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Technical Memorandum 33-512

Program Listing for Fault Tree Analysis of JPL Technical Report 32-1542

Paul O. Chelson

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JET PROPULSION LABORATORY

CALIFORNIA INSTITUTE OF TECHNOLOGY

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PREFACE

The work described in this report was performed by the Quality
Assurance and Reliability Division of the Jet Propulsion Laboratory.

CONTENTS

ABSTRACT

This technical memorandum presents the computer program listing for the fault tree analysis of Technical Report 32-1542, <u>Reliability Computation Using Fault Tree Analysis</u>, Jet Propulsion Laboratory, Pasadena, Calif., Dec. 1, 1971. The program is written in FORTRAN V and is currently running on a UNIVAC 1108.

I. INTRODUCTION

This technical memorandum presents the computer program listing for the MAIN program and those subroutines unique to the fault tree analysis described in Ref. 1. These subroutines are FLT, READDS, MODIFY, PRTEQ, PRRBD, IBSTBY, SUB7, GATE, and SETIB. The other subroutines called by MAIN are used for analyzing the reliability block diagram of Ref. 1 and are listed in Ref. 2. The program is written in FORTRAN V and is currently running on a UNIVAC 1108.

```
  1    C                        FAULT TREE COMPUTATION PROGRAM                    FMN   10
  2    C                                                                          FMN   20
  3    C                                                                          FMN   30
  4    C        WRITTEN BY PAUL CHELSON                                           FMN   40
  5    C                  JET PROPULSION LAB                                      FMN   50
  6    C                  SECTION 153 -- RELIABILITY                              FMN   60
  7    C                                                                          FMN   70
  8    C        LATEST EDITION - - 12 JULY 1971                                   FMN   80
  9    C                                                                          FMN   90
 10    C                                                                          FMN  100
 11    C        UNIVAC 1108, FORTRAN V VERSION, 65K CORE STORAGE REQUIRED.        FMN  110
 12    C                                                                          FMN  120
 13    C        ****************************************************************FMN  130
 14    C                                                                          FMN  140
 15    C        DATA DECK SETUP.                                                  FMN  150
 16    C                                                                          FMN  160
 17    C        FAULT TREE DESCRIPTION.                                           FMN  170
 18    C        IF THERE ARE N BASIC FAULTS, THERE WILL BE N CARDS OF THIS TYPE.  FMN  180
 19    C        BLOCK NUMBER(1-2),FAULT PATH(3-62) WITH FORMAT 20A3, A 1 IN (80)  FMN  190
 20    C        IN LAST CARD OF THIS TYPE.                                        FMN  200
 21    C                                                                          FMN  210
 22    C        DISTRIBUTION TYPE(1-2), MISSION TIME(3-14) E FORMAT.  -           FMN  220
 23    C        1 = EXPONENTIAL, 2 = NOT AVAILABLE.                               FMN  230
 24    C                                                                          FMN  240
 25    C        ACTIVE PARAMETERS FOR EACH BLOCK OTHER THAN SENSE BLOCKS(SWITCHES)FMN  250
 26    C        RO IS SET EQUAL TO 1.0 IF(15-25) LEFT BLANK.                      FMN  260
 27    C        BLOCK NUMBER(1-2), LAMBDA(3-14) E FORMAT, RO(15-25) F FORMAT.     FMN  270
 28    C        LAST CARD IN THIS SERIES HAS LAST(80) SET EQUAL TO 5.             FMN  280
 29    C                                                                          FMN  290
 30    C        IF NO DORMANCY INVOLVED, A BLANK CARD, OTHERWISE -                FMN  300
 31    C        BLANK(1-2), DORMANCY FACTOR(3-14) E FORMAT.TO BE MULTIPLIED BY    FMN  310
 32    C        ACTIVE LAMBDAS OR 99(1-2), BLANK(3-80) AND READ INDIVIDUAL DORMANTFMN  320
 33    C        LAMBDAS - BLOCK NUMBER(1-2), LAMBDA DORMANT(3-14) E FORMAT.       FMN  330
 34    C        LAST CARD IN THIS SERIES HAS LAST(80) SET EQUAL TO 6.             FMN  340
 35    C                                                                          FMN  350
 36    C                                                                          FMN  360
 37    C        SWITCHING OPTIONS FOR EACH SENSE BLOCK.                           FMN  370
 38    C                                                                          FMN  380
 39    C        0 = NO SWITCHING( PROBABILITY OF SWITCH WORKING = 1.0).           FMN  390
 40    C        SENSE BLOCK(1-2).                                                 FMN  400
 41    C                                                                          FMN  410
 42    C        1 = CONSTANT PROBABILITY THAT SWITCH WORKS.                       FMN  420
 43    C        SENSE BLOCK(1-2),BLANK(3-14),PROBABILITY(15-25) F FORMAT, 1(80).  FMN  430
 44    C                                                                          FMN  440
 45    C        2 = DORMANT FAILURE RATE FOR SWITCH.                              FMN  450
 46    C        SENSE BLOCK(1-2),LAMBDA DORMANT(3-14) E FORMAT, 2(80).            FMN  460
 47    C                                                                          FMN  470
 48    C        3 = DORMANT AND ACTIVE FAILURE RATE FOR SWITCH( 2 CARDS/SWITCH).  FMN  480
 49    C        SENSE BLOCK(1-2),LAMBDA DORMANT(3-14) E FORMAT, 3(80).            FMN  490
 50    C        SENSE BLOCK(1-2),LAMBDA ACTIVE(3-14).                             FMN  500
 51    C                                                                          FMN  510
 52    C        4 = NOT AVAILABLE.                                                FMN  520
 53    C        5 = NOT AVAILABLE.                                                FMN  530
 54    C                                                                          FMN  540
 55    C        LAST CARD IN DATA DECK HAS LAST(80) SET EQUAL TO 7, 8, OR 9 -     FMN  550
 56    C        7 = RECALCULATE WITH NEW PARAMETERS, 8 = NEW DIAGRAM, 9 = END.    FMN  560
 57    C                                                                          FMN  570
 58    C****************************************************************************FMN  580
 59    C                                                                          FMN  590
 60             COMMON/ALLSUB/M1,M2,M3,M4,M5,M6,M7,L1,L3,L4,L5,L6                 FMN  600
 61             COMMON/LGSUB/IB(15,2,50),IIS(50),IRB(50,30),ITEMP(41,20),N1,      FMN  610
 62            1 ISAVE(50,200),ISUC,JSUC,JS1,JSAVE(50,200),IJS1,TOT,PROB(65),     FMN  620
 63            2 PROB1(65),IPRINT,NSTDBY(15),NSBYMX,NOPRNT                        FMN  630
 64             COMMON/SMSUB/NPUP(200),NPUPMX,NBOUT(50),NBOTMX,NBIN(50),NBINMX,   FMN  640
 65            1 NBNUM(50),NBNMAX                                                 FMN  650
 66             DIMENSION RO(50),NP(50),RT(65,101), PSNS(101),IS(50),TL(50)      FMN  660
 67             DIMENSION IN(15),IOUT(15),         NRE(30),KRE(30),KSAVE(50,200) FMN  670
 68             DIMENSION LSAVE(50,200),            TLD(50)                       FMN  680
 69             DIMENSION SWPROB(50),TLDS(50),TLS(50)                            FMN  690
 70             DOUBLE PRECISION DPREC,DPREC1,DPREC2,DPREC3,DPREC4,DPREC5         FMN  700
 71             DOUBLE PRECISION PINT,YAVE,PSNS,TOT,PROB,PROB1                    FMN  710
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72        C  .                                                                FMN  720
73        C                                                                   FMN  730
74        C                                                                   FMN  740
75               M1 =  50   &MAXIMUM NUMBER OF BLOCKS IN DIAGRAM.              FMN  750
76               M2 = 200   &MAXIMUM NUMBER OF SUCCESS PATHS.                  FMN  760
77               M3 =  14   &MAXIMUM NUMBER OF INPUTS/OUTPUTS TO/FROM ONE BLOCK. FMN  770
78               M4 =  15   &MAXIMUM NUMBER OF SENSE BLOCKS CONTROLLING STANDBY. FMN  780
79               M5 =  29   &MAXIMUM NUMBER OF STANDBY BLOCKS CONTROLLED BY 1 SENSOR. FMN  790
80               M6 =  20   &MAXIMUM NUMBER OF EQUIVALENT BLOCKS IN A SINGLE SET. FMN  800
81               M7 =  20   &MAXIMUM NUMBER OF EQUIVALENT BLOCK SETS.          FMN  810
82               L1=M1+1                                                      FMN  820
83               L3=M3+1                                                      FMN  830
84               L4=M4*M1                                                     FMN  840
85               L5=M5+1                                                      FMN  850
86               L6=(2*M6)+1                                                  FMN  860
87               LL6=M6+1                                                     FMN  870
88        C                                                                   FMN  880
89        C                                                                   FMN  890
90        C        THE FOLLOWING SHOWS THE RELATIONSHIP OF THE ABOVE TO STORAGE. FMN  900
91        C                                                                   FMN  910
92        C        COMMON/ALLSUB/M1,M2,M3,M4,M5,M6,M7,L1,L3,L4,L5,L6          FMN  920
93        C        COMMON/LGSUB/IB(L3,2,M1),IIS(M1),IRB(M1,L5),ITEMP(L6, M7),N1, FMN  930
94        C       1 ISAVE(M1, M2),ISUC,JSUC,JS1,JSAVE(M1, M2),IJS1,TOT,PROB(L4), FMN  940
95        C       2 PROB1(L4),IFRINT,NSTDBY(M4),NSBYMX                        FMN  950
96        C        COMMON/SMSUB/NPUP( M2),NPUPMX,NBOUT(M1),NBOTMX,NBIN(M1),NBINMX, FMN  960
97        C       1 NBNUM(M1),NENMAX                                          FMN  970
98        C                                                                   FMN  980
99        C        NST = NSTEP + 1                                            FMN  990
100       C        DIMENSION RO(M1),NP(M1),RT(L4,NST), PSNS(NST),IS(M1),TL(M1) FMN 1000
101       C        DIMENSION IN(M1),IOUT(M1),         NRE(L5),KRB(L5),KSAVE(M1, M2) FMN 1010
102       C        DIMENSION LSAVE(M1, M2),IOR(M1),TLD(M1)                    FMN 1020
103       C        DIMENSION SWPROB(M1),TLDS(M1),TLS(M1)                      FMN 1030
104       C                                                                   FMN 1040
105       C                                                                   FMN 1050
106       C        CLEAR VARIABLES TO ZERO AND SET CONSTANTS.                 FMN 1060
107       C                                                                   FMN 1070
108       C        IPRINT CONTROLS HOW MUCH OUTPUT WILL BE PRINTED.           FMN 1080
109       C            IPRINT=0 - PRINTS FLT TREE AND RESULTS.                FMN 1090
110       C            IPRINT=1 - 0 + PRINTS THE EQUIVALENT BLOCK DIAGRAM.    FMN 1100
111       C            IPRINT=2 - 1 + OVERALL SYSTEM PROBABILITY TREES ARE PRINTED. FMN 1110
112       C            IPRINT=3 - 2 + ALL PROBABILITY TREES ARE PRINTED.      FMN 1120
113       C            IPRINT=4 - 3 + ALL DIAGNOSTIC INFO IS PRINTED.         FMN 1130
114       C                                                                   FMN 1140
115              IPRINT=0                                                     FMN 1150
116       C                                                                   FMN 1160
117       C        THE VARIABLE NSIG SPECIFIES THE NUMBER OF *SIGNIFICANT* FIGURES FMN 1170
118       C        TO BE PRINTED FOR THE RELIABILITIES.  NOTE THAT *SIGNIFICANT* FMN 1180
119       C        FIGURES IS DEFINED AS THE NUMBER OF NON-NINES IN THE RELIABILITY FMN 1190
120       C        NUMBER.  THUS, .99986, .985, AND.56 ALL HAVE TWO *SIGNIFICANT* FMN 1200
121       C        DIGITS.                                                    FMN 1210
122       C                                                                   FMN 1220
123              NSIG=3                                                       FMN 1230
124       C                                                                   FMN 1240
125       C        THE ARRAY V HOLDS THE FORMAT FOR THE FINAL RELIABILITY PRINTING. FMN 1250
126       C        THE ARRAY VK HOLDS THE ALPHA NUMBERS NEEDED TO CHANGE THE  FMN 1260
127       C        VARIABLE FORMAT V.                                         FMN 1270
128       C                                                                   FMN 1280
129       C        DIMENSION V(15),VK(10)                                     FMN 1290
130       C                                                                   FMN 1300
131              DATA V/'(36HRCR','ELIABI','LITY O','F THE ','SYSTEM',' THRU ', FMN 1310
132             1'TIME','F10.0,','3H HOU','RS = ','F','10','.','3',')'/        FMN 1320
133              DATA VK/'1','2','3','4','5','6','7','8','9','10'/             FMN 1330
134       C                                                                   FMN 1340
135         999 LAST=0                                                        FMN 1350
136              NOPRNT=1                                                      FMN 1360
137              DO 19 I=1,L3                                                  FMN 1370
138              DO 19 J=1,2                                                   FMN 1380
139              DO 19 K=1,M1                                                  FMN 1390
140          19 IB(I,J,K)=0                                                    FMN 1400
141              DO 6 I=1,M1                                                   FMN 1410
142              IS(I)=0                                                       FMN 1420
143              IIS(I)=0                                                      FMN 1430
144              DO 6 K=1,L5                                                   FMN 1440
145           6 IRB(I,K)=0                                                     FMN 1450
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146      C                                                               FMN 1460
147        997 REWIND 10                                                 FMN 1470
148            NSBYMX=0                                                  FMN 1480
149            KT=0                                                      FMN 1490
150            NBHOLD=0                                                  FMN 1500
151            NSTEP=100                                                 FMN 1510
152            JJJ=0                                                     FMN 1520
153            KRB1=1                                                    FMN 1530
154            NRB1=0                                                    FMN 1540
155            DO 10 I=1,L4                                              FMN 1550
156            PROB(I)=0.0D+0                                            FMN 1560
157            PROB1(I)=0.0D+0                                           FMN 1570
158            DO 10 L=1,101                                             FMN 1580
159            RT(I,L)=0.                                                FMN 1590
160         10 PSNS(L)=0.0D+0                                            FMN 1600
161            DO 15 I=1,M4                                              FMN 1610
162         15 NSTDBY(I)=0                                               FMN 1620
163            DO 16 I=1,L3                                              FMN 1630
164            IN(I)=0                                                   FMN 1640
165         16 IOUT(I)=0                                                 FMN 1650
166            DO 20 I=1,M1                                              FMN 1660
167            SWPROB(I)=1.0                                             FMN 1670
168            TLDS(I)=0.                                                FMN 1680
169            TLS(I)=0.                                                 FMN 1690
170            TL(I)=0.                                                  FMN 1700
171            TLD(I)=0.                                                 FMN 1710
172            RG(I)=0.                                                  FMN 1720
173            NF(I)=0                                                   FMN 1730
174            DO 17 K=1,L5                                              FMN 1740
175            NRB(K)=0                                                  FMN 1750
176         17 KRB(K)=0                                                  FMN 1760
177            DO 20 K=1,M2                                              FMN 1770
178            JSAVE(I,K)=0                                              FMN 1780
179         20 ISAVE(I,K)=0                                              FMN 1790
180      C                                                               FMN 1800
181            IF(LAST.EQ.7) GO TO 3000                                  FMN 1810
182      C                                                               FMN 1820
183      C     READ FAULT TREE AND CONVERT TO BLOCK DIAGRAM.             FMN 1830
184      C                                                               FMN 1840
185            CALL FLT(NB,NSR)                                          FMN 1850
186            RG(M1) = 1.0                                              FMN 1860
187            TL(M1) = 0.0                                              FMN 1870
188            TLD(M1) = 0.0                                             FMN 1880
189      C                                                               FMN 1890
190      C     NBHOLD = TEMPORARY HOLD FOR THE HIGHEST NUMBER BLOCK(NBMAX).  FMN 1900
191            NBHOLD = NB                                               FMN 1910
192      C                                                               FMN 1920
193      C     ISUC = SUCCESS BLOCK NUMBER(BASE OF PROBABILITY TREE TO BE GENER-  FMN 1930
194      C     ATED BY CALLING SUBROUTINE TREE).                        FMN 1940
195      C                                                               FMN 1950
196       1017 ISUC=NB                                                   FMN 1960
197      C                                                               FMN 1970
198      C     JSUC AND IPRINT ARE USED IN SUBROUTINE TREE TO CONTROL PRINTING.  FMN 1980
199      C                                                               FMN 1990
200            JSUC=NB                                                   FMN 2000
201      C                                                               FMN 2010
202      C     NBMAX = THE HIGHEST BLOCK NUMBER OF BLOCKS 1-50/1-M1.     FMN 2020
203      C                                                               FMN 2030
204            NBMAX=NBHOLD                                              FMN 2040
205      C                                                               FMN 2050
206      C     SET THE FIRST ELEMENTS OF THE IB ARRAY WITH THE QUANTITY OF  FMN 2060
207      C     INPUTS AND OUTPUTS TO EACH BLOCK.                         FMN 2070
208      C                                                               FMN 2080
209            CALL SETIB(IB,M1,L3)                                      FMN 2090
210      C                                                               FMN 2100
211      C     READ SENSE BLOCK AND STANDBY BLOCKS OF THAT SENSE BLOCK.  FMN 2110
212      C                                                               FMN 2120
213      C     IIS ARRAY HOLDS SENSE BLOCKS OF ORIGINAL TREE.            FMN 2130
214      C     IS ARRAY HOLDS SENSE BLOCKS OF ORIGINAL TREE AND VARIES.  FMN 2140
215      C     NNSR = NUMBER OF SENSE BLOCKS IN ORIGINAL TREE.           FMN 2150
216      C     NSR = NUMBER OF SENSE BLOCKS IN ORIGINAL TREE AND VARIES. FMN 2160
217      C     IRB ARRAY HOLDS STANDBY BLOCKS CONTROLLED BY THEIR SENSE BLOCKS.  FMN 2170
218      C     IRB(NUMBER OF SENSE BLOCK, 1) =          NUMBER OF STANDBY BLOCKS  FMN 2180
219      C     OF THAT SENSE BLOCK.                                      FMN 2190
220      C     IRB(NUMBER OF SENSE BLOCK, J ) = STANDBY BLOCK NUMBER CONTROLLED  FMN 2200
221      C     BY THAT SENSE BLOCK, J = 2, . . .                        FMN 2210
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222   C                                                              FMN 2220
223         NNSR=NSR                                                 FMN 2230
224         IF(NSR.EQ.0) GO TO 840                                   FMN 2240
225         DO 2001 I=1,NSR                                          FMN 2250
226         IS(I)=  IIS(I)                                           FMN 2260
227         NS = IIS(I)                                              FMN 2270
228         DO 2005 J = L5,2,-1                                      FMN 2280
229         IRB(NS,J) = IRB(NS,J-1)                                  FMN 2290
230   2005  CONTINUE                                                 FMN 2300
231         DO 2002 J=1,M5                                           FMN 2310
232         IF (IRB(NS,J+1) .EQ.0) GO TO 2003                        FMN 2320
233   2002  CONTINUE                                                 FMN 2330
234   2003  IRB(NS,1)=J-1                                            FMN 2340
235   2001  CONTINUE                                                 FMN 2350
236   C                                                              FMN 2360
237   C     STANDBY BLOCKS MUST FOLLOW ALL OTHER INPUT BLOCKS IN INPUT LISTS FMN 2370
238   C     FOR IB.  ARRANGE IB AND PRINT THE SENSE BLOCKS AND THE STANDBY   FMN 2380
239   C     BLOCKS.                                                  FMN 2390
240   C                                                              FMN 2400
241         CALL IBSTBY(3998,NSR,IS,IRB,IB,IPRINT,L3,L5)             FMN 2410
242   C                                                              FMN 2420
243   C     READ AND GENERATE ITEMP ARRAY OF EQUIVALENT BLOCKS.      FMN 2430
244   C     N1 = MAXIMUM NUMBER OF EQUIVALENT BLOCK SETS.            FMN 2440
245   C                                                              FMN 2450
246   C                                                              FMN 2460
247   C     PRINT RELIABILITY BLOCK DIAGRAM.                         FMN 2470
248   C                                                              FMN 2480
249    840  IF(IPRINT.EQ.0) GO TO 2045                               FMN 2490
250         CALL PRRBD(IB,M1)                                        FMN 2500
251   C                                                              FMN 2510
252   C     PRINT EQUIVALENT BLOCKS.                                 FMN 2520
253   C                                                              FMN 2530
254   2045  IF (N1.EQ.0) GO TO 2040                                  FMN 2540
255         CALL PRTEQ(ITEMP,IPRINT,N1,LL6)                          FMN 2550
256   2040  CONTINUE                                                 FMN 2560
257   C                                                              FMN 2570
258   C     RELIABILITY BLOCK DIAGRAM INPUT CHECKED.                 FMN 2580
259   C                                                              FMN 2590
260   C                                                              FMN 2600
261   C     GENERATE ORIGINAL TREE.                                  FMN 2610
262   C     ISAVE HOLDS THE PROBABILITY TREE SUCCESS PATHS           FMN 2620
263   C     JS1 = NUMBER OF SUCCESS PATHS.                           FMN 2630
264   C                                                              FMN 2640
265   3000  CALL TREE(3998)                                          FMN 2650
266   C                                                              FMN 2660
267   C     DUPLICATE ORIGINAL TREE INTO JSAVE.                      FMN 2670
268   C                                                              FMN 2680
269         CALL DUPTRE(JSAVE,IJS1,ISAVE, JS1)                       FMN 2690
270   C                                                              FMN 2700
271   C     IDIST DETERMINES WHAT FAILURE DISTRIBUTION IS USED(1=EXPONENTIAL) FMN 2710
272   C     TTOT = MISSION TIME.                                     FMN 2720
273   C                                                              FMN 2730
274         READ 4000, IDIST, TTOT                                   FMN 2740
275   4000  FORMAT(I2,E12.7)                                         FMN 2750
276   C                                                              FMN 2760
277   C     READ PARAMETERS OF FAILURE DISTRIBUTION.                 FMN 2770
278   C     RO IS SET = 1.0 IF READ IN AS BLANK OR ZERO.             FMN 2780
279   C                                                              FMN 2790
280         GO TO (4100,4200,4300,4400,4500),IDIST                  FMN 2800
281   C                                                              FMN 2810
282   C     READ ACTIVE PARAMETERS.                                  FMN 2820
283   C                                                              FMN 2830
284   4100  READ 4101, NB,TLAMBD, RO1,LAST                          FMN 2840
285   4101  FORMAT(I2,E12.7,F10.7,55X,I1)                            FMN 2850
286         IF(RO1)4109,4110,4109                                   FMN 2860
287   4109  TL(NB)=TLAMBD                                            FMN 2870
288         RO(NB)=RO1                                               FMN 2880
289         GO TO 4120                                               FMN 2890
290   4110  RO(NB)=1.0                                               FMN 2900
291         TL(NB)=TLAMBD                                            FMN 2910
292   4120  IF(LAST.LT.5) GO TO 4100                                 FMN 2920
293   C                                                              FMN 2930
294         IF(NSR.EQ.0) GO TO 4710                                  FMN 2940
295   C                                                              FMN 2950
296   C     READ DORMANCY PARAMETERS AND SWITCHING OPTIONS           FMN 2960
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297      C                                                                FMN 2970
298              CALL READOS(NSR,TLD,TL,RO,SWPROB,TLDS,TLS,IRB,IS)         FMN 2980
299      C                                                                FMN 2990
300      C                                                                FMN 3000
301      C      READ LAST(80), LAST = 7, 8, CR 9.                         FMN 3010
302      C      7 = RECALCULATE WITH NEW PARAMETERS, 8 = NEW DIAGRAM, 9 = END.  FMN 3020
303      C                                                                FMN 3030
304       4710 READ 2707, LAST                                           FMN 3040
305            GO TO 4800                                                 FMN 3050
306      C                                                                FMN 3060
307       4200 CONTINUE                                                   FMN 3070
308       4300 CONTINUE                                                   FMN 3080
309       4400 CONTINUE                                                   FMN 3090
310       4500 CONTINUE                                                   FMN 3100
311      C                                                                FMN 3110
312      C      4200,4300,4400,4500 AVAILABLE IF YOU WANT TO USE OTHER THAN  FMN 3120
313      C      EXPONENTIAL DISTRIBUTION.  ADD APPROPRIATE STATMENTS FOR NEW  FMN 3130
314      C      DISTRIBUTION.                                             FMN 3140
315      C                                                                FMN 3150
316       4800 IF(NSR.EQ.0) GO TO 8000                                    FMN 3160
317      C                                                                FMN 3170
318      C      FIND A SENSE TREE WITH NO OTHER SENSE BLOCKS IN IT.       FMN 3180
319      C                                                                FMN 3190
320       7000  CONTINUE                                                  FMN 3200
321            DO 7010 JJ=1,M1                                            FMN 3210
322       7010 NP(JJ)=0                                                   FMN 3220
323            INDEP=0                                                    FMN 3230
324            M=1                                                        FMN 3240
325            J=1                                                        FMN 3250
326            I=1                                                        FMN 3260
327       7011 IF(JSAVE(I,J).NE.0) GO TO 7001                            FMN 3270
328            IF(I-1) 7002,7003,7002                                    FMN 3280
329       7001 K=1                                                        FMN 3290
330       7004 L=1                                                        FMN 3300
331       7005 CONTINUE                                                   FMN 3310
332            IF(NP(L).EQ.IS(K)) GO TO 7006                             FMN 3320
333            IF(L.EQ.M) GO TO 7007                                     FMN 3330
334            L=L+1                                                      FMN 3340
335            GO TO 7005                                                 FMN 3350
336       7007 IF(ABS(JSAVE(I,J)).EQ.IS(K)) GO TO 7008                   FMN 3360
337       7006 IF(K.EQ.NSR) GO TO 7009                                   FMN 3370
338            K=K+1                                                      FMN 3380
339            GO TO 7004                                                 FMN 3390
340       7008 IF(IS(K).EQ.INDEP) GO TO 7009                            FMN 3400
341            M=M+1                                                      FMN 3410
342            NP(M-1)=INDEP                                              FMN 3420
343            INDEP=IS(K)                                                FMN 3430
344            IF(IPRINT.NE.4) GO TO 7009                                FMN 3440
345            PRINT 20001, INDEP                                        FMN 3450
346       7009 IF(I.EQ.M1) GO TO 7002                                    FMN 3460
347            I=I+1                                                      FMN 3470
348            GO TO 7011                                                 FMN 3480
349       7002 IF(J.EQ. M2) GO TO 7003                                   FMN 3490
350            I=1                                                        FMN 3500
351            J=J+1                                                      FMN 3510
352            GO TO 7011                                                 FMN 3520
353       7003 ISUC=INDEP                                                 FMN 3530
354            IF(IPRINT.NE.4) GO TO 7030                                FMN 3540
355            PRINT 20001, ISUC                                          FMN 3550
356      20001 FORMAT (I3)                                               FMN 3560
357            PRINT 20002, (IS(I),I=1,M1)                              FMN 3570
358            PRINT 20002, (NP(I),I=1,M1)                              FMN 3580
359      20002 FORMAT(1H0 25(I3,1X)/1H 25(I3,1X))                        FMN 3590
360      C                                                                FMN 3600
361      C                                                                FMN 3610
362      C      DETERMINE WHAT TYPE OF STANDBY IS INVOLVED.               FMN 3620
363      C                                                                FMN 3630
364      C                                                                FMN 3640
365      C      IF SENSE BLOCK CONTROLS ONE STANDBY BLOCK, SET ISTDBY = 1, SEE IF  FMN 3650
366      C      THAT STANDBY BLOCK HAS AN INPUT.  IF NO INPUT GO TO 7700.  IF IT  FMN 3660
367      C      HAS AN INPUT GO TO 7500.  IF SENSE BLOCK CONTROLS MORE THAN ONE  FMN 3670
368      C      STANDBY BLOCK, SET ISTDBY=2 AND CALL SUBROUTINE STDBY2.   FMN 3680
369      C                                                                FMN 3690
370       7030 IF(IRB(INDEP,1).GT.1) GO TO 7050                          FMN 3700
371            ISTDBY=1                                                   FMN 3710
372            IRBB=IRB(INDEP,2)                                          FMN 3720
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373              ITEST=IB(1,1,IRBB)                                          FMN 3730
374              IF(ITEST.EQ.0) GO TO 7700                                   FMN 3740
375              GO TO 7500                                                  FMN 3750
376      7050 ISTDBY=2                                                       FMN 3760
377    C                                                                     FMN 3770
378              CALL STDBY2($998,INDEP)                                     FMN 3780
379    C                                                                     FMN 3790
380    C        DUPLICATE STANDBY TREE RETURNED IN ISAVE INTO LSAVE.         FMN 3800
381    C                                                                     FMN 3810
382              CALL DUPTRE(LSAVE,LJS1,ISAVE, JS1)                          FMN 3820
383              IF(IPRINT.LE.2) GO TO 7200                                  FMN 3830
384              CALL TRPRNT(2,JSAVE,IJS1, 1 )                               FMN 3840
385              CALL TRPRNT(4,LSAVE,LJS1, 2 )                               FMN 3850
386    C                                                                     FMN 3860
387    C        GENERATE FULL STANDBY TREE.                                  FMN 3870
388    C                                                                     FMN 3880
389    C        SUBROUTINE TRENUM STORES IN NBNUM ALL THE DIFFERENT ABSOLUTE VALUEFMN 3890
390    C        BLOCK NUMBERS IN THE STANDBY TREE.  NUMOUT ZEROES OUT THESE  FMN 3900
391    C        BLOCK NUMBERS.                                               FMN 3910
392    C                                                                     FMN 3920
393      7200 CALL TRENUM(LSAVE,LJS1)                                        FMN 3930
394    C                                                                     FMN 3940
395              ISUC=IRB(INDEP,2)                                           FMN 3950
396    C                                                                     FMN 3960
397    C        IF STANDBY BLOCK HAS NO INPUT, GO TO 7500.                   FMN 3970
398    C                                                                     FMN 3980
399              ITEST=IB(1,1,ISUC)                                          FMN 3990
400              IF(ITEST.EQ.0) GO TO 7500                                   FMN 4000
401    C                                                                     FMN 4010
402              CALL TREE($998)                                             FMN 4020
403    C                                                                     FMN 4030
404    C        ZERO OUT STANDBY BLOCKS IN STANDBY TREE.                     FMN 4040
405    C                                                                     FMN 4050
406              CALL NUMOUT($998,ISAVE, JS1)                                FMN 4060
407              CALL SFLEFT($998,ISAVE, JS1)                                FMN 4070
408              CALL DUPOUT($998,ISAVE, JS1)                                FMN 4080
409              IF(IPRINT.LE.2) GO TO 7400                                  FMN 4090
410              CALL TRPRNT(1,ISAVE, JS1, 3 )                               FMN 4100
411      7400 CALL TRENUM(ISAVE,JS1)                                         FMN 4110
412    C                                                                     FMN 4120
413    C                                                                     FMN 4130
414    C        CALCULATE THE PROBABILITY(PI TREE) THAT YOU NEED THE STANDBY TREE.FMN 4140
415    C                                                                     FMN 4150
416    C                                                                     FMN 4160
417      7500 ISUC=INDEP                                                     FMN 4170
418              CALL TREE($998)                                            FMN 4180
419    C                                                                     FMN 4190
420    C        DUPLICATE SENSE TREE INTO KSAVE.                             FMN 4200
421    C                                                                     FMN 4210
422              CALL DUPTRE(KSAVE,KJS1,ISAVE, JS1)                          FMN 4220
423    C                                                                     FMN 4230
424    C        SUBTRACT FULL STANDBY TREE FROM SENSE TREE GIVING PI TREE.   FMN 4240
425    C                                                                     FMN 4250
426              GO TO (7515,7518),ISTDBY                                    FMN 4260
427    C                                                                     FMN 4270
428    C        GENERATE FULL STANDBY TREE.                                  FMN 4280
429    C                                                                     FMN 4290
430      7515 ISUC=IRB(INDEP,2)                                             FMN 4300
431              CALL TREE($998)                                            FMN 4310
432    C                                                                     FMN 4320
433              CALL TRENUM(ISAVE, JS1)                                     FMN 4330
434    C                                                                     FMN 4340
435    C        INITIALIZE                                                   FMN 4350
436    C                                                                     FMN 4360
437      7518 DO 7520 I=1,M1                                                 FMN 4370
438              NBOUT(I)=0                                                  FMN 4380
439      7520 CONTINUE                                                       FMN 4390
440    C                                                                     FMN 4400
441    C        ELIMINATE PATHS IN SENSE TREE IF THEY CONTAIN THE STANDBY BLOCKS. FMN 4410
442    C                                                                     FMN 4420
443              NBOTMX=IRB(INDEP,1)                                         FMN 4430
444              DO 7530 J=1,NBOTMX                                          FMN 4440
445              NBOUT(J)=IRB(INDEP,J+1)                                     FMN 4450
446      7530 CONTINUE                                                       FMN 4460
447              CALL PATHOT($998,KSAVE,KJS1)                                FMN 4470
448              IF(IPRINT.LE.2) GO TO 7535                                  FMN 4480
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449           CALL TRPRNT(3,KSAVE,KJS1, 4 )                           FMN 4490
450       C                                                           FMN 4500
451     7535 NENMAX=NBNMAX+1                                          FMN 4510
452           NBNUM(NBNMAX)=INDEP                                     FMN 4520
453           CALL NUMOUT($998,KSAVE,KJS1)                            FMN 4530
454           CALL SFLEFT($998,KSAVE,KJS1)                            FMN 4540
455           CALL DUPOUT($998,KSAVE,KJS1)                            FMN 4550
456           IF(IPRINT.EQ.0) GO TO 7538                             FMN 4560
457           CALL TRPRNT(3,KSAVE,KJS1, 5 )                           FMN 4570
458       C                                                           FMN 4580
459       C   CHECK PI TREE FOR STANDBY TREES REPLACED BY STANDBY BLOCK(51-65)/ FMN 4590
460       C   (L1-L4).                                                FMN 4600
461       C                                                           FMN 4610
462     7538 IF (NSBYMX.LE.1) GO TO 7545                              FMN 4620
463           REWIND 10                                               FMN 4630
464           DO 7540 N=1,NSBYMX                                      FMN 4640
465           READ(10) NSS,JS1                                        FMN 4650
466           DO 7537 I=1,M2                                          FMN 4660
467           READ(10) (ISAVE(J,I),J=1,M1)                            FMN 4670
468     7537 CONTINUE                                                 FMN 4680
469           CALL TRINTR($998,KSAVE,KJS1,ISAVE,JS1,NSTDBY,NSBYMX,NSS) FMN 4690
470     7540 CONTINUE                                                 FMN 4700
471       C                                                           FMN 4710
472       C   DUPLICATE KSAVE INTO ISAVE.                             FMN 4720
473       C                                                           FMN 4730
474     7545 CALL DUPTRE(ISAVE, JS1,KSAVE,KJS1)                       FMN 4740
475       C                                                           FMN 4750
476       C   PI TREE NOW IN ISAVE.                                   FMN 4760
477       C                                                           FMN 4770
478           IF(IPRINT.LE.2) GO TO 5000                             FMN 4780
479           CALL TRPRNT(1,ISAVE, JS1, 6 )                           FMN 4790
480           GO TO 5000                                              FMN 4800
481       C                                                           FMN 4810
482       C   GENERATE SENSE TREE.                                    FMN 4820
483       C                                                           FMN 4830
484     7700 ISUC=INDEP                                               FMN 4840
485           CALL TREE($998)                                         FMN 4850
486       C                                                           FMN 4860
487       C   INITIALIZE                                              FMN 4870
488       C                                                           FMN 4880
489           DO 7710 I=1,M1                                          FMN 4890
490           NBOUT(I)=0                                              FMN 4900
491           NBNUM(I)=0                                              FMN 4910
492     7710 CONTINUE                                                 FMN 4920
493       C                                                           FMN 4930
494       C   ELIMINATE PATHS IN SENSE TREE IF THEY CONTAIN THE STANDBY BLOCK. FMN 4940
495       C                                                           FMN 4950
496           NBOUT(1)=IRB(INDEP,2)                                   FMN 4960
497           NBOTMX=1                                                FMN 4970
498           CALL PATHOT($998,ISAVE, JS1)                            FMN 4980
499           IF(IPRINT.LE.2) GO TO 7720                             FMN 4990
500           CALL TRPRNT(1,ISAVE, JS1, 7 )                           FMN 5000
501       C                                                           FMN 5010
502       C   ZERO OUT SENSE BLOCK NUMBER IN SENSE TREE.              FMN 5020
503       C                                                           FMN 5030
504     7720 NBNUM(1)=INDEP                                           FMN 5040
505           NBNMAX=1                                                FMN 5050
506           CALL NUMOUT($998,ISAVE, JS1)                            FMN 5060
507           CALL SFLEFT($998,ISAVE, JS1)                            FMN 5070
508           CALL DUPOUT($998,ISAVE, JS1)                            FMN 5080
509           IF(IPRINT.LE.2) GO TO 5000                             FMN 5090
510           CALL TRPRNT(1,ISAVE, JS1, 8 )                           FMN 5100
511       C                                                           FMN 5110
512       C   CALCULATE PI, THE PROBABILITY YOU NEED SENSE TREE, STORE IN PSNS. FMN 5120
513       C                                                           FMN 5130
514     5000 T=0.                                                     FMN 5140
515           NOW=0                                                   FMN 5150
516           K=0                                                     FMN 5160
517     9000 CONTINUE                                                 FMN 5170
518           GO TO (5100,5200,5300,5400,5500),IDIST                 FMN 5180
519       C                                                           FMN 5190
520     5100 DO 5101 I=1,NBMAX                                        FMN 5200
521           DPREC=-T*TL(I)                                          FMN 5210
522           PROB1(I)=RO(I)*DEXP(DPREC)                              FMN 5220
523     5101 CONTINUE                                                 FMN 5230
524       C                                                           FMN 5240
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525       C      KRB ARRAY CONTAINS STANDBY BLOCKS THAT HAVE HAD THEIR PROBABILITY FMN 5250
526       C      PREVIOUSLY CALCULATED.                                             FMN 5260
527       C                                                                         FMN 5270
528              DO 5110 J=1,KRB1                                                   FMN 5280
529              IF(KRB(J).EQ.0) GO TO 5110                                         FMN 5290
530              NB=KRB(J)                                                          FMN 5300
531              PROB1(NB)=RT(NB,K+1)                                               FMN 5310
532       5110 CONTINUE                                                             FMN 5320
533       C                                                                         FMN 5330
534       C      SUBROUTINE SYSP CALCULATES THE SYSTEM PROBABILITY - RETURNS TOT.   FMN 5340
535       C                                                                         FMN 5350
536              CALL SYSP                                                          FMN 5360
537       C                                                                         FMN 5370
538              IF(NOW.EQ.1) GO TO 9001                                            FMN 5380
539              K=K+1                                                              FMN 5390
540              T=(TTOT*K)/NSTEP                                                    FMN 5400
541              PSNS(K)=1.0D+0 - TOT                                               FMN 5410
542       C                                                                         FMN 5420
543       C      PREVENT DIVISION BY ZERO WHEN 18 SIGNIFICANT FIGURES LOST.         FMN 5430
544       C                                                                         FMN 5440
545              IF(PSNS(K).GT.0.0D+0) GO TO 5160                                   FMN 5450
546              IF(K.EQ.1) GO TO 5160                                              FMN 5460
547       C                                                                         FMN 5470
548       C      NEXT STATEMENT ELIMINATES DIVISION BY ZERO LATER WHEN CALCULATING FMN 5480
549       C      RT.  THE NUMBER USED RESULTS FROM SUBTRACTING .999999999999999999 FMN 5490
550       C      FROM 1.0D+0 JUST BEFORE LOSING ALL SIGNIFICANT FIGURES.  THIS WILLFMN 5500
551       C      CAUSE AN INTEGRATION ERROR IN CALCULATING RT, THE RELIABILITY OF   FMN 5510
552       C      A SENSE BLOCK OR SENSE TREE.  THE SYSTEM RELIABILITY MAY NOT BE    FMN 5520
553       C      EFFECTED IF IT APPROACHES 1.0.                                     FMN 5530
554       C                                                                         FMN 5540
555              PSNS(K) = +.173472347597680709D-017                               FMN 5550
556       5160 IF(K.LE.NSTEP) GO TO 5100                                            FMN 5560
557              ISTEP=NSTEP+1                                                      FMN 5570
558              IF(IPRINT.NE.4) GO TO 6000                                         FMN 5580
559              PRINT 5180, (PSNS(K),K=1,ISTEP)                                    FMN 5590
560       5180 FORMAT(5D26.18)                                                      FMN 5600
561              GO TO 6000                                                         FMN 5610
562       5200 CONTINUE                                                             FMN 5620
563       5300 CONTINUE                                                             FMN 5630
564       5400 CONTINUE                                                             FMN 5640
565       5500 CONTINUE                                                             FMN 5650
566       C SEE COMMENT STATEMENT AFTER 4500.                                       FMN 5660
567              GO TO 6300                                                         FMN 5670
568       C                                                                         FMN 5680
569       C      NUMERICALLY INTEGRATE THE RELIABILITY OF THE STANDBY BLOCKS.       FMN 5690
570       C      TIME VARIABLE = JT = 0-MISSION TIME(TTOT).  KT = 1-101 INCREMENTS.FMN 5700
571       C                                                                         FMN 5710
572       C                                                                         FMN 5720
573       6000 GO TO (6100,6400),ISTDBY                                             FMN 5730
574       C                                                                         FMN 5740
575       C      METHOD FOR ONE STANDBY BLOCK(ISTDBY=1).                            FMN 5750
576       C                                                                         FMN 5760
577       6100 NB=IRB(INDEP,2)                                                      FMN 5770
578              RT(NB,1)=RO(NB)                                                    FMN 5780
579              GO TO (6102,6202,6302,6402,6502),IDIST                             FMN 5790
580       C                                                                         FMN 5800
581       6102 ISTEP=NSTEP+1                                                        FMN 5810
582              DO 6170 KT=2,ISTEP                                                 FMN 5820
583              DPREC =                 (-TTOT*(KT-1)/NSTEP)*TL(NB)                 FMN 5830
584              DPREC1=                 (-TTOT*(KT-1)/NSTEP)*TLS(INDEP)             FMN 5840
585              PINT= RO(NB)*PSNS(1)*DEXP(DPREC)*SWPROB(INDEP)*DEXP(DPREC1)         FMN 5850
586              JTEND=KT-1                                                         FMN 5860
587              DO 6150 JT=1,JTEND                                                 FMN 5870
588              DPREC2=((-TTOT*(KT-1)/NSTEP)*TL(NB))+((-TTOT*(JT-1)/NSTEP)*         FMN 5880
589             1 (TLD(NB)-TL(NB)))                                                 FMN 5890
590              DPREC3=((-TTOT*(KT-1)/NSTEP)*TL(NB))+((-TTOT*(JT  )/NSTEP)*         FMN 5900
591             1 (TLD(NB)-TL(NB)))                                                 FMN 5910
592              DPREC4=((-TTOT*(KT-1)/NSTEP)*TLS(INDEP))+((-TTOT*(JT-1)/NSTEP)*     FMN 5920
593             1 (TLDS(INDEP)-TLS(INDEP)))                                         FMN 5930
594              DPREC5=((-TTOT*(KT-1)/NSTEP)*TLS(INDEP))+((-TTOT*(JT  )/NSTEP)*     FMN 5940
595             1 (TLDS(INDEP)-TLS(INDEP)))                                         FMN 5950
596              YAVE=((DEXP(DPREC2)*DEXP(DPREC4))+(DEXP(DPREC3)*DEXP(DPREC5)))/2.0DFMN 5960
597              PINT = PINT + RO(NB)*(PSNS(JT+1)-PSNS(JT)) * YAVE * SWPROB(INDEP)   FMN 5970
598       6150 CONTINUE                                                             FMN 5980
599              RT(NB,KT)=PINT/PSNS(KT)                                            FMN 5990
600       6170 CONTINUE                                                             FMN 6000
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601              IF(IPRINT.NE.4) GO TO 6010                                  FMN 6010
602              PRINT 5888, (RT(NB,KT), KT=1,ISTEP)                         FMN 6020
603         5888 FORMAT(8E15.9)                                             FMN 6030
604              GO TO 6010                                                 FMN 6040
605         6202 CONTINUE                                                   FMN 6050
606         6302 CONTINUE                                                   FMN 6060
607         6402 CONTINUE                                                   FMN 6070
608         6502 CONTINUE                                                   FMN 6080
609      C SEE COMMENT STATEMENT AFTER 4500.                                FMN 6090
610      C                                                                  FMN 6100
611      C                                                                  FMN 6110
612      C        METHOD FOR MORE THAN ONE STANDBY BLOCK(ISTDBY=2)          FMN 6120
613      C        RO FOR ALL STANDBY BLOCKS(51-65) = 1                      FMN 6130
614      C                                                                  FMN 6140
615         6400 NB=NSTDBY(NSBYMX)                                          FMN 6150
616              RT(NB,1)=1.0                                               FMN 6160
617              GO TO (6103,6203,6303,6403,6503),IDIST                     FMN 6170
618      C                                                                  FMN 6180
619         6103 ISTEP=NSTEP+1                                              FMN 6190
620              DO 6500 KT=2,ISTEP                                         FMN 6200
621              DPREC =       STBYPR(LSAVE,LJS1,RO,TL,RT,KT,0,TTOT,NSTEP,TLD) FMN 6210
622              DPREC1=                    (-TTOT*(KT-1)/NSTEP)*TLS(INDEP)  FMN 6220
623              PINT=PSNS(1)*DPREC*SWPROB(INDEP)*DEXP(DPREC1)              FMN 6230
624              JTEND=KT-1                                                 FMN 6240
625              DO 6450 JT=1,JTEND                                         FMN 6250
626              DPREC4=((-TTOT*(KT-1)/NSTEP)*TLS(INDEP))+((-TTOT*(JT-1)/NSTEP)* FMN 6260
627             1 (TLDS(INDEP)-TLS(INDEP)))                                 FMN 6270
628              DPREC5=((-TTOT*(KT-1)/NSTEP)*TLS(INDEP))+((-TTOT*(JT   )/NSTEP)* FMN 6280
629             1 (TLDS(INDEP)-TLS(INDEP)))                                 FMN 6290
630              JJT=JT-1                                                   FMN 6300
631              YAVE=(STBYPR(LSAVE,LJS1,RO,TL,RT,KT,JT,TTOT,NSTEP,TLD)*DEXP(DPRECSFMN 6310
632             1 ) + STBYPR(LSAVE,LJS1,RO,TL,RT,KT,JJT,TTOT,NSTEP,TLD)*DEXP(DPRECFMN 6320
633             24))/2.0D+0                                                 FMN 6330
634              PINT = PINT + (PSNS(JT+1)-PSNS(JT)) * YAVE * SWPROB(INDEP) FMN 6340
635         6450 CONTINUE                                                   FMN 6350
636              RT(NB,KT)=PINT/PSNS(KT)                                     FMN 6360
637         6500 CONTINUE                                                   FMN 6370
638              IF(IPRINT.NE.4) GO TO 6010                                 FMN 6380
639              PRINT 5888, (RT(NB,KT), KT=1,ISTEP)                        FMN 6390
640              GO TO 6010                                                 FMN 6400
641         6203 CONTINUE                                                   FMN 6410
642         6303 CONTINUE                                                   FMN 6420
643         6403 CONTINUE                                                   FMN 6430
644         6503 CONTINUE                                                   FMN 6440
645              GO TO 6010                                                 FMN 6450
646      C                                                                  FMN 6460
647      C                                                                  FMN 6470
648      C        KRB ARRAY CONTAINS STANDBY BLOCKS WHOSE RELIABILITY HAS BEEN FMN 6480
649      C        CALCULATED.                                               FMN 6490
650      C                                                                  FMN 6500
651         6010 DO 6004 N=1,L5                                             FMN 6510
652              IF(KRB(N).EQ.0) GO TO 6005                                 FMN 6520
653         6004 CONTINUE                                                   FMN 6530
654         6005 KRB(N)=NB                                                  FMN 6540
655              KRB1=N                                                     FMN 6550
656      C                                                                  FMN 6560
657      C        CHECK IF ALL SENSE BLOCKS ACCOUNTED FOR, IF SO GO TO 8000. FMN 6570
658      C                                                                  FMN 6580
659              IQ=0                                                       FMN 6590
660              DO 6006 I=1,M1                                             FMN 6600
661              IF(IQ.EQ.1) GO TO 6007                                     FMN 6610
662              IF(IS(I).EQ.INDEP) IQ=1                                    FMN 6620
663              GO TO 6016                                                 FMN 6630
664         6007 IS(I-1)=IS(I)                                              FMN 6640
665         6016 CONTINUE                                                   FMN 6650
666              IF(IS(I).EQ.0) GO TO 6008                                  FMN 6660
667         6006 CONTINUE                                                   FMN 6670
668         6008 NSR=NSR-1                                                  FMN 6680
669              IF(I.EQ.2) GO TO 8000                                      FMN 6690
670              JJJ=JJJ+1                                                  FMN 6700
671              IF(JJJ.GE.M4) GO TO 8000                                   FMN 6710
672              GO TO 7000                                                 FMN 6720
673      C                                                                  FMN 6730
674      C        FINALIZE VARIABLES AND CALCULATE RELIABILITY OF TOTAL SYSTEM. FMN 6740
675      C        SET NOW = 1.                                              FMN 6750
676      C                                                                  FMN 6760
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677         8000 T=TTOT                                                      FMN 6770
678              K=NSTEP                                                     FMN 678C
679              NOW=1                                                       FMN 6790
680         C                                                                FMN 680C
681         C        DUPLICATE JSAVE INTO ISAVE.                             FMN 6810
682         C                                                                FMN 682C
683              CALL DUPTRE(ISAVE, JS1,JSAVE,IJS1)                          FMN 6830
684              GO TO 9000                                                  FMN 684C
685         C                                                                FMN 685C
686         C        PRINT RESULTS   IF RO = 1, SUPPRESS PRINTING OF RO.     FMN 686C
687         C                                                                FMN 687D
688         9001 PRINT 806                                                   FMN 688C
689          806 FORMAT(1H1)                                                 FMN 689C
690         C                                                                FMN 690C
691              IF(NSBYMX.LE.0) GO TO 700                                   FMN 6910
692         C                                                                FMN 692C
693         C        PRINT STANDBY BLOCKS(51-65) AND THEIR TREES.            FMN 6930
694         C        STORE ALL DIFFERENT STANDBY BLOCKS IN THESE TREES IN NRB ARRAY. FMN 6940
695         C                                                                FMN 695C
696              END FILE 10                                                 FMN 696C
697              REWIND 10                                                   FMN 6970
698              DO 530 N=1,NSBYMX                                           FMN 698C
699              READ(10) NS, LJS1                                           FMN 6990
700              DO 500 I=1,M2                                               FMN 7000
701              READ(10) (LSAVE(J,I),J=1,M1)                                FMN 7010
702          500 CONTINUE                                                    FMN 702C
703              IF(IPRINT.LE.1) GO TO 525                                   FMN 7030
704              PRINT 510, NS                                               FMN 7040
705          510 FORMAT('0STANDBY TREE REPLACED BY BLOCK'I3)                 FMN 7050
706              CALL TRPRNT(5,LSAVE,LJS1, 0 )                               FMN 706C
707          525 CALL TRENUM(LSAVE,LJS1)                                     FMN 7070
708              DO 520 K=1,NBNMAX                                           FMN 708C
709              NRB1=NRB1+1                                                 FMN 709C
710              NRB(NRB1)=NBNUM(K)                                          FMN 710C
711          520 CONTINUE                                                    FMN 7110
712          530 CONTINUE                                                    FMN 7120
713         C                                                                FMN 7130
714         C        PRINT THE ORIGINAL TREE WITH STANDBY BLOCKS(51-65)/(L1-L4). FMN 714C
715              IF(IPRINT.LE.1) GO TO 700                                   FMN 7150
716              PRINT 560, L1, L4                                           FMN 716C
717          560 FORMAT('1ORIGINAL PROBABILITY TREE WITH STANDBY BLOCKS ('I3, FMN 7170
718             1 ' THRU'I3,' ).')                                          FMN 718C
719              CALL TRPRNT(5,ISAVE, JS1, 0 )                               FMN 7190
720              PRINT 806                                                   FMN 720C
721         C                                                                FMN 7210
722          700 PRINT 701                                                   FMN 722C
723          701 FORMAT('                    ACTIVE F/R      DORMANT F/R     R-INITIAL  FMN 7230
724             1 RELIABILITY')                                             FMN 724C
725              DO 704 I=1,L4                                               FMN 7250
726              IF(I.LE.M1) GO TO 700                                       FMN 726C
727              IF(PROB1(I).LE.0) GO TO 704                                 FMN 7270
728              PRINT 703, I, PROB1(I)                                      FMN 7280
729          703 FORMAT(' BLOCK'I3,44X,D17.7)                               FMN 729C
730              GO TO 704                                                   FMN 7300
731         C                                                                FMN 7310
732         C        IF IN NRB ARRAY, HAS BEEN REPLACED, THEREFORE NO RELIABILITY. FMN 732C
733         C                                                                FMN 7330
734          706 DO 702 J=1,NRB1                                             FMN 734C
735              IF(I.NE.NRB(J)) GO TO 702                                   FMN 7350
736              IF(RO(I).GE.1.0) GO TO 711                                  FMN 736C
737              PRINT 707, I, TL(I), TLD(I), RO(I)                         FMN 7370
738              GO TO 704                                                   FMN 738C
739          711 PRINT 709, I, TL(I),TLD(I)                                  FMN 7390
740              GO TO 704                                                   FMN 7400
741          702 CONTINUE                                                    FMN 7410
742         C                                                                FMN 742C
743         C        DO NOT PRINT SENSE BLOCKS SINCE TL(I)=0, TLD(I)=0, AND RO(I)=1 AREFMN 7430
744         C        NOT RELATED TO THE SENSE SWITCH OPTION PARAMETERS AND ARE ONLY FMN 744C
745         C        USED TO SET SENSE BLOCK PROBABILITY = 1.0 IN TREE PATHS. FMN 7450
746         C                                                                FMN 746C
747              DO 715 J=1,NNSR                                             FMN 747C
748              IF(IIS(J).EQ.I) GO TO 704                                   FMN 748C
749          715 CONTINUE                                                    FMN 7490
750         C                                                                FMN 750C
751              IF(PROB1(I).LE.0.) GO TO 704                                FMN 7510
752              IF(RO(I)-1.)705,708,705                                     FMN 7520
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753        705 PRINT 707, I, TL(I), TLD(I), RO(I), PROB1(I)                           FMN 7530
754        707 FORMAT(* BLOCK*I3, 2E16.7 ,F12.7,D17.7)                                FMN 7540
755            GO TO 704                                                              FMN 7550
756        708 PRINT 709, I, TL(I), TLD(I), PROB1(I)                                 FMN 7560
757        709 FORMAT(* BLOCK*I3, 2E16.7 ,12X,D17.7)                                 FMN 7570
758        704 CONTINUE                                                              FMN 7580
759      C                                                                            FMN 7590
760      C        PRINT SENSE SWITCH OPTIONS.                                         FMN 7600
761      C                                                                            FMN 7610
762            IF(NNSR.EQ.0) GO TO 740                                               FMN 7620
763            PRINT 720                                                             FMN 7630
764        720 FORMAT(*0SENSE SWITCH   ACTIVE F/R     DORMANT F/R    PROBABILITY*)FMN 7640
765            DO 730 J=1,NNSR                                                       FMN 7650
766            NS=IIS(J)                                                            FMN 7660
767            PRINT 725, NS,TLS(NS),TLDS(NS),SWPROB(NS)                            FMN 7670
768        725 FORMAT(* BLOCK*I3, 2E16.7 ,F12.7,E16.7)                              FMN 7680
769        730 CONTINUE                                                             FMN 7690
770        740 R=TOT                                                                FMN 7700
771            K=-LOG10(1.-R)                                                       FMN 7710
772            K=K+NSIG                                                             FMN 7720
773            IF(K.GT.8)  K=8                                                      FMN 7730
774            V(12)=VK(K+2)                                                        FMN 7740
775            V(14)=VK(K)                                                          FMN 7750
776            WRITE(6,V) TTOT,R                                                    FMN 7760
777            PRINT 800                                                            FMN 7770
778      C                                                                            FMN 7780
779      C        MODIFY PROBABILITY DATA IF LAST = 7, GO TO 980.                     FMN 7790
780      C                                                                            FMN 7800
781            IF(LAST.LT.7) GO TO 998                                              FMN 7810
782            IF(LAST.EQ.7) GO TO 980                                              FMN 7820
783            IF(LAST.EQ.8) GO TO 999                                              FMN 7830
784            IF(LAST.EQ.9) GO TO 1066                                             FMN 7840
785            GO TO 998                                                            FMN 7850
786      C                                                                            FMN 7860
787      C        INITIALIZE VARIABLES FOR RECALCULATION WITH NEW PARAMETERS.         FMN 7870
788      C                                                                            FMN 7880
789        980 DO 990 I=1,M1                                                        FMN 7890
790        990 IS(I)=IIS(I)                                                         FMN 7900
791            NSR=NNSR                                                             FMN 7910
792            ISUC=JSUC                                                            FMN 7920
793            NOPRNT=0                                                             FMN 7930
794            GO TO 997                                                            FMN 7940
795      C                                                                            FMN 7950
796      C        ERROR RETURN FROM SUBROUTINES.  READ TO NEW DIAGRAM DATA DECK.      FMN 7960
797      C                                                                            FMN 7970
798        998 IF (LAST - 8) 9998,999,1066                                          FMN 7980
799       9998 READ 2707, LAST                                                      FMN 7990
800       2707 FORMAT (79X,I1)                                                      FMN 8000
801            IF(LAST-8)9998,999,1066                                             FMN 8010
802       1066 END                                                                 FMN 8020
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   1              SUBROUTINE FLT(NB,NRSW)                                         FLT   10
   2      C       FAULT TREE ANALYSIS SUBROUTINE.                                 FLT   20
   3      C       UNIVAC 1108, FORTRAN V VERSION.                                 FLT   30
   4      C       WRITTEN BY PAUL CHELSON.   JPL SECTION 153                      FLT   40
   5      C                                                                       FLT   50
   6      C       THIS SUBROUTINE CONVERTS THE FAULT TREE TO A RELIABILITY        FLT   60
   7      C       BLOCK DIAGRAM.                                                  FLT   70
   8      C                                                                       FLT   80
   9      C                                                                       FLT   90
  10              COMMON/ALLSUB/M1,M2,M3,M4,M5,M6,M7,L1,L3,L4,L5,L6               FLT  100
  11              COMMON/LGSUB/IB(15,2,50),IIS(50),IRB(50,30),ITEMP(41,20),N1,    FLT  110
  12             1 IGAVE(50,200),ISUC,JSUC,JS1,JSAVE(50,200),IJS1,TOT,PROB(65),   FLT  120
  13             2 PROB1(65),IFRINT,NSTOBY(15),NSBYMX,NOPRNT                      FLT  130
  14              COMMON/SUB/IPATH(20,50),IAND(49,12),IANDZ(25,12),IAN,BL3,M8     FLT  140
  15              COMMON/GT/BL1                                                   FLT  150
  16              DIMENSION ISAVE(49),MZ(49),A(8),NBSAVE(49),JPATH(20)            FLT  160
  17              DIMENSION NONACT(50,30),MATCSW(50)                             FLT  170
  18              EQUIVALENCE (NONACT(1,1),IRB(1,1)),(MATCSW(1),IIS(1))           FLT  180
  19              DOUBLE PRECISION PROB, PROB1,TOT                                FLT  190
  20              INTEGER A,BL3,BL1,GATE,EQ                                       FLT  200
  21      C                                                                       FLT  210
  22      C       IPATH(M,I) HOLDS THE M-TH GATE OF THE I-TH FAULT PATH. (THE I-TH FLT  220
  23      C          FAULT PATH IS THE FAULT PATH OF BLOCK I.)                    FLT  230
  24      C                                                                       FLT  240
  25              DATA EQ/'='/                                                    FLT  250
  26              DATA A/0160505050505,0350505050505,0060505050505,0240505050505, FLT  260
  27             10370505050505,0300505050505,0110505050505,0140505050505/        FLT  270
  28             2KTRE/0050505050505/                                            FLT  280
  29              BL3 = KTRE                                                      FLT  290
  30              BL1 = KTRE                                                      FLT  300
  31              M8 = 20  @MAX NO. OF GATES IN A FAULT PATH FOR A BLOCK.         FLT  310
  32              L9=M1-1  @MAXIMUM NUMBER OF INPUT BLOCKS IN FAULT TREE.         FLT  320
  33              M10 = 12 @MAX NO. OF AND GATES BEING WORKED ON AT ONE TIME.     FLT  330
  34              LL3=L3+1                                                        FLT  340
  35              LL6=M6+1                                                        FLT  350
  36              L8=M8-1                                                         FLT  360
  37      C                                                                       FLT  370
  38      C                                                                       FLT  380
  39      C                                                                       FLT  390
  40      C                                                                       FLT  400
  41      C                                                                       FLT  410
  42      C       INITIALIZE                                                      FLT  420
  43      C                                                                       FLT  430
  44          898 DO 11 I=1,M1                                                    FLT  440
  45              DO 11 J=1,2                                                     FLT  450
  46              DO 10 K=1,L3                                                    FLT  460
  47           10 IB(K,J,I)=0                                                     FLT  470
  48              DO 9 L=1,M8                                                     FLT  480
  49              JPATH(L)=BL3                                                    FLT  490
  50            9 IPATH(L,I)=BL3                                                  FLT  500
  51           11 CONTINUE                                                        FLT  510
  52              DO 12 I=1,M7                                                    FLT  520
  53              DO 12 J=1,L6                                                    FLT  530
  54           12 ITEMP(J,I)=0                                                    FLT  540
  55              DO 14 I=1,L9                                                    FLT  550
  56              ISAVE(I)=0                                                      FLT  560
  57              MZ(I)=0                                                         FLT  570
  58              NBSAVE(I)=0                                                     FLT  580
  59              DO 14 J=1,M10                                                   FLT  590
  60           14 IAND(I,J)=0                                                     FLT  600
  61              DO 16 J=1,M10                                                   FLT  610
  62              IAND(1,J)=BL3                                                   FLT  620
  63              IANDZ(1,J)=BL3                                                  FLT  630
  64              DO 16 K=2,L3                                                    FLT  640
  65           16 IANDZ(K,J)=0                                                    FLT  650
  66              IZ=0                                                            FLT  660
  67              MSAVE =0                                                        FLT  670
  68              NBSMAX=0                                                        FLT  680
  69              REWIND 10                                                       FLT  690
  70      C    INITIALISE VARIABLES USED IN MODIFYING TREES WITH DORMANCY.        FLT  700
  71              DO 517 J = 1,50                                                 FLT  710
  72              MATCSW(J) = 0                                                   FLT  720
  73              DO 517 K = 1,30                                                 FLT  730
  74              NONACT(J,K) = 0                                                 FLT  740
  75          517 CONTINUE                                                        FLT  750
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76      C                                                                        FLT  760
77      C                                                                        FLT  770
78      C           PHASE 2                                                      FLT  780
79      C           READ FAULT TREE, WRITE ON SCRATCH TAPE, STORE BLOCK NUMBERS IN  FLT  790
80      C           NBSAVE ARRAY.  NBKMAX = MAX NUMBER BLOCKS IN DIAGRAM.         FLT  800
81      C           NB=BOTTOM BLOCK,K=PATH NO.,J=A,I,OR O,I=A,I,OR O IDENTIFICATION NOFLT  810
82      C           RANK NBSAVE, LOWEST TO HIGHEST, ELIMINATING EQUAL BLOCK NUMBERS.  FLT  820
83      C                                                                        FLT  830
84      C                                                                        FLT  840
85       20 READ(5,100,ERR=105,END=105)  NB,JPATH,LAST                           FLT  850
86      100 FORMAT(I2,20A3,17X,I1)                                               FLT  860
87          NBSMAX=NBSMAX+1                                                      FLT  870
88          NBSAVE(NBSMAX)=NB                                                    FLT  880
89          GO TO 514                                                           FLT  890
90      105 READ(0,106,ERR=104,END=104) I,J                                      FLT  900
91      106 FORMAT(7X,I1,6X,I1)                                                  FLT  910
92          IF((I.GT.4).OR.(J.GT.8))  GO TO 104                                  FLT  920
93          IF(J.EQ.0)  J=3                                                      FLT  930
94          NSIG=J                                                               FLT  940
95          IPRINT=I                                                             FLT  950
96          PRINT 109,IPRINT,NSIG                                                FLT  960
97      109 FORMAT('0IPRINT OPTION SET AT'I4,'  NSIG OPTION SET AT'I4/1H1)       FLT  970
98          GO TO 20                                                            FLT  980
99      104 PRINT 108                                                            FLT  990
100     108 FORMAT('0ERROR** ATTEMPT TO SPECIFY IPRINT OR NSIG, BUT SPECIFIED FLT 1000
101         1OUT OF RANGE.'/' CARD IGNORED')                                     FLT 1010
102         GO TO 20                                                            FLT 1020
103     514 WRITE(10),NB,JPATH,LAST                                             FLT 1030
104         IF(LAST.LT.1) GO TO 20                                              FLT 1040
105         END FILE 10                                                         FLT 1050
106         REWIND 10                                                           FLT 1060
107     C                                                                        FLT 1070
108     C                                                                        FLT 1080
109     C     NBSAVE ORIGINALLY HOLDS BLOCK NOS USED BY THE FAULT TREE.  IT IS TFLT 1090
110     C     NBSAVE ORIGINALLY HOLDS BLOCK NOS USED BY THE FAULT TREE.  IT IS  FLT 1100
111     C     THEN FILLED OUT WITH NOS. NOT USED, THUS GIVING A LIST OF NUMBERS FLT 1110
112     C     THAT CAN BE ASSIGNED TO EQUIVALENT BLOCKS.                         FLT 1120
113     C                                                                        FLT 1130
114         IF(IPRINT.NE.4) GO TO 205                                           FLT 1140
115     C     PRINT NBSAVE TO CHECK                                             FLT 1150
116     C                                                                        FLT 1160
117         PRINT 201,NBSAVE                                                     FLT 1170
118     201 FORMAT('0NBSAVE'25I3/1H , 6X,25I3)                                   FLT 1180
119     C                                                                        FLT 1190
120     C                                                                        FLT 1200
121     C     NBKMAX = MAX NUMBER OF BLOCKS IN DIAGRAM.                          FLT 1210
122     C                                                                        FLT 1220
123     205 NBKMAX=NBSMAX                                                        FLT 1230
124     C                                                                        FLT 1240
125     C     RANK NBSAVE(BLOCK NUMBERS) ELIMINATING EQUALS.                     FLT 1250
126     C     JCOUNT = NUMBER OF EQUIVALENT BLOCKS.                              FLT 1260
127     C                                                                        FLT 1270
128         JCOUNT=0                                                            FLT 1280
129         IEND=NBKMAX-1                                                       FLT 1290
130         DO 250 I=1,IEND                                                     FLT 1300
131         JBEG=I+1                                                            FLT 1310
132         DO 240 J=JBEG,NBKMAX                                                FLT 1320
133         IF(NBSAVE(J).EQ.0) GO TO 250                                        FLT 1330
134         IF(NBSAVE(I).EQ.NBSAVE(J)) GO TO 200                                FLT 1340
135         IF(NBSAVE(I).LT.NBSAVE(J)) GO TO 240                                FLT 1350
136         JHOLD=NBSAVE(I)                                                     FLT 1360
137         NBSAVE(I)=NBSAVE(J)                                                 FLT 1370
138         NBSAVE(J)=JHOLD                                                     FLT 1380
139         GO TO 240                                                          FLT 1390
140     C                                                                        FLT 1400
141     C     CHECK IF DUPLICATE ALREADY IN ITEMP, IF NOT STORE.                 FLT 1410
142     C                                                                        FLT 1420
143     200 DO 210 L=1,M7                                                        FLT 1430
144         IF(ITEMP(2,L).EQ.0) GO TO 215                                       FLT 1440
145         IF(ITEMP(2,L).EQ.NBSAVE(I)) GO TO 225                               FLT 1450
146     210 CONTINUE                                                            FLT 1460
147         PRINT 211                                                           FLT 1470
148     211 FORMAT('1ITEMP IS FULL-STATEMENT NO. 211 OF FLT SUBROUTINE.'/' THERFLT 1480
149         1E ARE MORE THAN 20 SETS OF EQUIVALENT BLOCKS.')                    FLT 1490
150         GO TO 9999                                                          FLT 1500
151     215 ITEMP(2,L)=NBSAVE(I)                                                FLT 1510
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152        C                                                                    FLT 1520
153        C       ELIMINATE DUPLICATE BLOCK NUMBERS AND KEEP COUNT.            FLT 1530
154        C       SHIFT NBSAVE ARRAY TO LEFT.                                  FLT 1540
155        C                                                                    FLT 1550
156        225 DO 230 K=J,IEND                                                  FLT 1560
157            NBSAVE(K)=NBSAVE(K+1)                                            FLT 1570
158        230 CONTINUE                                                         FLT 1580
159            NBSAVE(NBKMAX)=0                                                 FLT 1590
160            JCOUNT=JCOUNT+1                                                  FLT 1600
161        240 CONTINUE                                                         FLT 1610
162        250 CONTINUE                                                         FLT 1620
163        C                                                                    FLT 1630
164        C    NBEG = END OF ORIGINAL BLOCK NUMBERS IN NBSAVE ARRAY.          FLT 1640
165        C    NEND = END OF ORIGINAL BLOCK NUMBERS IN NESAVE ARRAY.          FLT 1650
166        C                                                                    FLT 1660
167            NBEG=NBKMAX-JCOUNT                                               FLT 1670
168            NEND=NBEG                                                        FLT 1680
169        C                                                                    FLT 1690
170        C    PUT NEW BLOCK NUMBERS INTO LAST PART OF NBSAVE ARRAY.          FLT 1700
171        C                                                                    FLT 1710
172        C                                                                    FLT 1720
173        C    PRINT NBSAVE TO SEE IF RANKED                                   FLT 1730
174            IF(IPRINT.NE.4) GO TO 271                                        FLT 1740
175        C                                                                    FLT 1750
176            PRINT 201,NBSAVE                                                 FLT 1760
177        C                                                                    FLT 1770
178        271 K=1                                                             FLT 1780
179            N=NBEG                                                           FLT 1790
180            DO 280 J=1,L9                                                    FLT 1800
181            IF(NBSAVE(K).EQ.J) GO TO 270                                     FLT 1810
182            N=N+1                                                           FLT 1820
183            IF(N.GT.L9) GO TO 260                                            FLT 1830
184            NBSAVE(N)=J                                                      FLT 1840
185            GO TO 280                                                        FLT 1850
186        270 K=K+1                                                           FLT 1860
187            IF(K.GT.NEND) GO TO 265                                          FLT 1870
188        280 CONTINUE                                                         FLT 1880
189            GO TO 290                                                        FLT 1890
190        260 PRINT 261, N                                                     FLT 1900
191        261 FORMAT('1N IS GREATER THAN 50.  N='I4/' ERROR AT STATEMENT NO. 260FLT 1910
192          1 OF FLT SUBROUTINE.')                                            FLT 1920
193            GO TO 9999                                                       FLT 1930
194        265 LBEG=J+1                                                        FLT 1940
195            DO 275 L=LBEG,L9                                                 FLT 1950
196            N=N+1                                                           FLT 1960
197            IF(N.GT.L9) GO TO 260                                            FLT 1970
198            NBSAVE(N)=L                                                      FLT 1980
199        275 CONTINUE                                                         FLT 1990
200        C                                                                    FLT 2000
201        C    PRINT NBSAVE TO CHECK RANK AND NEW NB ASSIGNED.                FLT 2010
202        C                                                                    FLT 2020
203            IF(IPRINT.NE.4) GO TO 290                                        FLT 2030
204            PRINT 201, NBSAVE                                                FLT 2040
205        C                                                                    FLT 2050
206        C    REREAD DATA AND CHECK IF NB EQUAL ITEMP.                       FLT 2060
207        C                                                                    FLT 2070
208        290 READ(10) NK,JPATH,LAST                                          FLT 2080
209            DO 300 L=1,M7                                                    FLT 2090
210            IF(ITEMP(2,L).EQ.0) GO TO 300                                    FLT 2100
211            IF(ITEMP(2,L).EQ.NK) GO TO 310                                   FLT 2110
212        300 CONTINUE                                                         FLT 2120
213            GO TO 350                                                        FLT 2130
214        C                                                                    FLT 2140
215        C    CHECK IF FIRST TIME READ IN . IF NOT ASSIGN NEW NB.           FLT 2150
216        C                                                                    FLT 2160
217        310 ITEMP(1,L)=ITEMP(1,L)+1                                         FLT 2170
218            IF(ITEMP(1,L).LE.1) GO TO 350                                    FLT 2180
219            NBEG=NBEG+1                                                      FLT 2190
220            NB=NBSAVE(NBEG)                                                  FLT 2200
221            N=ITEMP(1,L)+1                                                   FLT 2210
222            ITEMP(N,L)=NB                                                    FLT 2220
223            GO TO 355                                                        FLT 2230
224        C                                                                    FLT 2240
225        C    STORE IPATH WITH NEW NB IF NEEDED.                            FLT 2250
226        C                                                                    FLT 2260
227        350 NB=NK                                                           FLT 2270
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228        355 DO 360 I=1,M8                                                    FLT 2280
229        360 IPATH(I,NB)=JPATH(I)                                            FLT 229C
230            IF(LAST.LT.1) GO TO 290                                         FLT 230C
231      C                                                                     FLT 231C
232      C       REINITIALIZE ITEMP                                           FLT 2320
233      C                                                                     FLT 233C
234            DO 370 L=1,M7                                                    FLT 2340
235        370 ITEMP(1,L)=0                                                     FLT 235C
236      C                                                                     FLT 2360
237      C       PRINT EQUIVALENT BLOCKS.   N1 = NUMBER OF OF EQUIVALENT BLOCK SETS.FLT 237C
238      C                                                                     FLT 2380
239.           PRINT 371                                                       FLT 239C
240        371 FORMAT('0EQUIVALENT BLOCKS')                                    FLT 2400
241            DO 380 I=1,M7                                                    FLT 241C
242            IF(ITEMP(2,I).EQ.0) GO TO 390                                   FLT 242C
243            DO 373 J=2,LL6                                                   FLT 243C
244            IF(ITEMP(J,I).EQ.0) GO TO 374                                   FLT 2440
245        373 CONTINUE                                                         FLT 245C
246        374 K=J-1                                                            FLT 246C
247            PRINT 372,ITEMP(2,I),((EQ,ITEMP(J,I)),J=3,K)                    FLT 2470
248        372 FORMAT('0'20(I3,A1))                                            FLT 2480
249            DO 380 K=2,LL6                                                   FLT 249C
250            ITEMP(K+M6,I)=-ITEMP(K,I)                                        FLT 250C
251        380 CONTINUE                                                         FLT 251C
252            N1=M7                                                            FLT 2520
253            GO TO 21                                                         FLT 253C
254        390 N1=I-1                                                           FLT 2540
255            IF(N1.EQ.0) PRINT 391                                           FLT 255C
256        391 FORMAT('0 NONE USED')                                           FLT 2560
257      C                                                                     FLT 257C
258      C       PRINT FAULT TREE PATHS AS A CHECK                            FLT 2580
259      C                                                                     FLT 259C
260         21 PRINT 633                                                        FLT 260C
261        633 FORMAT(1H116HFAULT TREE PATHS)                                  FLT 261C
262            DO 90 I=1,M1                                                     FLT 262C
263            IF(IPATH(1,I)-BL3)91,90,91                                      FLT 263C
264         91 PRINT 634,I,(IPATH(K,I),K=1,M8)                                 FLT 2640
265        634 FORMAT(1H05HBLOCKI3,3X,20(A3,1X))                              FLT 265C
266         90 CONTINUE                                                         FLT 2660
267      C                                                                     FLT 267C
268      C       PRINT ITEMP AS A CHECK IF IPRINT IS 4                        FLT 2680
269      C                                                                     FLT 269C
270            IF(IPRINT.NE.4) GO TO 410                                       FLT 270C
271            DO 400 I=1,M7                                                    FLT 271C
272            PRINT 393, I, (ITEMP(J,I), J=1,L6)                             FLT 2720
273        393 FORMAT('0ITEMP('I3,' )='21I3/'                *20I3)          FLT 273C
274        400 CONTINUE                                                         FLT 2740
275      C                                                                     FLT 275C
276      C                                                                     FLT 2760
277      C       PHASE 3                                                       FLT 277C
278      C                                                                     FLT 2780
279      C       THE SUBROUTINE MODIFY MODIFIES THE FAULT PATHS WHERE NECESSARY FLT 279C
280      C                                                                     FLT 280C
281        410 CALL MODIFY(NONACT,MATCSW,A,IPRINT,NRSW)                        FLT 2810
282      C                                                                     FLT 2820
283      C       THE MODIFIED FAULT TREE HAS ELIMINATED ALL SERIES *AND* AND *OR* FLT 283C
284      C       GATES, AND HAS REDUCED *STANDBY* GATES TO *AND* AND *OR* GATES FLT 2840
285      C       ( BUT WHICH ARE DENOTED D AND S RESPECTIVELY)               FLT 285C
286      C                                                                     FLT 2860
287        578 IF(IPRINT.EQ.0) GO TO 508                                       FLT 287C
288            PRINT 577                                                        FLT 2880
289        577 FORMAT (1H1,5X,'MODIFIED FAULT TREE PATHS')                     FLT 289C
290            DO 505 I=1,M1                                                    FLT 2900
291            IF (IPATH(1,I) -BL3) 506,505,506                               FLT 291C
292        506 PRINT 507,I,(IPATH(K,I),K=1,M8)                                 FLT 2920
293        507 FORMAT(1H05HBLOCKI3,3X,20(A3,1X))                              FLT 293C
294        505 CONTINUE                                                         FLT 2940
295      C                                                                     FLT 295C
296      C       PHASE 4                                                       FLT 2960
297      C       CONVERT CONDENSED PATHS TO RELIABILITY BLOCK DIAGRAM         FLT 2970
298      C                                                                     FLT 2980
299        508 IK=0                                                            FLT 299C
300            IAN=0                                                            FLT 3000
301            KS = 0                                                           FLT 3010
302      C                                                                     FLT 3020
303      C       IK ITERATES FAULT PATHS                                      FLT 3030
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304        C                                                              FLT 3040
305        40 IK=IK+1                                                     FLT 3050
306           MK=0                                                        FLT 3060
307           IF(IK-M1)1,82,82                                            FLT 3070
308        C                                                              FLT 3080
309        C     MK ITERATES THE GATE IN THE FAULT PATH                   FLT 3090
310        C                                                              FLT 3100
311        1 MK=MK+1                                                      FLT 3110
312          IF(MK-M8)170,170,40                                          FLT 3120
313     170 IF(IPATH(MK,IK)-BL3)41,40,41                                  FLT 3130
314        C                                                              FLT 3140
315        C     IS IT X                                                  FLT 3150
316        C     X MEANS THAT THIS GATE HAS ALREADY BEEN TREATED          FLT 3160
317        C                                                              FLT 3170
318       41 IF(IPATH(   MK,IK)-A(2))56,1,56                              FLT 3180
319       56 J=IPATH(   MK,IK)                                            FLT 3190
320       57 MSAVE=1                                                      FLT 3200
321        C                                                              FLT 3210
322        C     42,43 LOOP THROUGH ALL OTHER FAULT PATHS TO SEE IF GATE J IS IN  FLT 3220
323        C           ANY OTHER PATH.  IF YES, LOOP OUT TO 61.           FLT 3230
324        C                                                              FLT 3240
325           DO 42 I=1,L9                                                FLT 3250
326        C                                                              FLT 3260
327        C     IS PATH TO BE CHECKED BLANK * IF YES,IGNORE              FLT 3270
328        C                                                              FLT 3280
329           IF(IPATH(1,I)-BL3)58,42,58                                  FLT 3290
330        C                                                              FLT 3300
331        C     IS THIS THE PATH CURRENTLY BEING WORKED ON (IK) * IF YES,IGNORE  FLT 3310
332        C                                                              FLT 3320
333       58 IF(I-IK)59,42,59                                             FLT 3330
334       59 DO 43 N=1,M8                                                 FLT 3340
335          IF(IPATH(N,I)-J)43,61,43                                     FLT 3350
336       43 CONTINUE                                                     FLT 3360
337          GO TO 42                                                     FLT 3370
338        C                                                              FLT 3380
339        C     IS IT CLEARED                                            FLT 3390
340        C     IS GATE FOUND THE FIRST GATE IN THE FAULT PATH.  IF NOT, HAS THE  FLT 3400
341        C           PREVIOUS GATE IN THE FAULT PATH BEEN TREATED * I.E. IS THE  FLT 3410
342        C           PREVIOUS GATE = X *                                FLT 3420
343        C                                                              FLT 3430
344       61 IF(N-1)62,63,62                                              FLT 3440
345       62 IF(IPATH(N-1,I)-A(2))64,63,64                                FLT 3450
346        C                                                              FLT 3460
347        C     NOT CLEARED IS 64 ROUTE                                  FLT 3470
348        C                                                              FLT 3480
349       64 IF(IZ)172,518,172                                           FLT 3490
350      172 IF (GATE(J)-A(7)) 174,176,174                               FLT 3500
351      174 IF (GATE(J)-A(4)) 173,175,173                               FLT 3510
352      173 IF (GATE(J) - A(6)) 176,175,176                             FLT 3520
353      176 IZ=0                                                        FLT 3530
354      518 MK=0                                                        FLT 3540
355          IK=I                                                        FLT 3550
356          GO TO 1                                                     FLT 3560
357        C                                                              FLT 3570
358        C     CHECK TO SEE IF OR  GATE HAS BEEN HIT BEFORE             FLT 3580
359        C                                                              FLT 3590
360      175 DO 140 K=1,M10                                              FLT 3600
361          IF(IANDZ(1,K)-J)140,178,140                                 FLT 3610
362      140 CONTINUE                                                    FLT 3620
363          DO 146 K=1,M10                                              FLT 3630
364          IF(IANDZ(1,K)-BL3)146,177,146                               FLT 3640
365      146 CONTINUE                                                    FLT 3650
366        C                                                              FLT 3660
367        C     IANZ IS FULL, IMPLYING THAT MORE THAN 12 OR  GATES ARE INTER-  FLT 3670
368        C     RELATED.  J IS THE OR GATE BEING WORKED ON.             FLT 3680
369        C                                                              FLT 3690
370        5 PRINT 15, J                                                 FLT 3700
371       15 FORMAT('1ERROR ** THERE ARE MORE THAN 12 OR GATES INTERRELATED.'/ FLT 3710
372          1' THE GATE CURRENTLY BEING WORKED ON IS 'A3/' ERROR IS AT STATEMENFLT 3720
373          2T NO. 5 OF FLT SUBROUTINE.')                               FLT 3730
374          GO TO 9999                                                  FLT 3740
375        C                                                              FLT 3750
376      177 IAN=K                                                       FLT 3760
377          IANDZ(1,IAN)=J                                              FLT 3770
378        C                                                              FLT 3780
379        C     PUT BLOCKS WITH TEMPORARY OUTPUT OF Z INTO IANDZ(.,IAN)  FLT 3790
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380        C                                                          FLT 3800
381             4 IF(IZ.LT.L3)  GO TO 1004                            FLT 3810
382               STOP 1004                                           FLT 3820
383          1004 DO 141 K=1,IZ                                       FLT 3830
384           141 IANDZ(K+1,IAN)=MZ(K)                                FLT 3940
385               GO TO 176                                           FLT 3850
386           178 IAN=K                                               FLT 3860
387             7 CALL SUB7(IB)                                       FLT 3870
388           149 IAND(1,IAN)=BL3                                     FLT 3880
389               DO 144 K=2,L3                                       FLT 3890
390               IANDZ(K,IAN)=0                                      FLT 3900
391           144 IAND(K,IAN)=0                                       FLT 3910
392               DO 145 K=LL3,L9                                     FLT 3920
393           145 IAND(K,IAN)=0                                       FLT 3930
394               GO TO 4                                             FLT 3940
395        C                                                          FLT 3950
396        C      CLEARED IS 63 ROUTE                                 FLT 3960
397        C                                                          FLT 3970
398            63 MSAVE=MSAVE+1                                       FLT 3980
399        C                                                          FLT 3990
400        C      ISAVE SAVES PATH NUMBERS OF THE PATHS THAT CONTAIN GATE J   FLT 4000
401        C      MSAVE IS THE NUMBER OF BLOCKS STORED IN ISAVE       FLT 4010
402        C                                                          FLT 4020
403               ISAVE(MSAVE)=I                                      FLT 4030
404            42 CONTINUE                                            FLT 4040
405        C                                                          FLT 4050
406        C      RECORD ORIGINAL PATH                                FLT 4060
407        C                                                          FLT 4070
408               ISAVE(1)=IK                                         FLT 4080
409        C                                                          FLT 4090
410        C      SET THE FIRST NON-X-ED GATE IN EACH OF THE PATHS SORED IN ISAVE   FLT 4100
411        C          TO X.  THIS INDICATES THAT THESE GATES ARE WORKED ON.    FLT 4110
412        C                                                          FLT 4120
413               DO 44 I=1,MSAVE                                     FLT 4130
414               L=ISAVE(I)                                          FLT 4140
415               DO 45 N=1,M8                                        FLT 4150
416               IF(IPATH(  N,L)-A(2))65,45,65                       FLT 4160
417            45 CONTINUE                                            FLT 4170
418            65 IPATH(  N,L)=A(2)                                   FLT 4180
419            44 CONTINUE                                            FLT 4190
420        C                                                          FLT 4200
421        C      RECORD ISAVE IN IAND FOR ANY OR  GATES BEING WORKED ON   FLT 4210
422        C                                                          FLT 4220
423               DO 150 I=1,M10                                      FLT 4230
424               IF (IANDZ(1,I)-BL3)182,150,182                      FLT 4240
425           182 IF(IANDZ(1,I)-J)790,150,790                         FLT 4250
426           790 DO 151 K=2,L9                                       FLT 4260
427               IF(IAND(K,I))151,183,151                            FLT 4270
428           151 CONTINUE                                            FLT 4280
429           183 IAND(1,I)=IANDZ(1,I)                                FLT 4290
430               IL1 = MSAVE + K - 1                                 FLT 4300
431               DO 152 N=K,IL1                                      FLT 4310
432               L2=N-K+1                                            FLT 4320
433           152 IAND(N,I)=ISAVE(L2)                                 FLT 4330
434           150 CONTINUE                                            FLT 4340
435        C                                                          FLT 4350
436        C      NOTE IN THE FOLLOWING.. MZ HOLDS BLOCKS OF THE DIAGRAM THAT HAVE   FLT 4360
437        C      A TEMPORARY OUTPUT OF Z, I.E. OUTPUT BLOCK NOT YET DETERMINED.    FLT 4370
438        C      IZ IS QTY IN MZ.                                    FLT 4380
439        C TEST FOR A.O OR S.O BY WHETHER LT OR GT 'I'.             FLT 4390
440        C                                                          FLT 4400
441               IF (GATE(J) -   A(1)) 67,67,66                      FLT 4410
442        C                                                          FLT 4420
443        C  AND GATES USE 67 ROUTE.                                 FLT 4430
444        C                                                          FLT 4440
445        67     DO 50 I=1,MSAVE                                     FLT 4450
446               L=ISAVE(I)                                          FLT 4460
447               IB(2,2,L)=A(5)                                      FLT 4470
448            50 MZ(I)=L                                             FLT 4480
449               IZ=MSAVE                                            FLT 4490
450               GO TO 1                                             FLT 4500
451        C                                                          FLT 4510
452        C      HAS THIS OR  GATE APPEARED IN IANDZ                 FLT 4520
453        C                                                          FLT 4530
454            66 DO 153 I=1,M10                                      FLT 4540
455               IF(IANDZ(1,I)-J)153,184,153                         FLT 4550
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456          153 CONTINUE                                                      FLT 456C
457          185 CONTINUE                                                      FLT 457C
453              IF(IZ)70,188,70                                               FLT 458C
459      C                                                                     FLT 459C
460      C        PUT BLOCKS IN SERIES. PUT Z IN OUTPUT OF LAST.               FLT 460C
461      C                                                                     FLT 461C
462          188 L=ISAVE(1)                                                    FLT 462C
463              IB(2,2,L)=ISAVE(2)                                            FLT 463C
464              IF(MSAVE-2)73,73,72                                           FLT 464C
465           72 N=MSAVE-1                                                     FLT 465C
466                                                                            FLT 466C
467              DO 47 I=2,N                                                   FLT 467C
468              L=ISAVE(I-1)                                                  FLT 468C
469              M=ISAVE(I+1)                                                  FLT 469C
470              LM=ISAVE(I)                                                   FLT 470C
471              IB(2,1,LM)=L                                                  FLT 471C
472           47 IB(2,2,LM)=M                                                  FLT 472C
473           73 LM=ISAVE(MSAVE)                                              FLT 473C
474              L=ISAVE(MSAVE-1)                                             FLT 474C
475              IB(2,1,LM)=L                                                  FLT 475C
476              IB(2,2,LM)=A(5)                                               FLT 476C
477              IZ=1                                                          FLT 477C
478              MZ(1)=LM                                                      FLT 478C
479              MK=1                                                          FLT 479C
480              IK=LM                                                         FLT 480C
481      C                                                                     FLT 481C
482      C        BLANK OUT PATHS WITH OUTPUTS                                 FLT 482C
483      C                                                                     FLT 483C
484          793 IL1=MSAVE-1                                                   FLT 484C
485              DO 46 I=1,IL1                                                 FLT 485C
486              L=ISAVE(I)                                                    FLT 486C
487              DO 46 M=1,M8                                                  FLT 487C
488           46 IPATH( M,L)=BL3                                              FLT 488C
489              GO TO 1                                                       FLT 489C
490          184 IAN=I                                                         FLT 490C
491              IF(IAND(1,I)-BL3)186,187,186                                 FLT 491C
492          186 CALL SU37(IB)                                                FLT 492C
493      C                                                                     FLT 493C
494      C        REMOVE IANDZ FROM ISAVE                                      FLT 494C
495      C                                                                     FLT 495C
496          187 DO 154 I=2,L3                                                 FLT 496C
497              IF(IANDZ(I,IAN))51,154,51                                    FLT 497C
498           51 DO 155 N=1,MSAVE                                             FLT 498C
499              IF(IANDZ(I,IAN)-ISAVE(N))155,190,155                        FLT 499C
500          155 CONTINUE                                                      FLT 500C
501              GO TO 154                                                     FLT 501C
502          190 IF(N-MSAVE)189,191,189                                       FLT 502C
503          191 ISAVE(MSAVE)=0                                               FLT 503C
504              MSAVE=MSAVE-1                                                 FLT 504C
505              GO TO 154                                                     FLT 505C
506          189 IL1=MSAVE-1                                                   FLT 506C
507              DO 156 K=N,IL1                                                FLT 507C
508          156 ISAVE(K)=ISAVE(K+1)                                          FLT 508C
509              MSAVE=MSAVE-1                                                 FLT 509C
510          154 CONTINUE                                                      FLT 510C
511      C   BLANK IANDZ, IAND(..,IAN) HERE.                                   FLT 511C
512              IAND(1,IAN) = BL3                                            FLT 512C
513              IANDZ(1,IAN) = BL3                                           FLT 513C
514              DO 867 K = 2,L3                                              FLT 514C
515              IANDZ(K,IAN) = 0                                            FLT 515C
516              IAND(K,IAN) = 0                                             FLT 516C
517          867 CONTINUE                                                      FLT 517C
518              DO 868 K = LL3,L9                                            FLT 518C
519              IAND(K,IAN) = 0                                             FLT 519C
520          868 CONTINUE                                                      FLT 520C
521           70 N=0                                                          FLT 521C
522              IZ=0                                                          FLT 522C
523      C                                                                     FLT 523C
524      C        ELIMINATE BLOCKS WITH OUTPUT FROM ISAVE                      FLT 524C
525      C                                                                     FLT 525C
526           74 N=N+1                                                        FLT 526C
527              IF(MSAVE-N)75,76,76                                          FLT 527C
528           76 L=ISAVE(N)                                                   FLT 528C
529              IF(IB(2,2,L))77,74,77                                        FLT 529C
530           77 IZ=IZ+1                                                      FLT 530C
531              MZ(IZ)=L                                                      FLT 531C
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532              L=N-1
533           78 L=L+1
534              ISAVE(L)=ISAVE(L+1)                                    FLT 5340
535              IF(L+1-MSAVE)78,79,79                                  FLT 5350
536           79 MSAVE=MSAVE-1                                         FLT 5360
537              N=N-1                                                 FLT 5370
538              IF(MSAVE)74,1,74                                       FLT 5380
539           75 L=ISAVE(1)                                            FLT 5390
540        C                                                           FLT 5400
541        C     MAKE CHAIN                                            FLT 5410
542        C                                                           FLT 5420
543              DO 48 I=1,IZ                                          FLT 5430
544              M=MZ(I)                                               FLT 5440
545        C                                                           FLT 5450
546        C     BLANK OUT PATHS WITH NUMERICAL OUTPUT                 FLT 5460
547        C                                                           FLT 5470
548              DO 800 K=1,M8                                         FLT 5480
549          800 IPATH( K,M)=BL3                                       FLT 5490
550              N=I+1                                                 FLT 5500
551              IB(2,2,M)=L                                           FLT 5510
552           48 IB(N,1,L)=M                                           FLT 5520
553              IF(MSAVE-1)81,81,80                                   FLT 5530
554           80 DO 49 I=2,MSAVE                                       FLT 5540
555              L=ISAVE(I-1)                                          FLT 5550
556              M=ISAVE(I)                                            FLT 5560
557              IB(2,2,L)=M                                           FLT 5570
558           49 IB(2,1,M)=L                                           FLT 5580
559           81 L=ISAVE(MSAVE)                                        FLT 5590
560              IB(2,2,L)=A(5)                                        FLT 5600
561              IZ=1                                                  FLT 5610
562              MZ(1)=L                                               FLT 5620
563              IK=L                                                  FLT 5630
564              MK=0                                                  FLT 5640
565              IF(MSAVE-1)1,1,793                                    FLT 5650
566        C                                                           FLT 5660
567        C     SET UP M1 AS TOP BLOCK                                FLT 5670
568        C                                                           FLT 5680
569           82 DO 52 I=1,IZ                                          FLT 5690
570              L=MZ(I)                                               FLT 5700
571              I1=I+1                                                FLT 5710
572              IB(2,2,L)=M1                                          FLT 5720
573              NB = M1                                               FLT 5730
574           52 IB(I1,1,M1)=L                                         FLT 5740
575        C                                                           FLT 5750
576         9999 CONTINUE                                              FLT 5760
577              REWIND 10                                             FLT 5770
578        10000 RETURN                                                FLT 5780
579              END                                                   FLT 5790
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    1            SUBROUTINE READDS(NSR,TLD,TL,RO,SWPROB,TLDS,TLS,IRB,IS)        READ   1C
    2     C                                                                     READ  -20
    3     C      THIS SUBROUTINE READS THE DORMANT PARAMETERS (FAILURE RATES OR READ   3C
    4     C      FACTOR) AND THE SWITCHING OPTIONS AND PARAMETERS IF THERE       READ   40
    5     C      ARE ANY STANDBY BLOCKS IN THE RBD                              READ   5C
    6     C                                                                     READ   60
    7            DIMENSION SWPROB(5C),TLDS(50),TLS(5G)                          READ   7C
    8            DIMENSION RO(5G),IS(5O),TLD(5O),TL(5G),IRB(50,30)              READ   8D
    9     C                                                                     READ   90
   10     C      READ DORMANCY PARAMETERS.                                      READ  1CO
   11     C      DFACT = DORMANCY FACTOR TO BE MULTIPLIED EY STANDBY ACTIVE LAMBDASREAD 110
   12     C      IF IDUMMY NON ZERO AND DFACT = G - READ LAMBDA DORMANT = TLD(NB). READ 120
   13     C                                                                     READ  13C
   14            READ 41C1, IDUMMY, DFACT                                       READ  140
   15     41C1 FORMAT(I2,E12.7,F1C.7,55X,I1)                                    READ  15C
   16            IF(IDUMMY.EQ.0) GO TO 4160                                     READ  16C
   17            IF(DFACT.GT.C.) GO TO 4160                                     READ  17C
   18     4150 READ 41C1, NB, TLAMBD, DUMMY, LAST                              READ  180
   19            TLD(NB)=TLAMBD                                                 READ  19C
   2C            IF(LAST.LT.6) GO TO 415C                                       READ  200
   21            GO TO 4190                                                     READ  210
   22     4160 DO 4180 J=1,NSR                                                 READ  22C
   23            NS=IS(J)                                                       READ  230
   24            KEND=IRB(NS,1)+1                                               READ  24C
   25            DO 4170 K=2,KEND                                               READ  250
   26            NB=IRB(NS,K)                                                   READ  260
   27            TLD(NB)=DFACT*TL(NB)                                           READ  270
   28     4170 CONTINUE                                                         READ  280
   29     4180 CONTINUE                                                         READ  29C
   3C     C                                                                     READ  300
   31     C                                                                     READ  31C
   32     C      READ SWITCHING OPTIONS AND DATA FOR EACH SENSE BLOCK.          READ  320
   33     C                                                                     READ  33C
   34     C      C = PERFECT SWITCHING( PROBABILITY SWITCH WORKS EQUALS 1.0)    READ  340
   35     C      1 = CONSTANT PROBABILITY THAT SWITCH WORKS.                    READ  35C
   36     C      2 = DORMANT FAILURE RATE FOR SWITCH.                          READ  360
   37     C      3 = DORMANT AND ACTIVE FAILURE RATE FOR SWITCH.                READ  37C
   38     C      4 = NOT AVAILABLE                                              READ  380
   39     C      5 = NOT AVAILABLE                                              READ  39C
   40     C                                                                     READ  400
   41     4190 DO 4700 J=1,NSR                                                 READ  41C
   42            READ 41C1, NB,TLAMBD,SPROB,ISOPT                              READ  420
   43            IF(ISOPT.EQ.C) GO TO 46CO                                     READ  43C
   44            GO TO (4610,4620,463C,464C,4650), ISOPT                       READ  44C
   45     46CC SWPROB(NB)=1.C                                                  READ  45C
   46            TLDS(NB)=C.0                                                   READ  46C
   47            TLS(NB)=C.0                                                    READ  470
   48            GO TO 468C                                                     READ  480
   49     4610 SWPROB(NB)=SPROB                                                READ  490
   50            TLDS(NB)=0.0                                                   READ  5CO
   51            TLS(NB)=C.G                                                    READ  51C
   52            GO TO 468C                                                     READ  520
   53     462C SWPROB(NB)=1.C                                                  READ  53C
   54            TLDS(NB)=TLAMBD                                               READ  540
   55            TLS(NB)=C.G                                                    READ  55C
   56            GO TO 468C                                                     READ  56C
   57     4630 SWPROB(NB)=1.C                                                  READ  57C
   58            TLDS(NB)=TLAMBD                                               READ  58C
   59            READ 4101, NB,TLAMBD                                          READ  59C
   6C            TLS(NB)=TLAMBD                                                READ  6OO
   61            GO TO 468C                                                     READ  61C
   62     4640 CONTINUE                                                         READ  62C
   63            GO TO 468C                                                     READ  63C
   64     4650 CONTINUE                                                         READ  64C
   65     468C TLD(NB)=C.C                                                     READ  65C
   66            TL(NB)=0.C                                                     READ  66C
   67            RO(NB)=1.C                                                     READ  67C
   68     47CO CONTINUE                                                         READ  68C
   69            RETURN                                                         READ  69C
   70            END                                                           READ  7CC
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   1            SUBROUTINE MODIFY(NONACT,MATCSW,A,IPRINT,NRSW)          MODY  10
   2            COMMON/ALLSUB/M1,M2,M3,M4,M5,M6,M7,L1,L3,L4,L5,L6       MODY  2C
   3            COMMON/SUB/IPATH(2C,50),IAND(49,12),IANDZ(25,12),IAN,BL3,M8  MODY  3C
   4            DIMENSION NONACT(5C,3C),MATCSW(5C),NACV(5C)            MODY  4C
   5            INTEGER GATE,A(8),BL3                                  MODY  5C
   6            DATA ND/C11CC0G050505/,KNBCHN/00C77770CG0GG/,NS/03CG0G0C5C5C5/  MODY  6C
   7            L9=M1-1                                                MODY  7C
   8            L8=M8-1                                                MODY  8C
   9            DO 1CC I=1,50                                          MODY  9C
  1C      1CC NACV(I) = C                                             MODY 1CC
  11            NRSW = C                                               MODY 11C
  12     C                                                            MODY 12C
  13     C        CONDENSE PATHS BY ELIMINATING SERIES ANDS AND ORS,SAVING LAST.  MODY 13C
  14     C                                                            MODY 14C
  15     410  DO 3C IK=1,L9                                           MODY 15C
  16            IF(IPATH(1,IK)-BL3)31,3C,31                           MODY 16C
  17       31  DO 35 I=1,L8                                           MODY 17C
  18       32  IF(IPATH(I+1,IK)-BL3)36,3C,36                          MODY 18C
  19       36  IF(GATE(IPATH(I,IK)).NE.GATE(IPATH(I+1,IK)))  GO TO 35  MODY 19C
  2C     C                                                            MODY 2CC
  21     C        CHECK TO SEE IF I                                   MODY 21C
  22     C                                                            MODY 22C
  23       37  IF(GATE(IPATH(I,IK))-A(1))34,35,34                     MODY 23C
  24       34  DO 33 J=I,L8                                           MODY 24C
  25       33  IPATH(J,IK)=IPATH(J+1,IK)                              MODY 25C
  26            IPATH(M8,IK)=BL3                                      MODY 26C
  27            GO TO 32                                              MODY 27C
  28       35  CONTINUE                                               MODY 28C
  29       3C  CONTINUE                                               MODY 290
  3C     C                                                            MODY 3CC
  31     C        MODIFY GATES WITH DORMANCY.  GOOD OR G INPUTS TO STANDBY GATES  MODY 31C
  32     C        ARE CHANGED TO D GATES, AND SWITCH OR S GATES APPENDED TO EVERY  MODY 32C
  33     C        D GATE.  THIS ENSURES THAT ALL GATES HAVE AT LEAST 2 INPUTS IN  MODY 33C
  34     C        ADDITION TO CHANGING THE FORM TO ONE WHICH WILL DIRECTLY CONVERT  MODY 34C
  35     C        TO A RELIABILITY BLOCK DIAGRAM.  D GATES ARE TREATED AS AND GATES  MODY 35C
  36     C        AND S GATES ARE TREATED AS OR GATES.  WITH THE GATES, D GATES  MODY 36C
  37     C        CONNECT IN PARALLEL AND S GATES CONNECT IN SERIES.  MODY 37C
  38     C                                                            MODY 38C
  39     C    MATCSW IS ARRAY CONTAINING SWITCHES.                    MODY 39C
  4C     C    NONACT IS ARRAY WITH DORMANT BLOCKS AND RESPECTIVE SWITCHES.  MODY 4CC
  41     C                                                            MODY 41C
  42            KS = C                                                MODY 42C
  43            DO 528 IK = 1,M1                                      MODY 43C
  44            DO 522 I = 1,2C                                       MODY 44C
  45            JGT = IPATH(I,IK)                                     MODY 45C
  46            JG = GATE(JGT)                                        MODY 46C
  47     C    IS GATE A S GATE * * *                                  MODY 47C
  48            IF (JG.EQ.A(6)) GO TO 512                             MODY 48C
  49     C    IS GATE A G GATE * * *                                  MODY 49C
  5C            IF (JG.EQ. A(8)) GO TO 513                            MODY 5CC
  51     C    IS GATE NOT A D GATE * * *                              MODY 51C
  52            IF (JG.NE.A(7)) GO TO 522                             MODY 52C
  53     C    SET KS .NE. 0 , SINCE THIS IS D GATE.                   MODY 53C
  54            KS = 1                                                MODY 54C
  55     C    REMOVE LETTER PART OF THE GATE.                         MODY 55C
  56      523 JS = AND (JGT,KNBCHN)                                   MODY 56C
  57     CHANGE TO S GATE .                                           MODY 57C
  58            JS = OR(JS,NS)                                        MODY 58C
  59     C    TO BE D OR NOT BE D IS THE QUESTION.                    MODY 59C
  6C            IF (KS) 529,527,529                                   MODY 6CC
  61      529 DO 560 J = 1,M1                                         MODY 61C
  62     C    THIS IS A D GATE, SO FIND THAT S GATE TO WHICH THIS D GATE BELONGS.  MODY 62C
  63            IF (JS.EQ.IPATH(1,J)) GO TO 561                       MODY 63C
  64      560 CONTINUE                                                MODY 64C
  65      561 NACV(J ) = NACV(J ) + 1                                 MODY 65C
  66            MK = NACV(J )                                         MODY 66C
  67     C    PLACE THIS BLOCK WITH A D GATE INTO NONACT-WITH ITS RESPECTIVE S GAT  MODY 67C
  68            NONACT(J,MK) = IK                                     MODY 68C
  69            KS = C                                                MODY 69C
  7C            GO TO 527                                             MODY 7CC
  71     C    REMOVE LETTER PART OF THE GATE.                         MODY 71C
  72      513 JG = AND (JGT,KNBCHN)                                   MODY 72C
  73     CHANGE FROM G GATE TO A D GATE.                              MODY 73C
  74            IPATH(I,IK) = OR (JG,ND)                              MODY 74C
  75            GO TO 523                                             MODY 75C
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 76      512 NRSW = NRSW + 1                                              MODY 76C
 77    C    THIS IS A S GATE, SO LIST IT IN MATCSW AND ADD IT TO THE NUMBER OF SMODY 77C
 78    C    FOUND IN THIS TREE THUS FAR.                                  MODY 78C
 79          MATCSW(NRSW) = IK                                            MODY 79C
 80          GO TO 522                                                    MODY 80C
 81    C    SHIFT ALL GATES FOLLOWING THE D GATES ONE POSITION IN THE ARRAY  AHEMODY 81C
 82    C    SO THAT A S GATE CAN BE INSERTED AFTER THE D GATE.            MODY 82C
 83      527 L = 19 - I                                                   MODY 83C
 84          DO 525 N = 1,L                                               MODY 64C
 85          IPATH(M8 - N + 1,IK) = IPATH(M8 - N, IK)                     MODY 85D
 86      525 CONTINUE                                                     MODY 86C
 87          IPATH(I+1,IK)= JS                                            MODY 87C
 88          GO TO 528                                                    MODY 86C
 89      522 CONTINUE                                                     MODY 89C
 90      528 CONTINUE                                                     MODY 90C
 91    C    OUTPUT NONACT, MATCSW AND THE MODIFIED TREE AS A CHECK.       MODY 91C
 92          IF(NRSW.EQ.0) GO TO 578                                      MODY 92C
 93          IF(IPRINT.EQ.0) GO TO 578                                    MODY 93C
 94          DO 576 J = 1,NRSW                                            MODY 94C
 95          NON = MATCSW(J)                                              MODY 95C
 96          PRINT 516, NON                                               MODY 96C
 97      516 FORMAT ('0SWITCH'I3,' CONTROLS THE FOLLOWING BLOCKS')        MODY 97C
 98          DO 530 K=1,20                                                MODY 98C
 99          IF(NONACT(NON,K).EQ.0) GO TO 531                             MODY 99C
100      530 CONTINUE                                                     MODY100C
101      531 I=K-1                                                        MODY101C
102          PRINT 520, (NONACT(NON,K),K = 1,I)                           MODY102C
103      520 FORMAT (1H ,20I3)                                            MODY103C
104      576 CONTINUE                                                     MODY104C
105    C                                                                  MODY105C
106      578 RETURN                                                       MODY106C
107          END                                                         MODY107C
```

```
          1            SUBROUTINE PRTEQ(ITEMP,IPRINT,N1,LL6)                        PREQ   10
          2     C                                                                    PREQ   20
          3     C      THIS SUBROUTINE SETS UP THE COMPLIMENTS OF THE EQUIVALENT BLOCKS  PREQ   30
          4     C      IN THE SECOND PART OF THE ITEMP ARRAY.  IT ALSO PRINTS THE     PREQ   40
          5     C      THE EQUIVALENT BLOCKS.                                         PREQ   50
          6     C                                                                    PREQ   60
          7            DIMENSION ITEMP(41,20)                                         PREQ   70
          8            M6=LL6-1                                                       PREQ   80
          9            IF(IPRINT.EQ.0) GO TO 2041                                     PREQ   90
         10        140 PRINT 905                                                      PREQ  100
         11        905 FORMAT(1H017HEQUIVALENT BLOCKS)                                PREQ  110
         12       2041 DO 123 I=1,N1                                                  PREQ  120
         13            IF(IPRINT.EQ.0) GO TO 2042                                     PREQ  130
         14            PRINT 906,(ITEMP(J,I),J=2,LL6)                                 PREQ  140
         15        906 FORMAT('0',40I3)                                               PREQ  150
         16       2042 DO 125 K=2,LL6                                                 PREQ  160
         17        125 ITEMP(K+M6,I)=-ITEMP(K,I)                                      PREQ  170
         18        123 CONTINUE                                                       PREQ  180
         19            RETURN                                                         PREQ  190
         20            END                                                           PREQ  200
```

```
  1              SUBROUTINE PRRBD(IB,M1)                                    PRBD  10
  2         C                                                               PRBD  20
  3         C       THIS SUBROUTINE PRINTS THE RELIABILITY BLOCK DIAGRAM.   PRBD  30
  4         C                                                               PRBD  40
  5              DIMENSION IB(15,2,50)                                      PRBD  50
  6              PRINT 632                                                  PRBD  60
  7          632 FORMAT('0RELIABILITY BLOCK DIAGRAM')                       PRBD  70
  8              DO 18 I=1,M1                                               PRBD  80
  9              IF(IB(1,1,I))21,22,21                                      PRBD  90
 10           22 IF(IB(1,2,I))21,18,21                                      PRBD 100
 11           21 K=IB(1,1,I)+1                                             PRBD 110
 12              IF(K.LE.1) GO TO 40                                        PRBD 120
 13              PRINT 202,I,(IB(J,1,I),J=2,K)                             PRBD 130
 14          202 FORMAT(1H05HBLOCKI3,3X,5HINPUT14(I3,1X))                  PRBD 140
 15              GO TO 41                                                   PRBD 150
 16           40 PRINT 205,I                                               PRBD 160
 17          205 FORMAT(1H05HBLOCKI3,3X,5HINPUT)                          PRBD 170
 18           41 K=IB(1,2,I)+1                                             PRBD 180
 19              IF(K.LE.1) GO TO 42                                        PRBD 190
 20              PRINT 203,(IB(J,2,I),J=2,K)                              PRBD 200
 21          203 FORMAT(11X,6HOUTPUT,14(I3,1X))                           PRBD 210
 22              GO TO 18                                                   PRBD 220
 23           42 PRINT 206                                                 PRBD 230
 24          206 FORMAT(11X,6HOUTPUT)                                     PRBD 240
 25           18 CONTINUE                                                  PRBD 250
 26              RETURN                                                     PRBD 260
 27              END                                                       PRBD 270
```

```
  1              SUBROUTINE IBSTBY($,NSR,IS,IRB,IB,IPRINT,L3,L5)         IBSY  10
  2       C                                                             IBSY  20
  3       C      STANDBY BLOCKS MUST FOLLOW ALL OTHER INPUT BLOCKS IN INPUT LISTS IBSY  30
  4       C      FOR IB.                                                IBSY  40
  5       C      SUBROUTINE IBSTBY REARRANGES ANY ELEMENTS IN IB THAT NEED IT, AND IBSY  50
  6       C      ALSO PRINTS THE SENSE BLOCKS.                          IBSY  60
  7       C                                                             IBSY  70
  8              DIMENSION NHOLD(15),IS(50),IRB(50,30),IB(15,2,50)      IBSY  80
  9       C                                                             IBSY  90
 10              DO 2020 I=1,NSR                                        IBSY 100
 11              INS=IS(I)                                              IBSY 110
 12              DO 2200 J=1,L3                                         IBSY 120
 13              NHOLD(J)=0                                             IBSY 130
 14       2200 CONTINUE                                                 IBSY 140
 15              NUM=0                                                  IBSY 150
 16              KEND=IRB(INS,1)+1                                      IBSY 160
 17       C                                                             IBSY 170
 18              DO 2250 L=2,L3                                         IBSY 180
 19              IF(IB(L,1,INS).EQ.0) GO TO 2260                        IBSY 190
 20              DO 2240 K=2,KEND                                       IBSY 200
 21              IF(IB(L,1,INS).NE.IRB(INS,K)) GO TO 2240               IBSY 210
 22              NUM=NUM+1                                              IBSY 220
 23              NHOLD(NUM)=IRB(INS,K)                                  IBSY 230
 24              IB(L,1,INS)=0                                          IBSY 240
 25              GO TO 2250                                             IBSY 250
 26       2240 CONTINUE                                                 IBSY 260
 27       2250 CONTINUE                                                 IBSY 270
 28       2260 IF(NUM.NE.0) GO TO 2300                                  IBSY 280
 29              PRINT 2270, INS,NUM,INS                                IBSY 290
 30       2270 FORMAT('1ERROR IN IBSTBY SUB.  AT 2270.'/'0ERROR DURING SENSE BLOCIBSY 300
 31             1K'I3,' INPUT REARRANGE TO STORE ACTIVE BLOCKS BEFORE STANDBY BLOCKIBSY 310
 32             2S IN IB('I3,',1,'I3,').')                              IBSY 320
 33              RETURN 1                                               IBSY 330
 34       C                                                             IBSY 340
 35       C      SHIFT IB(NB,1,INS) TO LEFT ELIMINATING ZEROES.         IBSY 350
 36       C                                                             IBSY 360
 37       2300 ILEFT=0                                                  IBSY 370
 38              DO 2350 J=2,L3                                         IBSY 380
 39              IF(IB(J,1,INS).NE.0) GO TO 2330                        IBSY 390
 40              ILEFT=ILEFT+1                                          IBSY 400
 41              GO TO 2350                                             IBSY 410
 42       2330 IF(ILEFT.EQ.0) GO TO 2350                                IBSY 420
 43       C                                                             IBSY 430
 44       C      MOVE NB TO LEFT.                                       IBSY 440
 45       C                                                             IBSY 450
 46              M=J-ILEFT                                              IBSY 460
 47              IB(M,1,INS)=IB(J,1,INS)                                IBSY 470
 48       2350 CONTINUE                                                 IBSY 480
 49       C                                                             IBSY 490
 50       C      ADD NB IN NHOLD AT END.                                IBSY 500
 51       C                                                             IBSY 510
 52              KBEG=L3-ILEFT+1                                        IBSY 520
 53              M=0                                                    IBSY 530
 54              DO 2370 K=KBEG,L3                                      IBSY 540
 55              M=M+1                                                  IBSY 550
 56              IB(K,1,INS)=NHOLD(M)                                   IBSY 560
 57       2370 CONTINUE                                                 IBSY 570
 58       C                                                             IBSY 580
 59       C      PRINT SENSE BLOCK AND STANDBY BLOCKS OF THAT SENSE BLOCK. IBSY 590
 60       C                                                             IBSY 600
 61              IF(IPRINT.EQ.0) GO TO 2020                             IBSY 610
 62              DO 2025 K=2,L5                                         IBSY 620
 63              IF(IRB(INS,K).EQ.0) GO TO 2026                         IBSY 630
 64       2025 CONTINUE                                                 IBSY 640
 65       2026 K=K-1                                                    IBSY 650
 66              PRINT 2021, INS, (IRB(INS,J), J=2,K)                   IBSY 660
 67       2021 FORMAT('0SENSE SWITCH'I3,' CONTROLS BLOCKS',2(/1H 29I4)) IBSY 670
 68       2020 CONTINUE                                                 IBSY 680
 69              RETURN                                                 IBSY 690
 70              END                                                    IBSY 700
```

```
     1              SUBROUTINE SUB7(IB)                                          SUB7   10
     2      C                                                                    SUB7   20
     3              DIMENSION NSAVE(49),IB(15,2,50)                              SUB7   30
     4              COMMON/ALLSUB/M1,M2,M3,M4,M5,M6,M7,L1,L3,L4,L5,L6            SUB7   40
     5              COMMON/SUB/IPATH(20,50),IAND(49,12),IANDZ(25,12),IAN,BL3,M8  SUB7   50
     6              INTEGER BL3                                                  SUB7   60
     7              L9 = M1 - 1                                                  SUB7   70
     8              DO 13 I = 1,L5                                               SUB7   80
     9           13 NSAVE(I)=0                                                   SUB7   90
    10      C                                                                    SUB7  100
    11              N=0                                                          SUB7  110
    12      C                                                                    SUB7  120
    13      C       THE 142 LOOP TAKES THE BLOCK ENTRIES STORED IN IAND THAT DO NOT SUB7 130
    14      C          HAVE THEIR INPUTS SPECIFIED AND PUTS THESE BLOCKS IN NSAVE.  SUB7 140
    15      C                                                                    SUB7  150
    16            7 DO 142 K=2,L9                                                SUB7  160
    17              IF(IAND(K,IAN))179,142,179                                   SUB7  170
    18          179 L=IAND(K,IAN)                                               SUB7  180
    19              IF(IB(2,1,L))142,180,142                                     SUB7  190
    20          180 N=N+1                                                        SUB7  200
    21              NSAVE(N)=L                                                   SUB7  210
    22          142 CONTINUE                                                     SUB7  220
    23      C                                                                    SUB7  230
    24      C       GET RID OF DUPLICATE ENTRIES IN NSAVE                        SUB7  240
    25      C       THE 157 LOOP IS NEEDED BECAUSE THERE IS NO GUARANTEE THAT IAND SUB7 250
    26      C          DOES NOT CONTAIN DUPLICATE ENTRIES.                       SUB7  260
    27      C                                                                    SUB7  270
    28              N2=N-1                                                       SUB7  280
    29              DO 157 K=1,N2                                                SUB7  290
    30           85 IF(NSAVE(K))148,147,148                                      SUB7  300
    31          148 K1=K+1                                                       SUB7  310
    32              DO 158 K2=K1,N                                               SUB7  320
    33              IF(NSAVE(K2)-NSAVE(K))158,159,158                            SUB7  330
    34          158 CONTINUE                                                     SUB7  340
    35              GO TO 157                                                    SUB7  350
    36          159 DO 84 K2=K,N2                                               SUB7  360
    37           84 NSAVE(K2)=NSAVE(K2+1)                                        SUB7  370
    38              NSAVE(N)=0                                                   SUB7  380
    39              GO TO 85                                                     SUB7  390
    40          157 CONTINUE                                                     SUB7  400
    41      C                                                                    SUB7  410
    42      C       CONNECT THE OUPUTS OF THE SUBDIAGRAM STORED IN IANDZ TO THE INPUTS SUB7 420
    43      C          OF THE SUBDIAGRAM STORED IN IAND (BUT WHOSE LOOSE ENDS ARE  SUB7 430
    44      C          STORED IN NSAVE).                                         SUB7  440
    45      C                                                                    SUB7  450
    46          147 DO 794 K=2,L3                                                SUB7  460
    47              IF(IANDZ(K,IAN))181,794,181                                  SUB7  470
    48          181 M=IANDZ(K,IAN)                                              SUB7  480
    49              DO 160 K2=1,M8                                               SUB7  490
    50          160 IPATH(  K2,M)=BL3                                            SUB7  500
    51              DO 143 K1=1,N                                                SUB7  510
    52              LM=NSAVE(K1)                                                 SUB7  520
    53              IB(K1+1,2,M)=LM                                              SUB7  530
    54          143 IB(K,1,LM)=M                                                 SUB7  540
    55          794 CONTINUE                                                     SUB7  550
    56              RETURN                                                       SUB7  560
    57              END                                                          SUB7  570
```

```
TREA*FTREE.GATE
    1      C                                                                    GATE   10
    2      C   ***EXPLANATION OF FORTRAN CONTROL CARD***                        GATE   20
    3      C      A COMPILER ERROR IN THE UNIVAC 1108 FORTRAN LEVEL 7E COMPILER  GATE   30
    4      C         INHIBITS RETURNING THE CORRECT VALUE IN GATE.  WHILE N WILL GATE   40
    5      C         HOLD THE CORRECT VALUE, THE STATEMENT GATE=N WILL NOT TRANSFER GATE  50
    6      C         THIS VALUE TO GATE.  THIS HAS BEEN FIXED ON THE LEVEL 8A    GATE   60
    7      C         COMPILER, THUS THE CONTROL CARD.  NOTE THAT THE 8A WILL NOT GATE   70
    8      C         BECOME THE SYSTEM STANDARD BECAUSE OF INCOMPATIBILITY WITH  GATE   80
    9      C         ENCODE/DECODE.  IF MAKING MODIFICATIONS TO THIS PROGRAM, DO NOTGATE 90
   10      C         USE ENCODE/DECODE WITHOUT REWRITING THIS SUBROUTINE TO WORK GATE  100
   11      C         WITH THE LEVEL 7E COMPILER.                                 GATE  110
   12      C                                                                     GATE  120
   13             INTEGER FUNCTION GATE(IP)                                      GATE  130
   14             COMMON/GT/BL1                                                  GATE  140
   15             INTEGER BL1                                                    GATE  150
   16             IJ=IP                                                          GATE  160
   17             N=BL1                                                          GATE  170
   18             FLD(0,6,N)=FLD(0,6,IJ)                                         GATE  180
   19             GATE=N                                                         GATE  190
   20             RETURN                                                         GATE  200
   21             END                                                           GATE  210
```

```
    1              SUBROUTINE SETIB(IB,M1,L3)                                SET   10
    2    C                                                                   SET   20
    3    C         THIS SUBROUTINE PUTS THE QUANTITIES OF INPUTS AND OUPUTS TO EACH  SET   30
    4    C         BLOCK INTO THE FIRST ELEMENT OF THE IB ARRAY.             SET   40
    5    C                                                                   SET   50
    6              DIMENSION IB(15,2,50)                                     SET   6C
    7              DO 1021 J = 1,M1                                          SET   70
    8              IF ( (IB(2,1,J) + IB(2,2,J) ) .EG.C) GO TO 1021          SET   8C
    9              DO 1010 I = 2,L3                                          SET   90
   10              IF (IB(I,1,J) .EG. 0) GO TO 1011                         SET  1C0
   11    1010      CONTINUE                                                  SET  110
   12    1011      IB (1,1,J) = I-2                                          SET  120
   13              DO 1012 I = 2,L3                                          SET  13C
   14              IF (IB(I,2,J) . EG. C) GO TO 1013                        SET  140
   15    1012      CONTINUE                                                  SET  150
   16    1013      IB(1,2,J) = I-2                                           SET  16C
   17    1021      CONTINUE                                                  SET  170
   18              PRINT 2006                                                SET  18C
   19    2006      FORMAT(1H1)                                               SET  190
   20              RETURN                                                    SET  2C0
   21              END                                                       SET  210
```

REFERENCES

1. Chelson, P. O., <u>Reliability Computation Using Fault Tree Analysis</u>, Technical Report 32-1542. Jet Propulsion Laboratory, Pasadena, Calif., Dec. 1, 1971.

2. Chelson, P. O., and Eckstein, R. E., <u>Program Listing for Reliability Block Diagram Computation Program of JPL Technical Report 32-1543</u>, Technical Memorandum 33-513. Jet Propulsion Laboratory, Pasadena, Calif., Dec. 1, 1971.