINTS TO THE LAST WOR
/                               TO BE FREED                 426
        X10     MEM     X12     IS THIS THE LAST BLOCK
        IR      JCC     SKIP    IF NOT, GO TO SKIP
        LNGTH   XF      X8      GET LENGTH OF LAST FREE BLOCK
        X12     CPY     X1      SAVE IN X12                 432
        LNGTH   XF      X7      GET LENGTH ADDED TO FREE STORE
                ADD     X12+1                               434
        LNGTH   RF      X7      CREATE HEADER TO POINT TO ENLAR
                ADD     1                                   436
        LNGTH   RF      X7+c37777 ENLARGE X7 TO POINT TO ALL OF F
        X1      DATA    2       GIVE FREE HEADER MIXED ITAG
        ITAG    RF      X7                                  441
        PTAG    RF      X7+c37777 MARK NEW END POINTER AS FREE
        X9      LD      X6      IF WORDS 24 AND 28 AGREE, CHANG
        X8      LD      X15+28                              444
        X8      MEM     X9                                  445
        NZ      JCC     1                                   446
        X7      STO     X6      CHANGE WORD 24
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          X7      STO       X15+28                UPDATE WORD 28 TO REFLECT THE C
                                                                              451
/PREPARATION FOR STEP 2, GARBAGE COLLECTION THOURGH THE PROCESS BASE, WORDS 23
/OF THE PROCESS BASE ARE SAVED, SINCE THEY COULD BE MADE INVALID BY THE GARBAGE
/AND A TEST IS RUN TO SEE IF THE FIRST BLOCK OF THE POOL IS BEING FREED. IF SO,
/23 POINTER IS GIVEN A PTAG OF 2, TO SHOW THAT IT IS OUT OF USE.
                                                                              456
SKIP      X8      LD        X4                    SAVE WORD 23 IN X8
          X9      LD        X4+5                  AND WORD 28 IN X9
          X10     CPY       X7
                                                                              461
          X10     MEM       X8                    IS IT THE FIRST BLOCK
          IR      JCC       NOTFIR                IF NOT, JUMP TO NOTFIR
          X1      DATA      2                     CHANGE PTAG     464
          PTAG    RF        X8+C37777                             465
                                                                              466
/STEP 2 -> GARBAGE COLLECTION THROUGH THE PROCESS BASE, EACH WORD OF THE PROCES
/TO SEE IF IT IS AN ADDRESS POINTING INTO THE FREED AREA, ANY FOUND ARE GIVEN T
/RE-STORED, THE PROCESS-LOOP (PLOOP) ENDS WHEN THE END OF STACK MARK, A CONTROL
/OF VALUE ZERO IS FOUND.                                                      472
/REGISTER USE IS ->                                                           473
/X4 -> POINTER TO WORD 23                                                     474
/X6 -> POINTER TO CURRENT WORD OF PROCESS BASE                                475
/X7 -> POINTER TO HEADER WORD OF BLOCK TO BE FREED                            476
/X8 -> WORD 23 SAVED                                                          477
/X9 -> WORD 24 SAVED                                                          500
/X10 -> WORK REGISTER                                                         501
/X12 -> CONTENTS OF CURRENT WORD OF PROCESS BASE                              502
                                                                              503
NOTFIR    X6      CPY       X15                   INITIALIZE X6 TO WORD 1 OF PROC
PLOOP     X12     LD        X6                    FILL X12        505
          NAT,IR  JCC       ENG                   IF NOT AN ADDRESS, GO TO LOOK F
MEMTEST   X1      LD        X7                    FIRST WORD OF FREED BLOCK
          X10     CPY       X12                                   510
          X10     MEM       X1                    DOES THE ADDRESS POINT INTO THE
          IR      JCC       INC                   IF NOT, GO ON TO NEXT WORD
          X12     TAG       3                     ELSE, MAKE INVALID
          X12     STO       X6                    AND RE-STORE    514
INC       X6      MOD       1                     GET NEXT WORD OF THE PROC BASE
                  J         PLOOP                 LOOP            516
ENG       NCT,IR  JCC       INC                   IF NOT CONTROL, GET NEXT WORD
          X1      DATA      3                                     520
          HTAG    RF        X6                    GIVE CONTROL ELEMENT NUMERIC TA
          X1      DATA      0                                     522
                  TEST      X6                    CHECK AGAINST ZERO
          ZE      JCC       STAKEND               IF SO, LEAVE LOOP
          X1      DATA      10                                    525
          HTAG    RF        X6                    CHANGE TAG BACK TO CONTROL
          X9      REX       X12                                   527
          1       JSM       CONTROL               CHANGE FROM TAG 1 TO TAG 2 FOR
          X9      REX       X12+C37777                            531
                  J         MEMTEST                               532
STAKEND   X8      STO       X4                    RESTORE WORDS 23 AND 28 OF THE
          X9      STO       X4+5                                  534
          X1      DATA      10                                    535
          HTAG    RF        X6                    MAKE STACK END CONTROL AGAIN
                                                                        537
/PREPARATION FOR STEP 3 -> GARBAGE COLLECTION THROUGH THE STACK. IN PREPARATION
/THE STACK POINTER MUST BE SAVED IN THE PROCESS BASE, IN ADDITION, X12 IS GIVEN
/THE BEGINNING OF THE STACK, AND X4 IS FILLED WITH A PSEUDO-STACK POINTER, LONG
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/TO INCLUDE ALL OF THE REAL STACK.                                      543
                                                                        544
          X1    DATA    29              LNGTH OF PROC BASE PROPER
                ADD     X15+26          NUMBER OF GLOBAL VARIABLES
                ADD     X15+27          LENGTH OF STACK
          X12   CPY     X15                                           550
          X12   MOD     X1              X12 NOW POINTS TO THE STACK BEG
          X4    CPY     X0              GET READY TO SET UP X4
          X0    MV      X15             SAVE THE X0 SAVE AREA CONTENTS
          X0    STO     X15             SAVE X0                       554
          X1    LD      X15+27          STACK LENGTH                  555
          LNGTH RF      X4+C37777       SET UP THE LONG PSEUDO-STACK
                                                                        557
/STEP 3 -- GARBAGE COLLECTION THROUGH THE STACK. EACH WORD OF THE STACK IS CHEC
/POINTS INTO THE FORBIDDEN AREA. IF SUCH A WORD IS FOUND, IT IS MADE INVALID. T
/(SLOOP) ENDS WHEN THE STACK BEGINNING IS REACHED.                      562
/NOTE THAT THIS LOOP ALSO SERVES TO GARBAGE COLLECT THROUGH THE REGISTERS, SINC
/REGISTERS BUT X0,X1, AND X15 (WHICH IN CONTEXT ARE NOT NEEDED) ARE SAVED ON TH
/AND ARE RESTORED FROM THERE ON EXIT.                                   565
/REGISTER USAGE IN THIS PHASE IS --                                     566
/X4 -- PSEUDO-STACK POINTER                                             567
/X7 -- POINTER TO HEADER WORD OF FREED BLOCK                            570
/X10 -- WORK REGISTER                                                   571
/X12 -- POINTER TO STACK BEGINNING                                      572
                                                                        573
SLOOP     X4    MOD     1               MOVE 1 DOWN  PSEUDO-STACK
          X0    CPY     X4              MAKE PSEUDO-STACK REAL STACK
          X9    LD      X0              UNSTACK CURRENT ELEMENT
          AT    JCC     CHA             IF ADDRESS, CHECK FURTHER AT CH
REST      X9    STO     X0              RESTACK X9, POSSIBLY CHANGED TO
          X10   CPY     X12                                           601
          X10   MEM     X4              HAS STACK BEGINNING BEEN REACHE
          NZ    JCC     SLOOP           IF NOT, RELOOP
                J       RSTAK           IF SO, RESTORE THE STACK AND CO
CHA       AT    JCC     1                                             605
          1     JSM     CONTROL         CHANGE TO TAG2
          X1    LD      X7                                            607
          X10   CPY     X9                                            610
          X10   MEM     X1              DOES IT POINT INTO FREED AREA
          IR    JCC     REST            IF NOT, GO ON TO NEXT ELEMENT
          X9    TAG     3               IF SO, MAKE IT INVALID
                J       REST            CONTINUE                      614
RSTAK     X0    LD      X15             RESTORE THE STACK FROM THE PROC
          X15   MV      X0              RESTORE THE X0 SAVE AREA FROM T
                                                                        617
/PREPARATION FOR STEP 4 -- GARBAGE COLLECTION THROUGH MEMORY. SET UP X6 TO POIN
/STORAGE IN USE BY THIS PROCESS, X4 TO POINT TO THE BEGINNING OF SUCH STORAGE.
                                                                        622
          X6    CPY     X15                                           623
          X6    MOD     23                                            624
          X4    LD      X6                                            625
          X6    MOD     1                                             626
          X6    LD      X6                                            627
                                                                        630
/STEP 4 -- GARBAGE COLLECTION THROUGH THE PROCESS STORAGE POOL. THIS PHASE CHEC
/PROCESS STORAGE POOL TO SEE WHETHER IT IS IN USE AND MIXED, IF IT IS BOTH USED
/MAY CONTAIN FORBIDDEN ADDRESSES. AN INNER MEMORY LOOP (MLOOP) SCANS THESE BLOC
/INVALID ALL SUCH ADDRESSES. AT THE END OF SUCH A BLOCK, A RETURN IS MADE TO TH
/(BLOOP) SCANNING ALL THE BLOCKS IN THE STORAGE POOL. WHEN THE LAST OF THESE BL
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/THE REGISTERS ARE RESTORED AND A RET EXECUTED.                          636
/REGISTER USAGE FOR THIS PHASE IS AS FOLLOWS.-.                          637
/X4 -- POINTER TO THE BLOCK UNDER CONSIDERATION                          640
/X6 -- POINTER TO THE LAST BLOCK IN USE                                  641
/X7 -- POINTER TO THE HEADER WORD OF FREED BLOCK                         642
/X8 -- WORK REGISTER                                                     643
/X9 -- WORD BEING CONSIDERED FOR INVALIDATION                            644
/X10 -- WORK REGISTER                                                    645
/X12 -- POINTER TO END OF BLOCK BEING SCANNED, I.E., TO THE HEADER WORD FOR THE
                                                                         647
BLOOP   LNGTH   XF      X4+c37777       PUT BLOCK LENGTH-1 IN X1
        X12     CPY     X4                                               651
        X12     MOD     X1              X4 NOW POINTS TO THE LAST WORD
        ITAG    XF      X4+c37777       CHECK FOR MIXED TAG
                TEST    2                                                654
        NZ      JCC     GOON            IF NOT MIXED, NO NEED TO SCAN I
        PTAG    XF      X4+c37777       IF MIXED, SEE IF IN USE
                TEST    2                                                657
        ZE      JCC     GOON            IF NOT, GO ON                    660
MLOOP   X4      MOD     1               STEP 1 DOWN BLOCK
        X10     CPY     X12                                              662
        X10     MEM     X4              HAS END OF BLOCK BEEN REACHED
        ZE      JCC     GOON            IF YES, GO ON TO NEXT BLOCK
        X9      LD      X4              FILL X9                          665
        NT,IR   JCC     MLOOP           IF NOT TAG 1 OR TAG 2, GET NEXT
        AT      JCC     1                                                667
        1       JSM     CONTROL                                          670
        X10     CPY     X9                                               671
        X8      LD      X7              BEGINNING OF FREED BLOCK
        X10     MEM     X8              DOES IT POINT INTO FREED BLOCK
        IR      JCC     MLOOP           IF NOT, KEEP ON
        X9      TAG     3               IF YES, THEN MAKE INVALID
        X9      STO     X4              PUT BACK IN MEMORY
                J       MLOOP           LOOP                             677
GOON    X1      DATA    2               GIVE X12 MIXED ITAG TO PREVENT
        ITAG    RF      X12+c37777.                                      701
        X4      LD      X12             LOAD X4 WITH HEADER OF NEXT BLO
        X10     CPY     X4                                               703
        X10     MEM     X6              IS IT LAST BLOCK
        VR      JCC     THRU            IF SO, LEAVE PROGRAM
                J       BLOOP           ELSE, CONTINUE LOOP
                                                                         707
/CODA -- CODING TO PRINT ERROR MESSAGE (=10) FOR INVALID FREE            710
                                                                         711
BADFREE X1      DATA    10                                               712
                TOM     c224                                             713
                TOM     c23                                              714
                                                                         715
/CONTROL IS A SUBROUTINE TO TRANSFORM TAG1 WORDS INTO ADDRESSES SO THAT THEY MA
/ADDRESSES. THE ARGUMENT IS PASSED AND RETURNED IN X9.                   717
                                                                         720
CONTROL X1      DATA    2                                                721
        ITAG    RF      X9                                               722
        X9      TAG     2                                                723
                RET     1                                                724
                                                                         725
/THE END. STORE AT c202, ALIAS 130 DECIMAL.                              726
                                                                         727
<c202                                                                    730
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                                                                        1
                                                                        2
/PROC c203  SET UP PROCESS BASE, PUT PROC NAME                          3
/ON SYSTEM SYMBOL TABLE, POINTER IN PBASE,                              4
/OWNER NO. ON DEVC TABLE, TAKE CORE SPACE, PUT                          5
/PARAMS AND POINTERS ON PROCESS BASE                                    6
                                                                        7
/GO TO TLU TO CHECK FOR PROCESS NAME                                    10
/DUPLICATION AND FULL SYMBOL TARLE                                      11
            X3      LDA     153             PROC NAME FROM CTLIST
            X1      LD      X3+1                                        13
            X2      LDA     136             POINTER-STAB                14
                    LDR     1                                           15
            1       SYS     148                                         16
                    LLS     54                                          17
                    TEST    1                                           20
            NZ      J       ERR16                                       21
                                                                        22
/GET PARAMS ENTERED BY USER-- CORE->X10, TIME->X11, SENSE->X12, STACK->X13, GLOBAL VAR
            X7      DATA    c37                                         24
            X3      MOD     2                                           25
NEXT        X3      MOD     1                                           26
            X5      LD      X3              /1SR PARAM AFTER NAME AND ID
            EXP5    XF      X5+c37777       /GET EXPONENT               30
                    TEST    2                                           31
            ZE      JCC     CNTRL           /CONTROL CHAR HAS EXP 2
                    TEST    1                                           33
            NZ      JCC     ERR6                                        34
/EXPONENT 1 FOR PARAM NAME, MANTISSA HAS NAME, 6 CHARS MAX              35
            X9      DATA    0                                           36
            X8      LDA     152             POINTER->COMMAND VT
            X8      LD      X8              GET POINTER TO LIST
            X8      LD      X8              OF PROC COMMANDS IN X8
LOOK        X1      LD      X8              LOAD LEGAL PROC PARAM
                    SYD     X5                                          43
            ZE      J       NAME                                        44
            X9      LD      X9+1                                        45
            X8      JNL     LOOK                                        46
                    J       ERR10           NAME ON CTLIST NOT VALID
                                                                        50
/NAME FOUND ON VALID PARAM LIST, X9=INDEX OF PARAM                      51
NAME                CLA     X9                                          52
                    TEST    3               LOOK FOR 3,4(STACK,GV)
            ZE      JCC     STAK                                        54
                    TEST    4                                           55
            ZE      J       GVAR                                        56
                    TEST    2                                           57
            ZE      J       SENS                                        60
                    TEST    1                                           61
            ZE      J       TIME                                        62
            UN      J       CORE                                        63
                                                                        64
/INDEX 4--GVAR-- GO TO SUBRT TO CHECK NEXT TWO WORDS FOR =VALUE, RET WITH
/VALUE IN X5 , THEN COMPARE REQUESTED VALUE TO MAX ALLOWED FOR GV
GVAR        1       JSM     CHK                                         67
            X1      LD      X1+4                                        70
                    TEST    X5                                          71
            LT      J       ERR14           REQUEST TOO BIG
            X14     CPY     X5                                          73
```

```
                X1      DATA    c36                                     74
                        AND-    X7              /REMOVE GV BIT FROM
                UN      J       NEXT            /PARAM STATUS INDICATOR
                                                                        77
/INDEX 3--  STACK SIZE REQUEST-GO TO SUBRT TO CHECK NEXT 2  WORDS IN CTLIST FOR
/RET WITH VALUE IN X5. COMPARE REQUEST TO MAX VALUE                     101
STAK            1       JSM     CHK                                     102
                X1      LD      X1+3                                    103
                        TEST    X5                                      104
                LT      J       ERR14           REQUEST TOO BIG
                X13     CPY     X5                                      106
                X1      DATA    c35                                     107
                        AND-    X7              /REMOVE STAK BIT FROM
                UN      J       NEXT            /PARAM STATUS INDICATOR
                                                                        112
/INDEX 2--SENSE BITS--CHECK FOR =VALUE IN SUBRT CHK. RET WITH VALUE IN X5
SENS            1       JSM     CHK                                     114
                X12     CPY     X5                                      115
                X1      DATA    c33                                     116
                        AND-    X7              /REMOVE SENSE BIT FROM
                UN      J       NEXT            /PARAM STATUS INDICATOR
                                                                        121
/INDEX 1--TIME--CHECK FOR =VALUE IN SUBRT. CHECK AGAINST MAX ALLOWED
TIME            1       JSM     CHK                                     123
                X1      LD      X1+1                                    124
                        TEST    X5                                      125
                LT      J       ERR14           REQUEST TOO BIG
                X11     CPY     X5                                      127
                X1      DATA    c27                                     130
                        AND-    X7              REMOVE TIME BIT FROM X7
                UN      J       NEXT                                    132
                                                                        133
/INDEX 0--CORE SPACE--GO TO CHK FOR = VALUE. CHECK AGAINST MAX ALLOWED
CORE            1       JSM     CHK                                     135
                X1      LD      X1                                      136
                        TEST    X5                                      137
                LT      J       ERR14           REQUEST TOO BIG
                X10     CPY     X5                                      141
                X1      DATA    c17                                     142
                        AND-    X7                                      143
                UN      J       NEXT                                    144
                                                                        145
/CONTROL CHAR--MANTISSA 0 ENDS PARAMETER LIST                           146
CNTRL           LOCN    XF      X5                                      147
                        TEST    0                                       150
                NZ      J       ERR6                                    151
                                                                        152
/GET DEFAULT VALUES FOR PARAMETERS NOT ENTERED WITH COMMAND             153
                X1      CPY     X7                                      154
                        AND     c37                                     155
                ZE      J       GOT             X7=0 IF ALL PARAM BITS REMOVED
                X9      LDA     152                                     157
                X9      LD      X9                                      160
                X9      LD      X9+1            POINTER TO DEFAULT VECTOR
                        TEST    c20                                     162
                LT      J       2                                       163
                X10     LD      X9              LOAD CORE VALUE
                        AND     c17                                     165
                                                                        166
```

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                TEST    c10                                     167
        LT      J       2                                       170
        X11     LD      X9+1            LOAD TIME VALUE
                AND     c7                                      172
                                                                173
                TEST    c4                                      174
        LT      J       2                                       175
        X12     LD      X9+2            LOADSENSE BIT PATTERN
                AND     3                                       177
                                                                200
                TEST    2                                       201
        LT      J       2                                       202
        X13     LD      X9+3            LOAD STACK SIZE
                AND     1                                       204
                                                                205
                TEST    1                                       206
        NZ      J       1                                       207
        X14     LD      X9+4                                    210
        X3      LDA     153                                     211
                                                                212
/REQUEST CORE SPACE FROM STEX FOR USERS POOL                    213
GOT     X9      DATA    0                                       214
        X1      CPY     X14             GLOBAL VARS AND SYMBOL
                MPY     2               TABLE SAME LENGTH. ADD
                ADD     X10             CORE REQUEST AND STACK REQ
                ADD     X13+30          +30 FIXED LOCNS FOR TOTAL CORE
        LNGTH   RF      X9                                      221
        X1      DATA    2                                       222
        ITAG    RF      X9                                      223
        X1      CPY     X9                                      224
        1       SYS     130             TO STEX                 225
        X5      CPY     X1              X5 POINTS TO POOL
                                                                227
/SET UP PROC BASE AND ITS HEADER. STO HEADER                    230
/IN FIRST WORD OF CORE ALLOWANCE                                231
        X1      DATA    30                                      232
                ADD     X14                                     233
                ADD     X13             X1=PROCESS BASE LENGTH
        X7      CPY     X5                                      235
        X7      LIM     X1+1                                    236
        X7      STO     X5+24           POINTER TO PBASE HDR
        X9      DATA    0                                       240
        LNGTH   RF      X9              SET UP X9 FOR PBASE HDR
        LOCN    XF      X5+c37777                               242
                ADD     1                                       243
        LOCN    RF      X9                                      244
        X1      DATA    2                                       245
        ITAG    RF      X9                                      246
        X1      DATA    1                                       247
        PTAG    RF      X9                                      250
        X9      TAG     2                                       251
        X9      STO     X5                                      252
/GO TO TLU TO STORE PROC NAME IN STAB                           253
        X1      LD      X3+1                                    254
                LDR     0                                       255
        1       SYS     148                                     256
        X4      CPY     X1                                      257
        LNGTH   XF      X9+c37777       SET UP X9 FOR PBASE POINTER
                SUB     1                                       261
```

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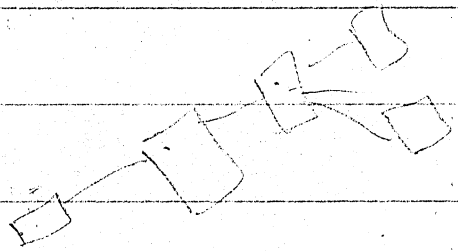
          LNGTH   RF      X9+c37777                                  262
          X7      LDA     135                                        263
          X7      MOD     X4                                         264
          X9      STO     X7                                         265
                                                                     266
/STORE PARAMS IN PROCESS BASE(POINTED TO BY X9)                      267
          X10     STO     X9+18       CORE ALLOWANCE
          X11     STO     X9+19       TIME                           271
          X12     STO     X9+16       SENSE BITS                     272
          X14     STO     X9+26       GLOBAL VAR SPACE
          X13     STO     X9+27       STACK LENGTH                   274
          X11     LD      X3+1                                       275
          X11     STO     X9+22       ID FROM CTLIST
                                                                     277
/SET UP AND STORE END OF STACK WORD (Z WORD WITH TAG 1),              300
/STACK POINTER (1ST WORD IN PBASE), AND 1ST WORD ON                   301
/STACK (TAG 1 WORD WITH MARK 15 )                                    302
          X11     CPY     X5          COPY POOL POINTER
          X1      DATA    30                                         304
                  ADD     X14+1                                      305
          X11     MOD     X1          X11 POINTS TO END OF STACK
          X1      DATA    -0                                         307
          X1      STO     X11                                        310
          X1      DATA    c12         TAG CODE FOR TAG1
          HTAG    RF      X11                                        312
          X11     MOD     X13-2                                      313
          X12     CPY     X11         IN STACK                       314
          X1      DATA    0                                          315
          LNGTH   RF      X12+c37777  LNGTH IN POINTER=0
          X12     STO     X5+1                                       317
          X11     MOD     1           X11=STACK BEGINNING
          X1      DATA    15          SET UP X12 WITH TAG1,
          X12     DATA    0           MARK 15                        322
          X12     TAG     1                                          323
          MARK    RF      X12                                        324
          X12     STO     X11                                        325
                                                                     326
/SET UP ACTIVE HEADER FOR USERS SYMBOL TABLE(PTAB)                   327
          X11     MOD     1                                          330
          X12     CPY     X11         POINTER TO HEADER LOCN
          X12     MOD     1                                          332
          X12     LIM     X14                                        333
          X12     STO     X11                                        334
          X1      DATA    1                                          335
          PTAG    RF      X11                                        336
          X12     LIM     X14-1                                      337
          X1      DATA    30                                         340
          IO      RF      X12+c37777                                 341
          X12     STO     X9+17       STO PTAB POINTER IN PROC BASE
                                                                     343
/SET UP INACTIVE HEADER AFTER PTAB FOR REST OF USERS POOL            344
          X11     MOD     X14+1                                      345
          X12     CPY     X11                                        346
          X1      DATA    2                                          347
          PTAG    RF      X12+c37777                                 350
          PTAG    RF      X11+c37777                                 351
          X12     MOD     1                                          352
          X12     STO     X11                                        353
                                                                     354
```

```
/STORE POINTER TO CORE AND FREE STORE IN PBASE                          355
/(ACTUALLY POINTS TO FREE STORE HEADER, NOT WORD FOLLOWING)             356
          X11     STO     X9+24                                         357
          X11     STO     X9+28                                         360
          LNGTH   XF      X11+c37777                                    361
                  ADD     1                                             362
          X1      STO     X9+25         NO. FREE WORDS
                                                                        364
/STORE OWNER NO. (X4) IN DEVC TABLE, DEVICE                             365
/NO. IN CTLST (153), FIRST ENTRY                                        366
          X1      LD      X3                                            367
                  LUR     12                                            370
          X5      LDA     137           X5 POINTER TO DEVC
          X5      MOD     X1            TABLE, ENTRY INDEXED
          X4      STO     X5            BY DEVC NO.                     373
                  RET     1                                             374
/SUBRT CHK--LOOKS AT NEXT TWO WORDS ON PARAM LIST (CTLIST--153) AFTER FINDING
/A PARAMETER WORD INDEX, FIRST WORD MUST BE = SIGN(EXP 2, MANT 1). NEXT WORD
/MUST BE VALUE REQUESTED (EXP ZERO). LOAD X1 WITH POINTER TO MAX VALUE TABLE
/AND X5 WITH VALUE REQUESTED FOR RETURN TO CALLING LOCN                 400
CHK       X3      MOD     1             X3 POINTS TO CTLIST
          X5      LD      X3                                            402
          EXP5    XF      X5            LOOK FOR = SIGN
                  TEST    2                                             404
          NZ      J       ERR6                                          405
          LOCN    XF      X5                                            406
                  TEST    1                                             407
          NZ      J       ERR6                                          410
          X3      MOD     1                                             411
          X5      LD      X3                                            412
          EXP5    XF      X5                                            413
                  TEST    0                                             414
          NZ      J       ERR6                                          415
          X1      LDA     152           X5=PARAM VALUE REQUEST. SET UP
          X1      LD      X1            X1 TO POINT TO MAX VAL VECTOR
          X1      LD      X1+2                                          420
                  RET     1                                             421
                                                                        422
/GO TO ERROR PRINTER, THEN RETURN TO OPERATING ROUTINE                  423
/FOR RETYPING OF PARAMETERS                                             424
ERR16             TEST    2                                           425
          ZE      J       STFULL                                      426
                  CLA     c16                                         427
                  J       ERPR                                        430
STFULL            CLA     c17                                         431
                  TOM     c224                                        432
                  RET     1                                           433
ERR6              CLA     6                                           434
                  J       ERPR                                        435
ERR10             CLA     c10                                         436
                  J       ERPR                                        437
ERR14             CLA     c14                                         440
ERPR              TOM     c224                                        441
          X1      LDA     153                                         442
          X1      LD      X1                                          443
                  LUR     12                                          444
                  ADD     c1000                                       445
          X2      LDA     141                                         446
                  J       X2                                          447
```



<131

```
/PROGRAM +145 BUTTIN

          U     STO     X0          SAVE DEVICE NO.

OPRT                    TEST        c1000       TEST STANDARD ENTRY
          LT    J       INTERRUP
          
                SUB     c1000
                J       ALPHA

INTERRUP                TEST        0           TEST TIMER
          NZ    JCC     DEVICE
          X2    LDA     c252        PROC NO.→X2
          X3    LDA     135         PBAS→X3
          X3    MOD     X2
          X3    LD      X3          PROC BASE ADDR→X3
          U     LD      X3+19       TIME ALLOWED→U
                SUB     1
          U     STO     X3+19
          ZE    J       NOTIME      TEST OVERFLOW
                RET     13          NO OVERFLOW.
NOTIME                  TOM         c216        OVERFLOW
          U     TAG     3
                RET     13

DEVICE                  TEST        5           TEST DEVICE
          LE    J       ALPHA

                CLA     1
                TOM     c224

                RET     13

ALPHA     X2    CPY     U
                TEST    5           TEST TAPE READER
          NZ    J       READ

          U     LDA     c221        BUFFR ADDR→U
                TOM     c223        READ TAPE
                J       SCAN

READ      U     LDA     c221        BUFFR ADDR→U
                TOM     c213        READ TPWTR

SCAN      1     SYS     198         LINE SCAN

          X3    LDA     137         DEVC→X3
          X3    MOD     X2
          U     LD      X3
                TEST    0           WHO OWNS DEVICE
          ZE    JCC     K           SYSTEM

          X3    CPY     U
          X4    LDA     c231        USER
                LUL     12
                ADD     X2
          U     STO     X4          DEVC NO+OWNER NO→U
```

```
                X2      LDA     c227            CST→X2                  74
                        LDR     1                                       75
                U       CPY     X14             NAME→U                  76
                1       SYS     148             GO TO STALK             77
                X5      CPY     U               COMMD INDEX → X5        100
                        STR     U                                       102
                        TEST    0               TEST NAME FOUND
                NZ      JCC     ERROR3          INVALID COMMD           104
                X2      LDA     c211            DEVC → X2               105
                X2      MOD     X0+1                                    106
                X4      LD      X2              OWNING PROC → X4
                X3      LDA     c231                                    110
                X3      MOD     1                                       111
                U       LD      X3              PROC NAME → U           112
                        LDR     1                                       113
                X2      LDA     136             STAB → X2               114
                1       SYS     148             GO TO STALK             115
                X2      CPY     U               PROC NO. → X2           116
                        STR     U               TEST NAME FOUND
                        TEST    0                                       120
                NZ      J       ERROR22         UNDEFINED PROC
                U       CPY     X4                                      122
                        TEST    X2                                      123
                NZ      JCC     ERROR20         WRONG PROC              124
                U       LDA     154             COMMD POINTER → U
                U       MOD     X5                                      126
                1       JSM     U               COMMAND ROUTINE
                        RET     13                                      130
                                                                        131
ERROR20                 CLA     c20                                     132
                        J       ERPRT                                   133
ERROR3                  CLA     3                                       134
                        J       ERPRT                                   135
ERROR22                 CLA     c22                                     136
ERPRT                   TOM     c224                                    137
                U       LD      X0+1            DEVICE NO. →U           140
                        J       ALPHA           TRY AGAIN               141
                                                                        142
K                       CLA     X14                                     143
                        TEST    PROC                                    144
                ZE      JCC     L                                       145
                                                                        146
                        CLA     4                                       147
                        TOM     c224                                    150
                        J       ALPHA                                   151
                                                                        152
L                       CLA     X2              GO TO PROC              153
                        LUL     12                                      154
                X4      LDA     c231                                    155
                U       STO     X4                                      156
                X1      LDA     131                                     157
                1       JSM     X1                                      160
                        RET     13                                      161
                                                                        162
PROC=c4023146714214                                                     163
                                                                        164
/END OF PROGRAM 145→→LNMC                                               165
                                                                        166
```

```
                                                                        1
/EXPRESSION RECOGNITON ROUTINE                                          2
/VERSION 2.                                                             3
/                                                                       4
/THE SEARCH FOR ALTERNATIVES                                            5
/                                                                       6
L7      X2      CPY     a0                                              7
L1      X1      LD      X4              TG                              10
        AT      J       L3                                              11
                                                                        12
        IR      J       L2                                              13
                SUB     X3                                              14
        NZ      J       L5                                              15
        X3      JNL     L2                                              16
L5      X2      LD      X2+1                                            17
        X4      JNL     L1                                              20
        X1      CPY     X14                                             21
        1       RET     2                                               22
                                                                        23
L3      X3      STO     X0                                              24
        X4      STO     X0                                              25
        X5      STO     X0                                              26
        X2      STO     X0                                              27
        X4      CPY     X1              TG                              30
        2       J       L10                                             31
        IR      J       L4                                              32
        X2      LD      X0                                              33
L2      X2      STO     X1              TG                              34
        1       RET     1                                               35
L4      X2      LD      X0                                              36
        X5      LD      X0                                              37
        X4      LD      X0                                              40
        X3      LD      X0                                              41
                J       L5                                              42
/                                                                       43
/SEQUENTIAL SEARCH                                                      44
/                                                                       45
L10     X2      CPY     a0                                              46
L18     X4      STO     X0                                              47
L11     X1      LD      X4              TG                              50
        NZ      J       L13                                             51
                SUB     X3                                              52
        ZE      J       L12                                             53
        X1      CPY     X14                                             54
        1       RET     2                                               55
L12     X3      JL      0                                               56
        X4      JL      L15                                             57
                J       L11                                             60
L13     X2      LD      X2+1                                            61
        X2      STO     X0                                              62
        X4      STO     X0                                              63
        X4      CPY     X1              TG                              64
        CT      J       L14                                             65
        1       J       L7                                              66
                J       a1                                              67
L14     1       J       X1                                              70
        X4      LD      X0                                              71
        X2      LD      X0                                              72
        X1      STO     X0              TG                              73
```

```
            X4      JNL     L11                             74
L15                 CLA     X2                              75
            NZ      J       L16                             76
            1       RET     2                               77
L16         X1      CPY     X5                              100
            X1      LIM     X2                              101
            X5      MOD     X2+1            TG              102
L17         X4      LD      X0              TG              103
            X6      CPY     X1                              104
            X6      MOD     X2                              105
            X4      STO     X6                              106
            X2      JGE     L17                             107
            1       RET     1                               110
<142                                                        111
```

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```
/REORGANIZATION
/ALAN BEALE

/THIS PROGRAM REORGANIZES THE STORAGE BELONGING TO A GIVEN PROCESS. THIS STORA
/GAPS, THAT IS, FREED BLOCKS, AND HOLES, BLOCKS OF STORAGE OUTSIDE THE PROCESS
/STEX DOMAIN. THE GAPS ARE FILLED IN, SO THAT STORAGE IS MADE AS CONTIGUOUS AS
/WHILE THE HOLES ARE LEFT INTACT.

/LEVEL 1 -- PROLOGUE. SAVE THE REGISTERS AND CALL THE PROGRAM PROPER. UPON RET
/REGISTERS AND LEAVE.

                SMD     0               DISABLE INTERRUPTS
          X2    SVF     X15+23          X2 SERVES THROUGHOUT AS FIRSTE
          X3    SVF     X15+24          X3 SERVES AS LASTEX
          X4    STO     X0
          X5    STO     X0
          X6    STO     X0
          X7    STO     X0
          X8    STO     X0
          X9    STO     X0
          X10   STO     X0
          X11   STO     X0
          X12   STO     X0
          X13   STO     X0
          X14   STO     X0
          2     JSM     HOLES           THE JSM 2 ALLOWS A RETURN TO BE
/                                       FROM THE THIRD LEVEL
          X14   LD      X0              RESTORE THE REGISTERS
          X13   LD      X0
          X12   LD      X0
          X11   LD      X0
          X10   LD      X0
          X9    LD      X0
          X8    LD      X0
          X7    LD      X0
          X6    LD      X0
          X5    LD      X0
          X4    LD      X0
          X3    LD      X0
          X2    LD      X0
                RET     1               GET BACK

/LEVEL 2 -- PHASE 1
/THIS PHASE PUTS THE LOCATION OF EACH HOLE ON THE STACK FOR FURTHER REFERENCE.
/1 JSM TO PHASE 2.
/REGISTER USAGE IS --
/X2 -- FIRSTEX
/X3 -- LASTEX
/X7 -- POINTER TO HEADER OF CURRENT BLOCK
/X10 -- WORK REGISTER
/X13 -- HOLE COUNTER

HOLES     X7    CPY     X2              INITIALIZE X7 TO FIRSTEX
          X13   DATA    0               SET HOLE COUNTER TO ZERO
FINDHOLE  X1    DATA    3
          HTAG  RF      X7              GIVE HEADER NUMERIC TAG
          LOCN  XF      X7              EXTRACT RELATIVIZED LOCN
```

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          X10    CPY     X1                STORE IN X1          74
          X1     DATA    12                                     75
          HTAG   RF      X7                MAKE ADDRESS AGAIN
          X1     CPY     X10                                    77
                 TEST    1                 IS THERE A HOLE
          ZE     JCC     ENDHOLE           IF NOT, GO TO ENDHOLE
          X7     TAG     0                 GIVE NUMERIC TAG SO POINTER ON
/                                          NOT BE DISTURBED BY GARBAGE COR
          X7     STO     X0                                     104
          X7     TAG     2                 CHANGE BACK TO ADDRESS
          X13    LD      X13+1             INCREMENT HOLE COUNTER
ENDHOLE   LNGTH  XF      X7                                     107
          X10    CPY     X1                SAVE LENGTH IN X10
          X7     LD      X7                LOAD HEADER          111
          X1     DATA    2                                      112
          ITAG   RF      X7+c37777                              113
          X7     MOD     X10               MOD TO POINT TO NEXT HEADER
          X10    CPY     X7                                     115
          X10    MEM     X3                HAS END BEEN REACHED
          IR     JCC     FINDHOLE          NO, LOOP             117
          X5     CPY     X0                SAVE STACK POINTER IN X5
          X13    STO     X0                STORE HOLE COUNTER
          1      JSM     REORG             ENTER PHASE 2        122
                                                                123
/LEVEL 2 ** PHASE 5                                             124
/AT THIS POINT, REORGANIZATION IS NEARLY COMPLETE. THIS PHASE HAS TO MAKE FINAL
/THE HEADERS PRECEDING HOLES. THUS, IF THERE ARE NO HOLES, THIS PHASE IS UNNECE
/ENTRY TO THIS PHASE, THE LAST BLOCK IN A SEGEMNT WILL HAVE A HEADER POINTING
/THUS, THE HOLE MAY SEEM ENLARGED. THIS PHASE REDUCES THE HOLE TO ITS FORMER S
/FILLS THE SEGMENT WITH FREE STORAGE.                            131
/REGISTER USAGE IS **                                           132
/X3 ** LASTEX                                                   133
/X5 ** POINTER TO THE LIST OF HOLES MADE IN PHASE 1             134
/X7 ** POINTER TO THE HEADER OF THE CURRENT BLOCK               135
/X8 ** POINTER TO THE NEXT HOLE                                 136
/X10 ** WORK REGISTER                                           137
/X13 ** NUMBER OF UNPROCESSED HOLES                             140
                                                                141
                 CLA     X0                GET NUMBER OF HOLES FROM STACK
          ZE     JCC     THRU              IF NONE, RETURN
          X13    CPY     X1                SAVE NO. HOLES IN X13
          X3     LD      X15+24            SET X3 TO LASTEX
          X7     LD      X15+23            INITIALIZE X7 TO FIRSTEX
          X5     CPY     X0                SET UP X5 TO POINT TO THE HOLE
          X10    CPY     X5                                     150
          X10    MOD     X13                                    151
          X8     LD      X10               X8 NOW CONTAINS THE FIRST HOLE
          X8     TAG     2                 MAKE IT NUMERIC
PATCHOLE  X1     DATA    3                                      154
          HTAG   RF      X7                MAKE HEADER NUMERIC
          LOCN   XF      X7                EXTRACT THE RELATIVIZED LOCN
          X10    CPY     X1                                     157
          X1     DATA    12                                     160
          HTAG   RF      X7                MAKE HEADER ADDRESS AGAIN
                 CLA     X10-1             IS THERE A HOLE
          ZE     JCC     ENDPATCH          NO, LEAVE            163
HOLECYC   X10    CPY     X7                                     164
          X10    MEM     X8                DOES THIS HOLE NEED CORRECTION
          ZE     JCC     NEXTHOLE          NO, SKIP CORRECTION
```

```
                X10     LD      X7                                      167
                X10     STO     X8      MOVE HEADER TO FRONT OF HOLE
                X8      STO     X7      OVER THE HEADER STORE A POINTE
                X1      DATA    3                                       172
                HTAG    RF      X7      MAKE IT NUMERIC
                LOCN    XF      X7      GET RELATIVE LOCN
                        SUB     1                                       175
                LNGTH   RF      X7      CREATE A BLOCK FROM HEADER TO
                X1      DATA    1                                       177
                LOCN    RF      X7      STILL NUMERIC                   200
                X1      DATA    12                                      201
                HTAG    RF      X7      MAKE ADDRESS AGAIN
                X1      DATA    2                                       203
                PTAG    RF      X7      MARK AS FREE                    204
                X7      CPY     X8      UPDATE X7                       205
NEXTHOLE                CLA     X13-1                                   206
                ZE      JCC     LASTBLOK LAST HOLE                      207
                X13     CPY     X1      NO, DECREMENT X13
                LOCN    XF      X8      GET LOCN OF CURRENT HOLE
                X10     CPY     X1                                      212
                X8      CPY     X5                                      213
                X8      DOT     X13     GET NEXT HOLE                   214
                X8      TAG     2                                       215
                LOCN    XF      X8+c37777                               216
                        TEST    X10     DOES THE HEADER SPAN ANOTHER H
                LE      JCC     HOLECYC IF SO, REPEAT                   220
ENDPATCH        LNGTH   XF      X7      GET THE NEXT BLOCK AND LOOP
                X7      LD      X7                                      222
                X7      MOD     X1                                      223
                X1      DATA    2                                       224
                ITAG    RF      X7+c37777                               225
                        J       PATCHOLE                                226
LASTBLOK        X10     CPY     X7                                      227
                X10     MEM     X3      IS THIS THE LAST BLOCK
                IR      JCC     THRU    IF NOT, LEAVE                   231
                LNGTH   XF      X7      IF SO, UPDATE PROCBASE POINTERS
                        ADD     1                                       233
                LNGTH   RF      X7+c37777                               234
                X7      STO     X15+24                                  235
                X7      STO     X15+28                                  236
THRU                    RET     2       RETURN TO LEVEL 1 AND LEAVE
                                                                        240
/LEVEL 3 -- PHASE 2                                                     241
/THIS PHASE COMPUTES THE DISPLACEMENT-TO-BE OF EACH BLOCK, IF THIS DISPLACEMENT
/IT IS RECORDED IN THE IO FIELD OF THE HEADER, IF IT IS TOO LARGE, THE IO IS SE
/DISPLACEMENT IS STACKED, FROM THEN ON, THE DISPLACEMENTS RECORDED IN IO ARE RE
/STACKED VALUE.                                                         245
/REGISTER USAGE IS--                                                    246
/X2 AND X3 AS USUAL                                                     247
/X4 -- INDEX OF NEXT STACK ENTRY                                        250
/X5 -- POINTER TO STACKED LIST OF HOLES                                 251
/X6 -- INDICATES WHETHER LASTEX HAS BEEN REACHED                        252
/X7 -- POINTER TO HEADER OF CURRENT BLOCK                               253
/X8 -- LOCATION FIELD OF NEXT HOLE                                      254
/X10 -- WORK REGISTER                                                   255
/X11 -- LAST DISPLACEMENT PUT ON STACK                                  256
/X12 -- INDICATES WHETHER ANY BLOCK HAS NON-ZERO DISPLACEMENT           257
/X13 -- INDEX OF CURRENT HOLE IN X5                                     260
/X14 -- NEXT AVAILABLE LOCATION                                         261
```

```
                                                                  262
REORG     X7      CPY     X2      INITIALIZE X7 TO FIRSTEX
          X11     DATA    0       START OFF WITH DISPLACEMENT OF
          X6      DATA    0       NO LASTEX                       265
          X12     DATA    0       NO NONZERO DISPLACEMENT YET
          X4      DATA    1       READY FOR FIRST ENTRY ON STACK
          LOCN    XF      X7
          X14     CPY     X1                                      270
                  CLA     X13     SET X14 TO LOCN(FIRSTEX)
          NZ      JCC     2       FROM PHASE1 = NUMBER OF HOLES
          X8      DATA    TOOMUCH                                 273
/                                 IF NO HOLES, LOAD X8 WITH A RID
                                  LARGE VALUE, c4000001
                  J       MARKDISP                                276
          X10     CPY     X5                                      277
          X10     MOD     X13                                     300
          LOCN    XF      X10                                     301
          X8      CPY     X1      X8 NOW CONTAINS LOCN(NEXT HOLE)
MARKDISP  PTAG    XF      X7                                      303
                  TEST    2       IS THIS BLOCK FREE
          ZE      JCC     ENDMARK YES, GET NEXT BLOCK
TRYFIT    LNGTH   XF      X7      FIND NEW LOCATION OF LAST MEMBE
                  ADD     X14                                     307
                  TEST    X8      WILL IT FIT IN THE CURRENT SEGM
          LE      JCC     WILLFIT YES                             311
          X14     CPY     X5      NO, TRY NEXT SEGMENT
          X14     DOT     X13     LOAD CURRENT HOLE
          X14     TAG     2       CHANGE BACK TO ADDRESS
          LOCN    XF      X14     LOCN OF BLOCK FOLLOWING HOLE
          X14     CPY     X1                                      316
          X13     LD      X13-1   DECREMENT HOLE COUNT
                  CLA     X13                                     320
          ZE      JCC     STAKOUT LAST HOLE                       321
          X10     CPY     X5      NEXT HOLE                       322
          X10     MOD     X13                                     323
          LOCN    XF      X10                                     324
          X8      CPY     X1                                      325
                  J       TRYFIT  TRY AGAIN                       326
STAKOUT   X8      DATA    TOOMUCH SET X8 VERY LARGE
WILLFIT   LOCN    XF      X7      COMPUTE DISPLACEMENT
                  SUB     X14     ACTUAL DISPLACEMENT
                  SUB     X11     ADJUSTED DISPLACEMENT
          LT      JCC     STACK   IF NEGATIVE, ADD TO STACK
                  TEST    ON14    IF TOO LARGE TO FIT IN IO FIEL
          LT      JCC     REPLACE                                 335
STACK     X4      LD      X4+1    INCREMENT STACK COUNTER
                  ADD*    X11     REAL DISPLACEMENT
          X11     STO     X0      STACK                           340
          X1      DATA    0       RESET X1 TO 0 TO INDICATE STAC
REPLACE           LDR     X1      SAVE DISPLACEMENT IN R
          LNGTH   XF      X7                                      343
                  ADD*    X14     INCREMENT NEXT AVAILABLE PLACE
          X14     LD      X14+1                                   345
                  STR     X1      PUT DISPLACEMENT BACK IN U
                  OR      EXP     SEE IF -0                       347
          ONES    JCC     1                                       350
          X12     DATA    1       IF NOT, TURN ON X12
          IO      RF      X7      PUT DISPLACEMENT IN IO OF HEAD
                  CLA     X6                                      353
          NZ      JCC     GARBAGE IF LAST BLOCK, GO TO PHASE 3
```

```
ENDMARK   LNGTH   XF      X7          GET NEXT BLOCK
          X10     CPY     X1                        356
          X7      LD      X7                        357
          Y1      DATA    2                         360
          ITAG    RF      X7+c37777                 361
          X1      DATA    0                         362
          I0      RF      X7+c37777   REMOVE I0 IN X7 TO PREVENT ERR
          X7      MOD     X10                       364
          X10     CPY     X7                        365
          X10     MEM     X3          LAST BLOCK    366
          IR      JCC     MARKDISP    NO. GO AGAIN  367
                  CLA     X13         ANY HOLES LEFT
          ZE      JCC     STOREND     NO. SKIP TO STOREND
          X14     LD      X13+1       LAST HOLE     372
          X14     TAG     2           MAKE ADDRESS  373
          LOCN    XF      X14         PLACE AFTER LAST HOLE
          X14     CPY     X1          UPDATE X14    375
STOREND   X6      DATA    1           SIGNAL LAST BLOCK
                  J       WILLFIT                   377
                                                    400
/LEVEL 3 -- PHASE 3                                 401
/THIS PHASE PERFORMS GARBAGE CORRECTION, THAT IS, IT SEARCHES FOR ADDRESSES AN
/AND CORRECTS THEM TO POINT TO CORRECTED LOCATIONS, SO THAT AFTER MEMORY IS RE
/WILL ALL POINT CORRECTLY.                          404
/REGISTER USAGE IS AS FOLLOWS --                    405
/X2 AND X3 -- AS USUAL                              406
/X4 -- NUMBER OF ENTRIES ON THE STACK CREATED BY PHASE 2   407
/X5 -- PSEUDO-STACK POINTER                         410
/X6 -- CURRENT BLOCK BEING CHECKED (WITHIN THE WORDLOOP ONLY)   411
/X7 -- CURRENT BLOCK BEING SEARCHED                 412
/X9 -- POINTER TO THE WORD BEING CHECKED            413
/X10 -- WITHIN WORDLOOP, THE WORD TO BE CORRECTED, ELSEWHERE, A WORK REGISTER
/X11 -- LAST DISPLACEMENT TAKEN FROM STACK          415
/X12 -- WITHIN MEMLOOP, THE WORD TO BE CORRECTED    416
/X13 -- INDEX OF NEXT ENTRY ON PSEUDO-STACK         417
                                                    420
GARBAGE             CLA     X12         ARE THERE ANY NON-ZERO DISPLACE
          ZE        JCC     THRU        IF NOT, QUIT AND GO HOME
          X7        CPY     X2          INITIALIZE X7 TO FIRSTEX
          X5        CPY     X0          SET UP THE PSEUDO-STACK
CORRECT   ITAG      XF      X7                        425
                    TEST    2           IS THIS BLOCK MIXED
          NZ        JCC     NEXTBLOK    IF NOT, GO TO THE NEXT BLOCK
          PTAG      XF      X7                        430
                    TEST    2           IS IT FREE    431
          ZE        JCC     NEXTBLOK    IF SO, GET NEXT BLOCK
          X9        LD      X7          PUT FIRST WORD OF BLOCK IN X9
          X1        DATA    0                         434
          I0        RF      X9+c37777   CORRECT I0    435
WORDLOOP  X10       LD      X9                        436
          NT,IR     JCC     NEXTWORD    DOES IT NEED CORRECTION
          AT        JCC     FOMEM       IS IT ADDRESS 440
          X10       DATA    0           IF CONTROL, CREATE A DUMMY ADDR
/                                       FOR USE WITH MEM
          LOCN      XF      X9                        443
          LOCN      RF      X10                       444
          X1        DATA    1                         445
          ITAG      RF      X10                       446
          X10       TAG     2                         447
```

```
FOMEM     X12    CPY    X10      PUT WORD TO BE CHECKED IN X12
          X6     CPY    X2       INITIALIZE X6  451
          X13    CPY    X4       INITIALIZE X13
          X11    DATA   0        MAKE 1ST DISPLACEMENT 0
MEMLOOP   PTAG   XF     X6                      454
          TEST   2                IS THE BLOCK BEING CHECKED FREE
          ZE     JCC    MEMEND   YES, LOOP      456
          X10    LD     X6                      457
          X12    MEM    X10      DOES X12 POINT INTO THIS BLOCK
          VR     JCC    FOUND    YES, LEAVE     461
          IO     XF     X6       FIND DISPLACEMENT OF THIS BLOCK
          TEST   0                               463
          NZ     JCC    MEMEND   IF STACK IS NOT INVOLVED, LOOP
          CLB    X1       IS IT A -0     465
          NNUL   JCC    MEMEND   IF SO, LOOP    466
          X13    LD     X13-1    UPDATE PSEUDO-STACK COUNTER
          X11    CPY    X5                      470
          X11    DOT    X13                     471
MEMEND    LNGTH  XF     X6       GET NEXT BLOCK
          X10    CPY    X1                      473
          X6     LD     X6                      474
          X1     DATA   2                       475
          ITAG   RF     X6+c37777               476
          X1     DATA   0                       477
          IO     RF     X6+c37777               500
          X6     MOD    X10                     501
          X10    CPY    X6                      502
          X10    MEM    X3       HAS LASTEX BEEN REACHED
          IR     JCC    MEMLOOP  NO, LOOP       504
NEXTWORD  X9     MOD    1        NEXT WORD      505
          X10    CPY    X9       HAS THE NEXT BEEN REACHED
          X10    JNL    WORDLOOP IF NOT, RELOOP
NEXTBLOK  LNGTH  XF     X7       PUT NEXT BLOCK IN X7
          X10    CPY    X1                      511
          X7     LD     X7                      512
          X1     DATA   2                       513
          ITAG   RF     X7+c37777               514
          X1     DATA   0                       515
          IO     RF     X7+c37777               516
          X7     MOD    X10                     517
          X10    CPY    X7                      520
          X10    MEM    X3       HAS LASTEX BEEN REACHED
          IR     JCC    CORRECT  NO, LOOP       522
                 J      MOVE     YES, GO TO PHASE5
FOUND     LOCN   XF     X9       GET LOCN OF TO-BE-CORRECTED WO
          X10    CPY    X1                      525
          IO     XF     X6       GET DISPLACEMENT
                 CLB    X1                      527
          NNUL   JCC    NOSTACK  IF NOT +0, NO NEED TO ACCESS S
          X13    LD     X13-1                   531
          X11    CPY    X5                      532
          X11    DOT    X13      GET NEXT ENTRY
          X1     DATA   0                       534
NOSTACK   CLA    X1                             535
          ZE     JCC    1        IF NOT ZERO, AND WITH ON14 TO
                 AND    ON14     A POSITIVE NUMBER
                 ADD    X11      ADD TO LAST STACK ENTRY
                 SUB    X10      SUBTRACT FROM OLD LOCN
          LOCN   RF     X9       REPLACE LOCN   542
```

```
                J       NEXTWORD                GET NEXT WORD   543
                                                                544
/LEVEL 3 -> PHASE 4                                             545
/THIS PHASE PHYSICALLY MOVES THE STORAGE BLOCKS TO FILL UP THE GAPS. REGISTER
/X2 AND X3 -> AS USUAL                                          547
/X4 -> NUMBER OF STACKED DISPLACEMENTS, LATER A WORK REGISTER    550
//X5 -> THE PSEUDO-STACK                                        551
/X6 -> THE PLACE FOR THE NEXT HEADER WORD                       552
/X7 -> THE POINTER TO THE HEADER WORD OF THE BLOCK BEING MOVED
/X8 -> INDICATES WHETHER LASTEX HAS BEEN REACHED                554
/X10 -> THE POSITION TO BE MOVED INTO                           555
/X11 -> THE LAST DISPLACEMENT TAKEN FROM THE PSEUDO-STACK       556
/X12 ->THE POSITION BEING MOVED FROM                            557
/X13 -> THE CURRENT INDEX WITHIN THE PSEUDO-STACK               560
/X14 -> THE ACTUAL DISPLACEMENT                                 561
                                                                562
MOVE    X7      CPY     X2              INITIALIZE X7           563
        X8      DATA    0               NO LASTEX YET           564
        X11     DATA    0               START DISPLACEMENT AT 0
        X13     CPY     X4                                      566
        X6      CPY     X2              INITIALIZE X6           567
CONDENSE PTAG   XF      X7                                      570
                TEST    2               IS THIS BLOCK FREE
        ZE      JCC     IGNORE          IF SO, IGNORE IT
SHIFT   IO      XF      X7              EXTRACT IO              573
                CLB     X1                                      574
        NNUL    JCC     DISPLACE        IF NULL, GO TO STACK
        X13     LD      X13-1           DECREMENT INDEX
        X1      CPY     X5                                      577
        X1      DOT     X13                                     600
        X11     CPY     X1              UPDATE X11              601
                CLA     X1              SET CC ARITHMETICALLY
                J       4                                       603
DISPLACE        CLA     X1                                      604
        ZE      JCC     1               IF 0, DO NOT AND
                AND     ON14            TREAT AS UNSIGNED INTEGER
                ADD     X11             ADD TO UNSTACKED DISPLACEMENT
        ZE      JCC     LEAVE           IF NO DISPLACEMENT, GO TO LEAVE
        X14     CPY     X1              UPDATE X14              611
        LOCN    XF      X7                                      612
                SUB     X14             PLACE FOR FIRST WORD
        X10     LD      X7                                      614
        LOCN    RF      X10+c37777      MAKE X10 POINT THERE
        PTAG    XF      X7                                      616
        PTAG    RF      X10+c37777      GIVE X10 SAME PTAG
        X1      DATA    0                                       620
        IO      RF      X10+c37777                              621
        IO      RF      X7              WIPE OUT IO'S           622
        X10     STO     X6              STORE AS HEADER WORD
                CLA     X8              IS IT LAST BLOCK
        NZ      JCC     LENGTHEN        IF SO, GO TO LENGTHEN
        X12     LD      X7              SET UP X12              626
MOVELOOP X1     LD      X12                                     627
        X1      STO     X10             MOVE                    630
        X10     MOD     1                                       631
        X12     MOD     1                                       632
        X1      CPY     X12                                     633
        X1      JNL     MOVELOOP        IF HEADER HAS NOT BEEN REACHED,
        X7      CPY     X12             SET X7 TO POINT TO NEXT HEADER
```

```
                X6      CPY     X10             RESET X6                636
                X1      DATA    2                                       637
                ITAG    RF      X7+c37777                               640
                ITAG    RF      X6+c37777                               641
                        J       ENDCHECK                                642
LEAVE                   CLA     X8              IS THIS THE LAST BLOCK
                NZ      JCC     PROCBASE        IF SO, UPDATE THE PROCESS BASE
                LNGTH   XF      X7              PUSH BOTH X6 AND X7 AHEAD ONE
                X10     CPY     X1                                      646
                X1      DATA    0                                       647
                IO      RF      X7                                      650
                X7      LD      X7                                      651
                X1      DATA    2                                       652
                ITAG    RF      X7+c37777                               653
                X7      MOD     X10                                     654
                X6      CPY     X7                                      655
                        J       ENDCHECK                                656
IGNORE          LNGTH   XF      X7              PUSH X7 ONLY AHEAD
                X10     CPY     X1                                      660
                X7      LD      X7                                      661
                X1      DATA    2                                       662
                ITAG    RF      X7+c37777                               663
                X7      MOD     X10                                     664
ENDCHECK        X1      DATA    0                                       665
                IO      RF      X7+c37777                               666
                X10     CPY     X7                                      667
                X10     MEM     X3              LAST BLOCK              670
                IR      JCC     CONDENSE                                671
                X8      DATA    1               IF SO, TURN ON X8
                        J       SHIFT           MOVE IT                 673
LENGTHEN        LNGTH   XF      X6              EXTEND THE LAST BLOCK TO COVER
/                                               OF THE STORAGE POOL
                        ADD     X14                                     676
                LNGTH   RF      X6                                      677
                        ADD     1                                       700
                LNGTH   RF      X6+c37777                               701
                X1      DATA    2                                       702
                PTAG    RF      X6              GIVE FREE PTAG
                PTAG    RF      X6+c37777                               704
                X6      STO     X15+24          STORE AS LASTEX
                X6      STO     X15+28          AND FREE STORE POINTER
PROCBASE        X4      LD      X15+23          SET UP THE FIRSTEX POINTER
                X4      LD      X4                                      710
                LNGTH   XF      X4+c37777                               711
                X1      LD      X1+1                                    712
                LNGTH   RF      X4+c37777                               713
                LOCN    XF      X4+c37777                               714
                X1      LD      X1-1                                    715
                LOCN    RF      X4+c37777                               716
                X1      DATA    2                                       717
                ITAG    RF      X4+c37777                               720
                X4      STO     X15+23                                  721
                        RET     1               RETURN TO LEVEL 2
                                                                        723
/ON14 IS A SORT OF MASK. ON THE REAL R2, IT WILL = c37777, I.E., 14 BITS ON F
/14 BITS. IN THE SIMULATOR, HOWEVER, IO IS ONLY 8 BITS, SO ON14=c377.
                                                                        726
ON14=c377                                                               727
TOOMUCH=c4000001                                                        730
```

```
                                                                    1
/PROGRAM =148 STALK 224                                             2
/
/                   SYMBOL TABLE LOOK UP.  THIS PROGRAM
/                   FINDS OR ADDS ITEMS IN THE TABLE RE-
/                   FERENCED BY X2.  INPUT IS NAME IN U
/                   1 IN R FOR SEARCH, 0 FOR ADD, AND THE
/                   ADDRESS OF THE TABLE TO BE SEARCHED
/                   IN X2.  OUTPUT IS THE INDEX OF THE
/                   ITEM IN U, AND A 0 IN R IF THE ITEM
/                   WAS ORIGINALLY IN THE TABLE, 1 IF NOT.
/                   A 2 IS RETURNED IN R IF THE ITEM COULD
/                   NOT BE FOUND AND THE SYMBOL TABLE WAS
/                   FULL.
                    X3      STO     X0                              16
                    X4      STO     X0                              17
                    X5      STO     X0                              20
                    X6      STO     X0                              21
                    X9      STO     X0                              22
                    X7      STO     X0          SAVE REGS           23
                    X3      CPY     U           NAME=>X3            24
                    X4      CPY     X2          TABLE=>X4           25
                    X5      DATA    0                               26
                            STR     X5          CONDITION=>X5       27
                    LNGTH   XF      X2+C37777                       30
                    X6      CPY     U           TABLE LENGTH=>X6
                    X7      DATA    -1                              32
                    IO      XF      X2+C37777                       33
                    X9      CPY     U           IO=>X9              34
                    U       DATA    0                               35
                    IO      RF      X2+C37777                       36
                    IO      RF      X4+C37777                       37
NAMELOOP            U       LD      X2                              40
                            TEST    0           TEST NULL ENTRY
                    NZ      J       WHATNAME                        42
                            CLA     X7          TEST 1ST NULL ENTRY
                    GE      J       NEXTNAME                        44
                    LNGTH   XF      X2+C37777                       45
                            BUS     X6                              46
                    X7      CPY     U           INDEX OF NULL=>X7
                            J       NEXTNAME                        50
WHATNAME                    TEST    X3          ST ENTRY VS NAME
                    ZE      J       FOUND                           52
NEXTNAME            X2      JNL     NAMELOOP                        53
                            CLA     X7                              54
                            TEST    -1          TEST ST FULL        55
                    NZ      J       NOTFULL                         56
                            LDR     2                               57
                            J       GOBACK                          60
NOTFULL                     CLA     X5                              61
                            TEST    0           SEARCH OR ADD       62
                    ZE      J       ADD                             63
                            LDR     1           NAME NOT FOUND
                            J       GOBACK                          65
ADD                 X2      CPY     X4                              66
                    X2      MOD     X7                              67
                    X3      STO     X2          STORE NAME ON ST
                            CLA     X9          ADJUST INDEX        71
                            ADD     X7                              72
                    EXP5    RF      X2          STORE INEDEX IN EXP
```

```
                LDR     1                                       74
                J       GOBACK                                  75
FOUND   LNGTH   XF      X2+c37777                               76
                BUS+    X6                                      77
                CLA     X9          ADJUST INDEX                100
                ADD     X6          COMPUTE INDEX               101
                LDR     0                                       102
GOBACK  X7      LD      X0                                      103
        X9      LD      X0                                      104
        X6      LD      X0                                      105
        X5      LD      X0                                      106
        X2      CPY     X4                                      107
        X4      LD      X0                                      110
        X3      LD      X0                                      111
                RET     1                                       112
                                                                113
/END OF PROGRAM 148++LNMC                                       114
                                                                115
<148                                                            116
```

```
/PROGRAM -156 TRANS  c234                                          1
/                                                                  2
/                    TRANSLATE ROUTINE.  THIS PROGRAM
/                    DETERMINES WHAT PROCESS THE PROGRAM
/                    TO BE TRANSLATED IS TO BE LOADED IN,
/                    AND PUTS THE NAME OF THE PROGRAM IN
/                    THE SYSTEM PROCESS BASE, THEN RETURNS
/                    TO MIXMASTER, WHICH CALLS A ROUTINE
/                    THAT EXECUTES A TOM 340.
            X4      LDA     c231        LOAD PARAM POINTER
            X4      MOD     1                              13
            X2      LDA     136         STAB POINTER->X2
                    LDR     1                              15
            U       LD      X4          PROC NAME->U       16
            1       SYS     148         GO TO STALK        17
            X2      CPY     U           INDEX->X2          20
                    STR     U                              21
                    TEST    0           TEST NAME ON ST
            NZ      J       ERROR21                        23
            X4      MOD     1                              24
            U       LD      X4          NAME->U            25
            U       STO     X15+1       STORE IN PROC BASE
            X3      LDA     c252        SAVE OLD PROC NUMBER
                    LDR     X2          INDEX->R           30
            X2      STO     c252        CHANGE PROC NUMBER
            U       LDA     196         CW FOR THFTY->U
            1       SYS     c301        GO TO SWITCH       33
            X3      STO     c252                           34
                    RET     1                              35
ERROR21             CLA     c21                            36
                    TOM     c224        PRINT ERROR        37
            U       TAG     3                              40
                    RET     1                              41
                                                           42
/END OF PROGRAM 155<->LNMC                                 43
                                                           44
<156                                                       45
```

```
                                                                        1
/SET UP 152(CVT--NAMES, DEFAULT, AND MAX) FOR PROC                      2
        X5      LDA     152                                             3
        X5      LD      X5                                              4
        X6      CPY     X5                                              5
        X1      DATA    5                                               6
        X3      DATA    0                                               7
        LNGTH   RF      X3                                              10
        X1      DATA    1                                               11
        ITAG    RF      X3                                              12
        X1      CPY     X3                                              13
TAKE    1       SYS     130             TAKE SPACE FOR BLOCK 5 LNGTH
        X1      STO     X5                                              15
        X1      TAG     0                                               16
        X3      REX     X1                                              17
        X1      DATA    5                                               20
        LNGTH   RF      X3                                              21
        X3      REX     X1                                              22
        X5      JNL     TAKE                                            23
        X5      CPY     X6                                              24
READ    X1      LD      X6                                              25
                TOM     c223                                            26
        X6      MOD     1                                               27
        X1      LD      X6                                              30
                TOM     c222                                            31
        X6      JNL     -3                                              32
        X6      LD      X5                                              33
        X1      DATA    1                                               34
        EXP5    RF      X6                                              35
        X6      JNL     -2                                              36
/STORE COMMAND NAMES INTO CST (151)                                     37
        X1      LDA     151                                             40
                TOM     c223                                            41
/SET UP LIST OF SPECIAL CHARS FOR OPERATING RT                          42
/(CHLIST c305) STORE ' = ( ) . , IN LIST                                43
        X1      DATA    64                                              44
        X3      DATA    0                                               45
        LNGTH   RF      X3                                              46
        X1      DATA    1                                               47
        ITAG    RF      X3                                              50
        X1      CPY     X3                                              51
        1       SYS     130                                             52
        X1      STO     c305                                            53
                TOM     c223                                            54
        X2      CPY     X1                                              55
        X2      LIM     5                                               56
                LDR     X1                                              57
        X1      CPY     0                                               60
                LLS     6                                               61
SHFT            LLS     8                                               62
        X1      STO     X2                                              63
        X1      CPY     0                                               64
        X2      JNL     SHFT                                            65
/SET UP BUFFR c221 (18 WORDS LONG)                                      66
        X1      DATA    c20                                             67
        LNGTH   RF      X3                                              70
        X1      CPY     X3                                              71
        1       SYS     130                                             72
        X1      STO     c221                                            73
```

```
/STORE NAME IN SYMBOL TABLE FOR SYSTEM                    74
          X1      LDA     136                             75
                  TOM     c223                            76
                  TOM     c23                             77
<c253                                                     100
```

301

```
                                                                    1
                                                                    2
        X1      STO     X0                                          3
        X1      LDA     c207                                        4
        X1      LD      X1                                          5
        X1      MEM     X15                                         6
        ZE      JCC     SYSSAVE                                     7
        X1      LD      X0                                          10
        X0      STO     X15                                         11
        X2      STO     X15+2                                       12
        X3      STO     X15+3                                       13
        X4      STO     X15+4                                       14
        X5      STO     X15+5                                       15
        X6      STO     X15+6                                       16
        X7      STO     X15+7                                       17
        X8      STO     X15+8                                       20
        X9      STO     X15+9                                       21
        X10     STO     X15+10                                      22
        X11     STO     X15+11                                      23
        X12     STO     X15+12                                      24
        X13     STO     X15+13                                      25
        X14     STO     X15+14                                      26
                J       CALLRET                                     27
SYSSAVE X1      LD      X0                                          30
        X2      STO     X0                                          31
        X3      STO     X0                                          32
        X4      STO     X0                                          33
        X5      STO     X0                                          34
        X6      STO     X0                                          35
        X7      STO     X0                                          36
        X8      STO     X0                                          37
        X9      STO     X0                                          40
        X10     STO     X0                                          41
        X11     STO     X0                                          42
        X12     STO     X0                                          43
        X13     STO     X0                                          44
        X14     STO     X0                                          45
        X0      MV      X15+15                                      46
        X2      LD      X15                                         47
        X2      STO     X0                                          50
        X0      STO     X15                                         51
CALLRET X3      CPY     X15                                         52
        X2      CPY     X1                                          53
        NT      JCC     PRETURN                                     54
                STR     X1                                          55
                CLA     X1                                          56
        ZE      JCC     SYSCALL                                     57
        X15     LDA     c207                                        60
        X15     DOT     X1                                          61
        X0      LD      X15                                         62
        X3      STO     X0                                          63
        X2      STO     X0                                          64
        1       JSM     NONSYS                                      65
        X1      LD      X0+2                                        66
        X1      LD      X1+1                                        67
        13      JSM     X0                                          70
                J       RETURN                                      71
SYSCALL X15     LDA     c207                                        72
        X15     LD      X15                                         73
```

```
                X0      LD      X15                     74
                X2      STO     X15+2                   75
                X3      STO     X15+3                   76
                        LDR     X0+2                    77
                X14     LD      X0+3                    100
                X13     LD      X0+4                    101
                X12     LD      X0+5                    102
                X11     LD      X0+6                    103
                X10     LD      X0+7                    104
                X9      LD      X0+8                    105
                X8      LD      X0+9                    106
                X7      LD      X0+10                   107
                X6      LD      X0+11                   110
                X5      LD      X0+12                   111
                X4      LD      X0+13                   112
                X3      LD      X0+14                   113
                X2      LD      X0+15                   114
                X0      MV      X15+3                   115
                X1      LD      X0+1                    116
                X1      LD      X1+1                    117
                13      JSM     X15+2                   120
                        J       RETURN                  121
PRETURN                 STR     X2                      122
                        CLA     X2                      123
                ZE      JCC     RETO                    124
                X3      LDA     c207                    125
                X3      DOT     X2                      126
                        J       OTHRET                  127
RETURN          X2      LDA     c207                    130
                X2      LD      X2                      131
                X3      LD      X0                      132
                X2      MEM     X3                      133
                NZ,IR   JCC     OTHRET                  134
RETO            X15     LDA     c207                    135
                X15     LD      X15                     136
                X0      LD      X15                     137
                X2      LD      X0                      140
                X2      STO     X15                     141
                        LDR     X0                      142
                X14     LD      X0                      143
                X13     LD      X0                      144
                X12     LD      X0                      145
                X11     LD      X0                      146
                X10     LD      X0                      147
                X9      LD      X0                      150
                X8      LD      X0                      151
                X7      LD      X0                      152
                X6      LD      X0                      153
                X5      LD      X0                      154
                X4      LD      X0                      155
                X3      LD      X0                      156
                X2      LD      X0                      157
                        RET     1                       160
OTHRET          X15     CPY     X3                      161
                X0      LD      X15                     162
NONSYS          X2      LD      X15+2                   163
                X3      LD      X15+3                   164
                X4      LD      X15+4                   165
                X5      LD      X15+5                   166
```

```
      X6      LD      X15+6                   167
      X7      LD      X15+7                   170
      X8      LD      X15+8                   171
      X9      LD      X15+9                   172
      X10     LD      X15+10                  173
      X11     LD      X15+11                  174
      X12     LD      X15+12                  175
      X13     LD      X15+13                  176
      X14     LD      X15+14                  177
              LDR     X15+15                  200
              RET     1                       201
<C301                                         202
```

```
/PROGRAM ←195 THFTY C304
                LDR     0                                       1
                X2      LD.     X15+17                          2
                1       SYS     148     LOOK UP PROG NAMES      3
                X2      CPY     U                               4
                        STR     U                               5
                        TEST    2       TEST ST FULL            6
                ZE      J       ERROR17                         7
                        TEST    1       TEST OLD PROG           8
                ZE      J       NOFREE                          9
                U       CPY     X15                             10
                U       DOT     X2      CONTROLWORD→U           11
                U       STO     c302                            12
NOFREE                  TOM     c225    CALL ASSEMBLER          13
                X3      LDA     c302                            14
                U       CPY     X15                             15
                U       MOD     X2                              16
                X3      STO     U       PROG ADDR→VT            17
                        CLA     0                               18
                X1      STO     c302                            19
                        RET     13                              20
                                                                21
ERROR17                 CLA     c17                             22
                        TOM     c224                            23
                        RET     13                              24
                                                                25
/END OF PROGRAM 195←→LNMC                                       26
                                                                27
<196                                                            30
```

```
                                                                        1
/PROGRAM +198 SCAN  c306                                                2
B       X3      LDA     c221                    B                       3
                CLA     0                       B                       4
        X4      LD      X3                      BB                      5
                LDR     X4                      B                       6
                LLS     14                      B                       7
                STR     X4                      B                       10
                TEST    c100                    B                       11
        NZ      JCC     J                       B                       12
        X5      CPY     U                       B                       13
                CLA     1                       B                       14
        X6      CPY     U                       B                       15
CLOP            CLA     0                                               16
                LDR     X4                                              17
                LLS     3                       B                       20
                STR     X4                      BB                      21
                TEST    c200                    BB                      22
        LT      JCC     CMMD                    B                       23
                LRS     3                                               24
                LDU     X5                      B                       25
                LLS     3                       BB                      26
        X5      CPY     U                       BB                      27
                CLA     X6                      B                       30
                TEST    5                       B                       31
        GE      JCC     CMMD                    BB                      32
                ADD     1                       B                       33
        X6      CPY     U                       BB                      34
                J       CLOP                    BB                      35
CMMD    X14     CPY     X5                      B                       36
                TEST    5                                               37
        NZ      JCC     1                       B                       40
        1       JSM     NEXTCHAR                BB                      41
        X5      CPY     U                       BB                      42
        X6      LDA     151                     BB                      43
        LNGTH   XF      X6+c37777               BB                      44
        X7      CPY     U                       BB                      45
        U       CPY     X14                     BB                      46
CMLP            TEST    X6                      BB                      47
        ZE      JCC     CLIST                   BB                      50
        X6      JNL     CMLP                    BB                      51
                CLA     3                       BB                      52
                TOM     c224                    BB                      53
                J       K                       BB                      54
CLIST   LNGTH   XF      X6+c37777               BB                      55
                BUS     X7                      BB                      56
                ADD     c232                    BB                      57
        X13     CPY     U                       BB                      60
                CLA     1                       BB                      61
        EXP5    RF      X13                     BB                      62
        X13     TAG     1                       BB                      63
        X6      LDA     c231                    BB                      64
        X6      MOD     1                       BB                      65
ALPHA   U       CPY     X5                      C                       66
/THE FOLLOWING INSTRUCTION, UNEDITED, WAS A TEST c176.                  67
/UNTIL THE NEW SAMPLE IS AVAILABLE, IT MUST BE EDITED TO TEST 0.
                TEST    0                       D                       71
        NZ      JCC     E                       D                       72
                CLA     0                       DA                      73
```

```
                U       STO     X6              DA      74
                        CLA     2               DA      75
                EXP5    RF      X6              DB      76
                X6      MOD     1               DA      77
                        RET     1               DB      100
E                       TEST    c160                    101
                NZ      JCC     2                       102
                1       JSM     NEXTCHAR        E       103
                        J       ALPHA           E       104
                        TEST    c171            E       105
                NZ      JCC     2               E       106
                1       JSM     NEXTCHAR        E       107
                        J       ALPHA           E       110
                        TEST    2               E       111
                NZ      JCC     2               E       112
                1       JSM     NEXTLINE        EA      113
                        J       ALPHA           EA      114
                        CLA     0               G       115
                X7      CPY     U               G       116
                U       CPY     X5              G       117
                        TEST    c245            G       120
                ZE      JCC     NUMB            G       121
                        CLA     1               G       122
                        ADD*    X7              G       123
                U       CPY     X5              G       124
                        TEST    c246            G       125
                ZE      JCC     NUMB            G       126
                        CLA     1               G       127
                        ADD*    X7              G       130
                U       CPY     X5              G       131
                        TEST    c253            G       132
                ZE      JCC     NUMB            G       133
                        TEST    c200            G       134
                LT      JCC     IA              G       135
                        TEST    c211            G       136
                GT      JCC     H               G       137
                        CLA     1                       140
                        ADD*    X7                      141
                        J       GA              G       142
NUMB            1       JSM     NEXTCHAR        GA      143
GA              1       JSM     NUMBER          GA      144
                        LDU     X5                      145
                        TEST    c160                    146
                ZE      J       ALPHA                   147
                        TEST    c171                    150
                ZE      J       ALPHA                   151
                        TEST    c2                      152
                ZE      J       ALPHA                   153
                        TEST    c176                    154
                ZE      J       ALPHA                   155
                        TEST    0                       156
                ZE      J       ALPHA                   157
                        CLA     6                       160
                        TOM     c224                    161
                        J       K                       162
H                       TEST    c243            H       163
                GT      JCC     J               H       164
                1       JSM     IDENT           HA      165
                        J       ALPHA           HA      166
```

```
IA          X7      LDA     197             IA              167
            LNGTH   XF      X7+c37777                       170
            X9      CPY     U                               171
            U       CPY     X5                              172
SCLP        X5      LD      X7              IA              173
                    TEST    X5              IA              174
            ZE      JCC     CHART           IA              175
            X7      JNL     SCLP            IA              176
                    J       J               IA              177
CHART       LNGTH   XF      X7+c37777                       200
                    BUS     X9                              201
            U       STO     X6                              202
                    CLA     2               IA              203
            EXP5    RF      X6              IA              204
            X6      MOD     1               IA              205
            1       JSM     NEXTCHAR        IA              206
                    J       ALPHA           IA              207
J                   CLA     6               J               210
                    TOM     c224            J               211
K                   CLA     X2                              212
                    TEST    5               K               213
            ZE      JCC     LB              K               214
            U       LDA     c221            LA              215
                    TOM     c213            LA              216
                    J       8               LA              217
LB                  TOM     c223            LB              220
                    J       8               LB              221
                                                            222
NEXTCHAR            CLA     0                               223
                    LDR     X4                              224
                    LLS     8                               225
            NNUL    JCC     NNWD                            226
            X3      JL      NEWTYPE                         227
CHAR                LDR     X3                              230
                    LLS     14                              231
NNWD                STR     X4                              232
            X5      CPY     X1                              233
                    RET     1                               234
NEWTYPE     U       LDA     c221                            235
                    CLA     5                               236
                    TEST    X2                              237
            NZ      J       TYPE                            240
                    TOM     c223                            241
                    J       LINE                            242
TYPE                TOM     c213                            243
LINE        X3      LDA     145                             244
                    CLA     0                               245
                    J       CHAR                            246
                                                            247
NEXTLINE            TEST    X2                              250
            ZE      JCC     NEWLINE                         251
            1       JSM     NEXTCHAR                        252
                    RET     1                               253
NEWLINE     U       LDA     c221                            254
                    TOM     c213                            255
            X3      LDA     145                             256
                    LDR     X3                              257
                    LLS     14                              260
                    STR     X4                              261
```

```
                X5      CPY     U                       262
                        RET     1                       263
                                                        264
IDENT           X8      CPY     U                       265
NECH            1       JSM     NEXTCHAR                266
                        TEST    c200                    267
                LT      JCC     RTN                     270
                        LRS     8                       271
                        LDU     X8                      272
                        LLS     8                       273
                X8      CPY     U                       274
                        J       NECH                    275
RTN             X8      STO     X6                      276
                        CLA     1                       277
                EXP5    RF      X6                      300
                X6      MOD     1                       301
                        RET     1                       302
                                                        303
NUMBER          U       CPY     X5                      304
                        SUB     c200                    305
                X8      CPY     U                       306
                        CLA     X7                      307
                        TEST    0                       310
                NZ      JCC     NOTBIT                  311
NEXTBIT         1       JSM     NEXTCHAR                312
                        TEST    c200                    313
                LT      JCC     BACK                    314
                        TEST    c201                    315
                GT      JCC     BACK                    316
                        LRS     1                       317
                        LDU     X8                      320
                        LLS     1                       321
                X8      CPY     U                       322
                        J       NEXTBIT                 323
NOTBIT                  TEST    1                       324
                NZ      JCC     NOTOCT                  325
NEXTOCT         1       JSM     NEXTCHAR                326
                        TEST    c200                    327
                LT      JCC     BACK                    330
                        TEST    c207                    331
                GT      JCC     BACK                    332
                        LRS     3                       333
                        LDU     X8                      334
                        LLS     3                       335
                X8      CPY     U                       336
                        J       NEXTOCT                 337
NOTOCT                  TEST    2                       340
                NZ      JCC     DECIMAL                 341
NEXTHDC         1       JSM     NEXTCHAR                342
                        TEST    c200                    343
                LT      JCC     BACK                    344
                        TEST    c217                    345
                GT      JCC     BACK                    346
                        LRS     4                       347
                        LDU     X8                      350
                        LLS     4                       351
                X8      CPY     U                       352
                        J       NEXTHDC                 353
DECIMAL         1       JSM     NEXTCHAR                354
```

```
                TEST    c200                    355
        LT      JCC     BACK                    356
                TEST    c211                    357
        GT      JCC     BACK                    360
                SUB     c200                    361
        X5      CPY     X1                      362
                CLA     X8                      363
                MPY     10                      364
                ADD     X5                      365
        X8      CPY     U                       366
                J       DECIMAL                 367
BACK    X8      STO     X6                      370
        X6      MOD     1                       371
                RET     1                       372
                                                373
/END OF PROGRAM 198<->LNMC                      374
                                                375
<198                                            376
```

310

```
                                                                    1
                                                                    2
        X4      DATA    c2000453200000000                           3
        X9      LDA     c200                                        4
        LOCN    XF      X9+c37777                                   5
        X1      LD      X1+1                                        6
        LOCN    RF      X4                                          7
        X4      TAG     2                                           10
        X8      CPY     X9                                          11
        X8      MOD     1                                           12
        X8      LIM     300                                         13
        X1      DATA    1                                           14
        PTAG    RF      X8+c37777                                   15
        X8      STO     X9                                          16
        X8      STO     c311                                        17
        X9      MOD     301                                         20
        X10     CPY     X9                                          21
        X9      MOD     1                                           22
        X9      STO     X10                                         23
        X15     CPY     X4                                          24
        X10     STO     X4+24                                       25
        X10     STO     X4+28                                       26
        LNGTH   XF      X10+c37777                                  27
        X1      STO     X4+25                                       30
        X1      DATA    70                                          31
        X1      STO     X4+26                                       32
        X1      DATA    200                                         33
        X1      STO     X4+27                                       34
        X1      DATA    -1                                          35
        X1      STO     X4+19                                       36
        X0      CPY     X15                                         37
        X0      MOD     299                                         40
        X5      CPY     X15                                         41
        X5      MOD     100                                         42
        X1      DATA    c7777777777777777                           43
        X1      STO     X5                                          44
        X1      DATA    10                                          45
        HTAG    RF      X5                                          46
        15      JSM     DEST                                        47
                TOM     c23                                         50
DEST    X1      DATA    c2000112200000177                           51
        X1      TAG     2                                           52
        X1      STO     X4+23                                       53
        X1      MOD     1                                           54
        X1      STO     c177                                        55
        X1      DATA    c20000100000000233                          56
        X1      TAG     2                                           57
        X1      STO     154                                         60
        X1      DATA    c2000062200000000                           61
        1       SYS     130                                         62
        X1      STO     135                                         63
        X15     STO     X1                                          64
        X1      DATA    c1000062200000000                           65
        1       SYS     130                                         66
        X1      STO     136                                         67
        X1      DATA    c1000106217000000                           70
        1       SYS     130                                         71
        X1      STO     X15+17                                      72
        X1      DATA    c1000006200000000                           73
```

```
          1       SYS     130                                     74
          X1      STO     137                                     75
          X1      DATA    c1000024200000000                       76
          1       SYS     130                                     77
          X1      STO     151                                     100
          X1      DATA    c2000024200000000                       101
          1       SYS     130                                     102
          X1      STO     152                                     103
          X10     CPY     X1                                      104
CVTLOP    X1      DATA    c2000003200000000                       105
          1       SYS     130                                     106
          X1      STO     X10                                     107
          X10     JNL     CVTLOP                                  110
          X1      DATA    c2000062200000000                       111
          1       SYS     130                                     112
          X1      STO     153                                     113
                                                                  114
                  TOM     c23                                     115
<c310                                                             116
```