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THE FLOWCHART PROGRAM

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THE FLOWCHART PROGRAM

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THE FLOWCHART PROGRAM

ABSTRACT

The FLOWCHART program accepts, as input, special FORTRAN comment cards and, by means of SC-4020 output, produces a flowchart of the program. These input cards contain directions for the plotting of command or decision flowchart figures and for the labeling of these figures when necessary. The appearance of the flowchart on the paper is under the complete control of the user of the program.

INTRODUCTION

The FLOWCHART program is in reality not a flowcharting program, but a documentation program. It was written to produce flowcharts from special FORTRAN comment cards so that the flowchart of a FORTRAN program is an integral part of the program itself. Anytime the program is changed, the flowchart comment cards are modified or added to the program to reflect this change. When a new flowchart of the program is required, the FORTRAN deck is input to the FLOWCHART program and the current flowchart is produced. There should no longer be any discrepancy between the latest FORTRAN compilation and the existing flowchart of the program.

Because our primary purpose in writing this program was documentation and not flowcharting, we have written a very simple program to accomplish our aims. Thus, we have not attempted to analyze the FORTRAN program or to arrange flowchart figures in an optimum way. The user, therefore, has almost complete control of how his flowchart will appear on the paper. The rules which he must follow in order to produce the exact flowchart which he desires are described on these few pages.

PROGRAM DESCRIPTION

The FLOWCHART program accepts, as input, special FORTRAN comment cards and, by means of SC-4020 plotter output, produces a flowchart of the program. There are presently three kinds of figures which can be drawn. They are:

1. A calculation or command box. Inside this figure (pictured below) may appear up to 71 characters of calculation or command information.

2. A decision box. This figure (pictured below) is used to

indicate two different branches in the program. Inside the box must always appear a question, again limited to 71 characters, which can be answered yes or no. Inside the circle following the branch must always appear the label for that part of the program which, for the branch, is logically next.

3. A GO TO figure. This figure (pictured below), when it is used,

is attached to the right of either figures 1 or 2 above. A label for the logically next part of the program must appear inside the circle. This figure must be used whenever the physically next flowchart figure is not logically next. When used, the program determines if there is sufficient space to begin a new labeled section on the same line of figures. If this is the case, a space, adequately large to insure clarity, is allowed before the flowcharts continue.

In addition to the three figures described above, there are also two types of connector figures. These are the arrow , and the arrow with label . These connectors are plotted to the left of the figures described in 1 and 2 above to indicate that the program proceeds logically from the preceding physical figure (or from the last figure from the line above). The arrow with label is used when it is necessary to label a figure because a decision or GO TO figure from some other portion of the program transfers to this figure. When no such transfer occurs, a plain arrow may be used.

One other type of figure, , which is plotted to the left of a command or decision box, is used when a labelled section of a flowchart is separate and distinct from the previous flow. This can occur in two situations: (1) at the beginning of a main program or subroutine, and (2) at the beginning of a new section when the last figure in the previous section was a GO TO figure. Because of (2) above, the programmer must always label the first figure in a section when the previous one ends with a GO TO figure.

PROGRAM INPUT

First Card

Columns 1-3 Number of cases to be run. This number, which is punched in an I3 field, must be right-adjusted.

Second Card Title of first case to be run; 80 columns may be used. All the cards necessary for this first case follow.

All other FLOWCHART input cards will have the following format:

Column 1	Contains a "C".
2	Contains a "Z" to indicate a flowchart card.
3	The contents indicate what type of figure is to be drawn.
	A one (1) indicates a calculation or command box.
	A two (2) indicates a decision box with a NO branch.

A three (3) indicates a GO TO figure.

A four (4) indicates a decision box with a YES branch.

A nine (9) indicates the end of a case.

- 4-6 Contains the label of the box or is blank for a command or decision box (1 or 2 in column 3).
- 7-9 Contains the "NO branch" or "YES branch" for a decision box (2 or 4 respectively in column 3), or the GO TO number for the GO TO figure (a 3 in column 3); is otherwise blank.
- 10-80 Contains the comment to be printed inside the box.

Each case to be run must end with the CZ9 card. After this follows the title card of the next case, if there is one. The last case need end only with the CZ9 card.

The 71 columns allotted for comment are read with a format of 71A1. The user need not plan the appearance of his comment for the program condenses it to the point where one word is separated from the other by only one blank and then determines the maximum number of words that will fit in a line consisting of 18 available spaces. The words, in this way, are distributed among as many of the 6 available lines as are needed. The words are then centered in the lines and the lines in the box.

The 80 columns allotted to the title are read with a format of 13A6, A2. This is divided, upon writing, into three lines, with 30 characters assigned to each of the first two lines, and 20 to the last.

ACKNOWLEDGMENT

The authors gratefully acknowledge the contributions of G. Long and W. McCune to this program. The program was written primarily for the purpose of documenting the Astrofuel Data System Program.

REFERENCE

Computer-Drawn Flowcharts, Donald E. Knuth, Communications of the ACM, September 1963.

SAMPLE PROBLEM

The following pages contain listings of the entire FLOWCHART program and all subroutines along with the special flowchart comment cards. Following the listing are the flowcharts produced by inputting these routines to the FLOWCHART program.

```

      R
SC-4020 FLOWCHART PROGRAM                                MAIN
C                                FLOWCHART PROGRAM          B.J.S.
      COMMON IBLANK,IC,ICOUNT,IN,INC,INDERR,INUM,IRY,IT,ITITLE,IX,IY,
1      JTITLE,KTITLE
      DIMENSION IN(71),IRY(5),ITITLE(5),JTITLE(5),KTITLE(5)
      EQUIVALENCE      (A7,IZ),(ANINE,ININE),(AUNE,IUNE),(ATHREE,ITHREE),
1      (ABLANK,IBLANK),(AFOUR,IFOUR)
      DIMENSION IA(5)
CZ1 S      INITIALIZE VARIABLES
      AZ = 1HZ
      ANINE = 1H9
      AUNE = 1H1
      ATHREE = 1H3
      AFOUR = 1H4
      ABLANK = 1H
      IRY(1) = 848
      IRY(2) = 640
      IRY(3) = 432
      IRY(4) = 224
      IT = 0
      ICCT = 0
      ILAB = 0
      N = 12
      REWIND N
      CALL LOWDEN(12)
      CALL CAMRAV(10)
CZ1      READ THE NUMBER OF CASES
      READ INPUT TAPE 5,1007,ICASE
CZ1 S      READ TITLE OF CASE
      5      READ INPUT TAPE 5,1001,(ITITLE(I),I = 1,5),(JTITLE(I),I = 1,5),
1      (KTITLE(I),I = 1,4)
CZ1      CALL 'TITLE'
      CALL TITLE
      IT = 1
CZ1 S      READ 1 AND
      10      READ INPUT TAPE 5,1002,(IA(I),I = 1,5),(IN(I),I = 1,71)
CZ2      01 IS IT A FLOWCHART CASE
      IF (IA(2) - 12) 10,2(,1)

```

```

C74 12015 IT A 'CZP' CASE, INDICATING THE END OF A CASE
20 IF (IA(3) - ININE) 30,260,30
C22 05015 THERE A LABEL
30 IF (IA(4) - IBLANK) 40,90,40
C21 STORE THE LABEL IN 'INUM'
40 INUM = IA(4)
C22 030SHOULD IT BE AN INTERFIGURE LABEL
IF (IX) 80,80,45
45 IF (ILAB) 75,50,75
C24 02015 THERE ENOUGH SPACE ON THE LINE
50 IF ((1024 - IX) - 240) 60,70,70
C21 CALL 'CHEK'
60 CALL CHEK
70 IC = 2
IND = 4
CZ1020 CALL 'CIRCLE'
CALL CIRCLE
C21 CALL 'ARROW'
CALL ARROW
C21 UPDATE X-RASTER COUNT BY 80
IX = IX + 80
C23 110
GO TO 180
CZ4030040ARE WE AT THE BEGINNING OF A LINE
C24 04015 THERE ENOUGH SPACE ON THE LINE
75 IF ((1024 - IX) - 240) 76,76,80
C71 CALL 'CHEK'
75 CALL CHEK
80 IC = 1
IND = 2
CZ1040 CALL 'CIRCLE'
CALL CIRCLE
C21 CALL 'ARROW'
CALL ARROW
C21 UPDATE X-RASTER COUNT BY 60
IX = IX + 60
ILAB = 0
C23 110

```



```

        GO TO 180
90      ILAB = 0
CZ2050090 IS IT A 'GO TO' CARD
        IF (IA(3) - ITHREE) 150,100,150
CZ4      060 IS THERE ENOUGH SPACE ON THE LINE
100     IF ((1024 - IX) - 60) 110,120,120
CZ1      CALL 'CHEK'
110     CALL CHEK
CZ1050    STORE 'GO TO' IN 'INUM'
120     INUM = IA(5)
        IC = 2
        IND = 3
CZ1      CALL 'CIRCLE'
        CALL CIRCLE
CZ1      CALL 'ARROW'
        CALL ARROW
CZ1      UPDATE X-RASTER COUNT BY 60
        IX = IX + 60
CZ2      070 IS THERE ENOUGH SPACE ON THE LINE TO DRAW THE NEXT LABELED FIGURE
        IF ((1024 - IX) - 200) 122,122,121
CZ1      UPDATE X-RASTER COUNT BY 200
121     IX = IX + 200
CZ1      INDICATE THE NEXT FIGURE IS TO BE DRAWN ON THE SAME LINE
        ILAB = 1
CZ3      010
        GO TO 10
CZ4070080 ARE WE AT THE END OF THE PAGE
122     IF (ICOUNT - 4) 130,140,140
CZ1      UPDATE LINE COUNT
130     ICOUNT = ICOUNT + 1
CZ1      SET X-RASTER TO ZERO
        IX = 0
CZ1      SET Y-RASTER COUNT FOR THE NEXT LINE
        IY = IY(ICOUNT)
CZ3      010
        GO TO 10
CZ1000    CALL 'TITLE'
140     CALL TITLE
CZ3      010

```

```

        GO TO 10
CZ4000100 IS THERE ENOUGH SPACE FOR A CONNECTING ARROW AND FIGURE
150 IF ((1024 - IX) - 224) 160,170,170
CZ1     CALL 'CHEK'
160 CALL CHEK
170 IND = 1
CZ1100 CALL 'ARROW'
        CALL ARROW
CZ1     UPDATE X-RASTER COUNT BY 64
        IX = IX + 64
CZ2110120 IS THE FIGURE A DECISION BOX
180 IF (IA(3) - IONE) 190,230,170
CZ1     STORE 'BRANCH' LABEL IN 'INUM'
190 INUM = IA(5)
        IC = 3
        IND = 5
CZ1     CALL 'PRINT'
        CALL PRINT
        IF (INDERR) 290,291,290
CZ1     CALL 'DECBOX'
291 CALL DECBOX
CZ1     CALL 'ARROW'
        CALL ARROW
CZ1     CALL 'CIRCLE'
        CALL CIRCLE
CZ1     PRINT THE 'YES' AND 'NO' BRANCHES
        IWX = IX + 100
        IWY = IY - 60
        IF (IA(3) - IFOUR) 195,200,195
195 CALL PRINTV(-2,2HNO,IWX,IWY)
        GO TO 205
200 CALL PRINTV(-3,3HY-S,IWX,IWY)
CZ1     UPDATE THE X-RASTER COUNT BY 160
205 IX = IX + 160
        IF ((1024 - IX) - 24) 210,220,220
210 CALL CHEK
220 IWX = IX + 4
        IWY = IY + 24

```

```

        IF (IA(3) - IFOUR) 221,222,221
221  CALL PRINTV(-3,3HYFS,IWY,IY)
    GO TO 10
222  CALL PRINTV(-2,2HND,IWX,IWY)
CZ3  010
    GO TO 10
CZ1110  BLOCK FIGURE
CZ1  CALL 'P-INT'
230  CALL PRINT
    IF (INDEX) 240,240,25
CZ1  CALL 'BLOCK'
240  CALL BLOCK
    IX = IX + 160
CZ3  010
    GO TO 10
CZ1120  UPDATE CASE COUNT
260  ICCT = ICCT + 1
CZ2  5 HAVE ALL THE CASES BEEN RUN
    IF (ICCT - ICASE) 270,280,280
270  IT = 0
    GO TO 5
280  CALL FRAMEV(3)
    CALL PRINTV(-18,18THIS JOB COMPLETED,300,500)
    CALL PRINTV(-44,44SEND TO WESTINGHOUSE ASTRONUCLEAR LABORATORY,
1 300,550)
    CALL PRINTV(-41,41POST OFFICE BOX 10864, PITTSBURGH 36, PA., 300,
1 500)
    CALL PRINTV(-44,44ATTENTION DIGITAL COMPUTER FACILITY BLDG. 5 ,
1 300,450)
    CALL PLTND
    END FILE N
    TERMIN
    GO TO 300
290  WRITE OUTPUT TAPE 3,1003
CZ1  CALL EXIT
300  CALL EXIT
1000  FORMAT(I3)
1001  FORMAT(13A6,42)
1002  FORMAT(3A1,2A3,7A1)

```

```
1003 FORMAT(1H1,10H LINK COMMENT CARD)
C71      END
C20      END
```


SC-4020 FLOWCHART PROGRAM

SUBROUTINE ARROW

```

      SUBROUTINE ARROW
      COMMON IBLANK,IC,ICOUNT,IN,IND,INDE R,I000,IXY,IT,ITITLE,IX,IY,
1          JTITLE,KTITLE
      DIMENSION IN(71),IBY(5),ITITLE(5),JTITLE(5),KTITLE(5)
      EQUIVALENCE (AZ,17),(ANINE,I,NINE),(ACUT,ONE),(ATHR,ITHREE),
1          (APLANK,IBLANK),(AFOUR,IFOUR)
      CZ1 5    X-FASTER COUNT FOR ENTRANCE TO SUBROUTINE DESIGNATED BY 'IX'
      CZ1      Y-FASTER COUNT OF ENTRANCE TO SUBROUTINE DESIGNATED BY 'IY'
      CZ1      INITIALIZATION POINT OF ARROW DESIGNATED BY 'IAX' AND 'IAY'
      CZ1      END POINT OF ARROW DESIGNATED BY 'IBX' AND 'IBY'
      CZ3      I
      GO TO (10,20,30,30,40),IND
      CZ1I=1    CONNECTING ARROW
      CZ1      IAX = IX, IBX = IX + 64
      10      IAX = IX
      IBX = IX + 64
      CZ3      J10
      GO TO 50
      CZ1I=2    ARROW FOR LABEL
      CZ1      IAX = IX + 40, IBX = IX + 50
      20      IAX = IX + 40
      IBX = IX + 50
      CZ3      J10
      GO TO 50
      CZ1I=3    ARROW FOR 'GO TO' AND INTERIOUR LABEL
      CZ1      IAX = IX, IBX = IX + 20
      30      IAX = IX
      IBX = IX + 20
      CZ3      J10
      GO TO 50
      CZ1I=5    ARROW FOR DECISION IX
      CZ1      IAX = IX + 30, IAY = IY + 40, IBX = IAX, IBY = IAY + 4
      40      IAX = IX + 30
      IAY = IY + 40
      IBX = IAX
      IBY = IAY + 24
      CZ3      J20
      GO TO 50

```

```

CZ1010  IAY = IY, IBY = IAY
50  IAY = IY
    IBY = IAY
CZ1020  DRAW ARROW
60  DO 70 I = 1,4
70  CALL LINEV(IAx, IAY, IBX, IBY)
    IF (IND - 4) 100,80,100
80  IAX = IX + 60
    IBX = IX + 80
CZ1    DRAW ARROWHEAD
    DO 90 I = 1,4
90  CALL LINEV(IAx, IAY, ICX, ICY)
100  IF (IND - 5) 110,140,110
110  ICX = IBX - 8
    IDX = IBX
    ICY = IY + 8
    IDY = IY
    DO 120 I = 1,4
120  CALL LINEV(ICX, ICY, IDX, IDY)
    ICY = IY - 8
    DO 130 I = 1,4
130  CALL LINEV(ICX, ICY, IDX, IDY)
    GO TO 170
140  ICX = IBX + 8
    IDX = IBX
    ICY = IBY + 8
    IDY = IBY
    DO 150 I = 1,4
150  CALL LINEV(ICX, ICY, IDX, IDY)
    ICX = IBX - 8
    DO 160 I = 1,4
160  CALL LINEV(ICX, ICY, IDX, IDY)
CZ1    RETURN
170  RETURN
    END
CZ9

```

SC-4020 FLOWCHART PROGRAM

SUBROUTINE BLOCK

SUBROUTINE BLOCK

COMMON IBLANK, IC, ICOUNT, IN, IND, INDEK, INUM, IRY, IT, ITITLE, IX, IY,

1 JTITLE, KTITLE

DIMENSION IN(71), IPY(5), ITITLE(5), JTITLE(5), KTITLE(5)

EQUIVALENCE (A7, I2), (ANINE, ININE), (AONE, IONE), (ATHREE, ITHREE),

1 (ABLANK, IBLANK), (AFOUR, IFOUR)

CZ1 S X-RASTER COUNT UPON ENTRANCE TO SUBROUTINE DESIGNATED BY 'IX'

CZ1 Y-RASTER COUNT UPON ENTRANCE TO SUBROUTINE DESIGNATED BY 'IY'

CZ1 IAX = IX + 160

IAX = IX + 160

CZ1 IAY = IY + 48

IAY = IY + 48

CZ1 IBY = IY - 48

IBY = IY - 48

DO 10 I = 1,4

CZ1 DRAW VECTOR BETWEEN (IX, IAY) AND (IAX, IAY)

CALL LINEV(IX, IAY, IAX, IAY)

CZ1 DRAW VECTOR BETWEEN (IAX, IAY) AND (IAX, IBY)

CALL LINEV(IAX, IAY, IAX, IBY)

CZ1 DRAW VECTOR BETWEEN (IAX, IBY) AND (IX, IBY)

CALL LINEV(IAX, IBY, IX, IBY)

CZ1 DRAW VECTOR BETWEEN (IX, IBY) AND (IX, IAY)

10 CALL LINEV(IX, IBY, IX, IAY)

CZ1 RETURN

RETURN

END

CZ9

SC-4020 FLOWCHART PROGRAM

SUBROUTINE CHEK

SUBROUTINE CHEK

COMMON IBLANK, IC, ICOUNT, IN, IND, INDERR, INUM, IRY, IT, ITITLE, IX, IY,

1 JTITLE, KTITLE

DIMENSION IN(71), IRY(5), ITITLE(5), JTITLE(5), KTITLE(5)

EQUIVALENC (AZ, IZ), (ANINE, ININE), (AONE, IONE), (ATHREE, ITHREE),

1 (ABLANK, IBLANK), (AFOUR, IFOUR)

CZ4 S 010 ARE WE AT THE END OF A PAGE

IF (ICOUNT - 4) 20, 30, 30

CZ1 UPDATE LINE COUNT

20 ICOUNT = ICOUNT + 1

CZ1 SET X-RASTER COUNT TO ZERO

IX = 0

CZ1 SET Y-RASTER COUNT

IY = IRY(ICOUNT)

CZ3 020

GO TO 40

CZ1010 CALL 'TITLE'

30 CALL TITLE

CZ1020 RETURN

40 RETURN

END

CZ9

SC-4020 FLOWCHART PROGRAM

SUBROUTINE CIRCLE

```

SUBROUTINE CIRCLE
COMMON IPLANK, IC, ICOUNT, IN, IND, INFER, INH, IRY, IT, ITITLE, IX, IY,
1      JTITLE, KTITLE
DIMENSION IN(71), IRY(5), ITITLE(5), JTITLE(5), KTITLE(5)
EQUIVALENCE (AZ, IZ), (AMINE, ININE), (ACN, IONE), (ATHREE, ITHREE),
1          (ABLANK, IRLANK), (AFOUR, IFOUR)
CZ1 5 X-FASTER COUNT ENTRANCE TO SUBROUTINE DESIGNATED BY 'IX'
CZ1 Y-FASTER COUNT ENTRANCE TO SUBROUTINE DESIGNATED BY 'IY'
CZ3 1
GO TO (10, 20, 40), IC
CZ11=1 CIRCLE FOR LABEL
CZ1 KCX = IX + 20
10 KCX = IX + 20
CZ3 010
GO TO 30
CZ11=2 CIRCLE FOR 'GO TO' AND INTERFIGURE LABEL
20 KCX = IX + 40
CZ1010 KCY = IY
30 KCY = IY
CZ3 020
GO TO 50
CZ11=3 CIRCLE FOR DECISION PLX
CZ1 KCX = IX + 60
40 KCX = IX + 80
CZ1 KCY = IY - 92
50 KCY = IY - 92
CZ1020 CX = KCX, CY = KCY
50 CX = KCX
CY = KCY
CZ1 RADIUS OF CIRCLE = 20 HASTERS = R
R = 20.0
CZ1 A SOLAR INC EFFIT = 3.1415/15.0 = DINC
DINC = 3.1417/15.0
CZ1 ALPHA = 0.0
ALPHA = 0.0
CZ1 BEGINNING RASTER COORDINATES OF VECTOR = (MX, MY)
CZ1 END RASTER COORDINATES OF VECTOR = (NX, NY)
DO 7 I = 1, 50

```

```

CZ1      I = 0
CZ1030   I = I + 1
CZ1      BETA = ALPHA + DINC
        BETA = ALPHA + DINC
CZ1      MX = RADIUS X COSINE OF ALPHA + CX + .5
        MX = R*COSF(ALPHA) + CX + .5
CZ1      MY = RADIUS X SINE OF ALPHA + CY + .5
        MY = R*SINF(ALPHA) + CY + .5
CZ1      NX = RADIUS X COSINE OF BETA + CX + .5
        NX = R*COSF(BETA) + CX + .5
CZ1      NY = RADIUS X SINE OF BETA + CY + .5
        NY = R*SINF(BETA) + CY + .5
CZ1      DRAW VECTOR FROM (MX,MY) TO (NX,NY)
        DO 60 J = 1,4
        60 CALL LINEV(MX,MY,NX,NY)
CZ1      ALPHA = BETA
        70 ALPHA = BETA
CZ2      030 IS 'I' GREATER THAN 30
        JX = KCX - 8
        JY = KCY
CZ1      PRINT LABEL IN 'INUM'
        DO 80 I = 1,2
        80 CALL PRINTV(3,INUM,JX,JY)
CZ1      RETURN
        END
CZ9

```

SC-4020 FLOWCHART PROGRAM

SUBROUTINE DECBUX

```

SUBROUTINE DECBUX
COMMON IBLANK, IC, ICOUNT, IN, IND, INDECR, INUM, IRY, IT, ITITLE, IX, IY,
1      JTITLE, KTITLE
DIMENSION IN(71), IRY(5), ITITLE(5), JTITLE(5), KTITLE(5)
EQUIVALENCE (AZ, IZ), (ANINE, ININE), (AONE, IONE), (ATHREE, ITHREE),
1          (ABLANK, IBLANK), (AFOUR, IFOUR)
CZ1 S      X-RASTER COUNT UPON ENTRANCE TO SUBROUTINE DESIGNATED BY 'IX'
CZ1      Y-RASTER COUNT UPON ENTRANCE TO SUBROUTINE DESIGNATED BY 'IY'
CZ1      IX1 = IX + 8
      IX1 = IX + 8
CZ1      IX2 = IX + 152
      IX2 = IX + 152
CZ1      IX3 = IX + 160
      IX3 = IX + 160
CZ1      IY1 = IY + 48
      IY1 = IY + 48
CZ1      IY2 = IY - 48
      IY2 = IY - 48
      DO 10 I = 1,4
CZ1      DRAW VECTOR BETWEEN (IX,IY) AND (IX1,IY1)
      CALL LINEV(IX,IY,IX1,IY1)
CZ1      DRAW VECTOR BETWEEN (IX1,IY1) AND (IX2,IY1)
      CALL LINEV(IX1,IY1,IX2,IY1)
CZ1      DRAW VECTOR BETWEEN (IX2,IY1) AND (IX3,IY)
      CALL LINEV(IX2,IY1,IX3,IY)
CZ1      DRAW VECTOR BETWEEN (IX3,IY) AND (IX2,IY2)
      CALL LINEV(IX3,IY,IX2,IY2)
CZ1      DRAW VECTOR BETWEEN (IX2,IY2) AND (IX1,IY2)
      CALL LINEV(IX2,IY2,IX1,IY2)
CZ1      DRAW VECTOR BETWEEN (IX1,IY2) AND (IX,IY)
      10 CALL LINEV(IX1,IY2,IX,IY)
CZ1      RETURN
      RETURN
END
CZ9

```

SC-4020 FLOWCHART PROGRAM

SUBROUTINE PRINT

SUBROUTINE PRINT

COMMON IBLANK,IC,ICOUNT,IN,INO,INDERR,INC,IRY,IT,ITITLE,IX,IY,

1 JTITLE,KTITLE

DIMENSION IN(71),IRY(5),ITITLE(5),JTITLE(5),KTITLE(5)

EQUIVALENC (A2,I7),(ANINE,ININE),(AONE,IONE),(ATHREE,ITHREE),

1 (ABLANK,IBLANK),(AFOUR,IFOUR)

DIMENSION IARRAY(18,6),IB1(18),IB2(18),IB3(18),IB4(18),IB5(18),

1 IB6(18),NCHAR(71)

IAOD = 0

IFEND = 18

IFIN = 72

IFIRST = 0

INDERR = 0

IST = 1

LINECT = 0

DO 5 J = 1,6

DO 5 I = 1,18

5 IARRAY(I,J) = IBLANK

DO 10 I = 1,18

IB1(I) = IBLANK

IB2(I) = IBLANK

IB3(I) = IBLANK

IB4(I) = IBLANK

IB5(I) = IBLANK

10 IB6(I) = IBLANK

IY1 = IY + 40

IY2 = IY + 24

IY3 = IY + 8

IY4 = IY - 8

IY5 = IY - 24

IY6 = IY - 40

IX1 = IX + 12

DO 15 I = 1,71

IFIN = IFIN - 1

IF (IN(IFIN) - IBLANK) 20,15,20

15 CONTINUE

GO TO 370


```

20  DO 30 I = 1,71
30  NCHAR(I) = IBLANK
CZ1  CONDENSE COMMENT
    DO 70 I = 1,IFIN
    IF (IN(I) - IBLANK) 50,40,50
40  IF (IN(I+1) - IBLANK) 50,70,50
50  IF (IFIRST) 60,70,60
60  IFIRST = 1
    IADD = IADD + 1
CZ1  STORE COMMENT IN 'NCHAR' ARRAY
    NCHAR(IADD) = IN(I)
70  CONTINUE
    IFIN = IADD
80  IF (NCHAR(IEND) - IBLANK) 90,120,90
90  IF (NCHAR(IEND + 1) - IBLANK) 100,160,100
100 ICHAR = IEND
    DO 110 I = 1,17
    ICHAR = ICHAR - 1
    IF (NCHAR(ICHAR) - IBLANK) 110,140,110
110 CONTINUE
    GO TO 370
120 ICHAR = IEND
CZ1  DIVIDE COMMENT INTO APPROPRIATE NUMBER OF LINES
    DO 130 I = 1,17
    ICHAR = ICHAR - 1
    IF (NCHAR(ICHAR) - IBLANK) 150,130,150
130 CONTINUE
    GO TO 370
140 ICHAR = ICHAR - 1
CZ1  CENTER CHARACTERS IN THE LINES
150 ICT = (18 - (ICHAR - IST))/2
    GO TO 170
160 ICT = (18 - (IEND - IST))/2
    ICHAR = IEND
170 LINECT = LINECT + 1
    DO 180 I = IST, ICHAR
    ICT = ICT + 1
180 IARRAY(ICT,LINECT) = NCHAR(I)
    IF (IFIN - ICHAR) 220,220,190

```

```

190  IST = ICHAR + 2
    IF ((IFIN - IST) - 17) 200,200,210
200  IEND = IFIN
    GO TO 80
210  IEND = IST + 17
    GO TO 80
CZ1  CENTER LINES IN THE BLOCK
220  GO TO (270,250,230,310,290,330),LINECT
230  DO 240 I = 1,18
240  IB5(I) = IARRAY(I,3)
250  DO 260 I = 1,18
260  IB4(I) = IARRAY(I,2)
270  DO 280 I = 1,18
280  IB3(I) = IARRAY(I,1)
    GO TO 350
290  DO 300 I = 1,18
300  IB6(I) = IARRAY(I,5)
310  DO 320 I = 1,18
    IB2(I) = IARRAY(I,1)
    IB3(I) = IARRAY(I,2)
    IB4(I) = IARRAY(I,3)
320  IB5(I) = IARRAY(I,4)
    GO TO 350
330  DO 340 I = 1,18
    IB1(I) = IARRAY(I,1)
    IB2(I) = IARRAY(I,2)
    IB3(I) = IARRAY(I,3)
    IB4(I) = IARRAY(I,4)
    IB5(I) = IARRAY(I,5)
340  IB6(I) = IARRAY(I,6)
CZ1  PRINT COMMENT
350  IX2 = IX1
    DO 360 I = 1,2
    DO 351 J = 1,18
        ITEM = IB1(J)
        CALL PRINTV(1,ITEM,IX1,IY1)
351  IX1 = IX1 + 8
    IX1 = IX2

```

```

      DO 352 J = 1,18
      ITEMP = IB2(J)
      CALL PRINTV(1,ITEMP,IX1,IY2)
352  IX1 = IX1 + 8
      IX1 = IX2
      DO 353 J = 1,18
      ITEMP = IB3(J)
      CALL PRINTV(1,ITEMP,IX1,IY3)
353  IX1 = IX1 + 8
      IX1 = IX2
      DO 354 J = 1,18
      ITEMP = IB4(J)
      CALL PRINTV(1,ITEMP,IX1,IY4)
354  IX1 = IX1 + 8
      IX1 = IX2
      DO 355 J = 1,18
      ITEMP = IB5(J)
      CALL PRINTV(1,ITEMP,IX1,IY5)
355  IX1 = IX1 + 8
      IX1 = IX2
      DO 356 J = 1,18
      ITEMP = IB6(J)
      CALL PRINTV(1,ITEMP,IX1,IY6)
356  IX1 = IX1 + 8
      IX1 = IX2
360  CONTINUE
      GO TO 380
370  INDERR = 1
CZ1   RETURN
380  RETURN
      END
CZ11

```

SC-4020 FLOWCHART PROGRAM

SUBROUTINE TITLE

```

SUBROUTINE TITLE
COMMON IBLANK, IC, ICOUNT, IN, IND, INDEPR, INUM, IRY, IT, ITITLE, IX, IY,
1      JTITLE, KTITLE
DIMENSION IN(71), IRY(5), ITITLE(5), JTITLE(5), KTITLE(5)
EQUIVALENCE      (AZ, IZ), (ANINE, ININE), (AONE, IONE), (ATHREE, ITHREE),
1      (ABLANK, IBLANK), (AFOUR, IFOUR)
CZ2 S 0101S IT A NEW CASE
      IF (IT) 20, 10, 20
10    CALL FRAMEV(3)
CZ1    PRINT IDENTIFICATION FRAME
      CALL RITE2V(332, 566, 992, 90, 2, 30, 1, ITITLE, NLAST)
      CALL RITE2V(332, 512, 992, 90, 2, 30, 1, JTITLE, NLAST)
      CALL RITE2V(392, 458, 992, 90, 2, 20, 1, KTITLE, NLAST)
20    CALL FRAMEV(1)
C71010 PRINT PAGE HEADING
      CALL PRINTV(30, ITITLE, 396, 968)
      CALL PRINTV(30, JTITLE, 396, 952)
      CALL PRINTV(20, KTITLE, 436, 936)
CZ1    SET RASTER COORDINATES FOR FIRST LINE OF PAGE
      ICOUNT = 1
      IX = 0
      IY = IRY(ICOUNT)
CZ1    RETURN
      END
CZ0
```

SC-4020 FLOWCHART PROGRAM

MAIN

SC-4020 FLOWCHART PROGRAM

MAIN

SC-4020 FLOWCHART PROGRAM

MAIN

SC-4020 FLOWCHART PROGRAM

MAIN

SC-4020 FLOWCHART PROGRAM

MAIN

SC-4020 FLOWCHART PROGRAM

SUBROUTINE ARROW

SC-4020 FLOWCHART PROGRAM

SUBROUTINE ARROW

SC-4020 FLOWCHART PROGRAM

SUBROUTINE ARROW

SC-4020 FLOWCHART PROGRAM

SUBROUTINE BLOCK

SC-4020 FLOWCHART PROGRAM

SUBROUTINE BLOCK

SC-4020 FLOWCHART PROGRAM

SUBROUTINE CHEK

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SC-4020 FLOWCHART PROGRAM

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SUBROUTINE CIRCLE

SC-4020 FLOWCHART PROGRAM

SUBROUTINE CIRCLE

SC-4020 FLOWCHART PROGRAM

SUBROUTINE DECBOX

SC-4020 FLOWCHART PROGRAM

SUBROUTINE DECBOX

SC-4020 FLOWCHART PROGRAM

SUBROUTINE PRINT

SC-4020 FLOWCHART PROGRAM

SUBROUTINE PRINT

SC-4020 FLOWCHART PROGRAM

SUBROUTINE TITLE

SC-4020 FLOWCHART PROGRAM

SUBROUTINE TITLE