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1620 USERS GROUP PROGRAM REVIEW AND EVALUATION

(fill out in typewriter or pencil, do not use ink)

Program No. _____ Date _____

Program Name: _____

1. Does the abstract adequately describe what the program is and what it does? Yes___ No___
   Comment _____

2. Does the program do what the abstract says? Yes___ No___
   Comment _____

3. Is the Description clear, understandable, and adequate? Yes___ No___
   Comment _____

4. Are the Operating Instructions understandable and in sufficient detail? Yes___ No___
   Comment _____
   Are the Sense Switch options adequately described (if applicable)? Yes___ No___
   Are the mnemonic labels identified or sufficiently understandable? Yes___ No___
   Comment _____

5. Does the source program compile satisfactorily (if applicable)? Yes___ No___
   Comment _____

6. Does the object program run satisfactorily? Yes___ No___
   Comment _____

7. Number of test cases run_____. Are any restrictions as to data, size, range, etc. covered adequately in description? Yes___ No___
   Comment _____

8. Does the Program Meet the minimal standards of the 1620 Users Group? Yes___ No___
   Comment _____

9. Were all necessary parts of the program received? Yes___ No___
   Comment _____

10. Please list on the back any suggestions to improve the usefulness of the program. These will be passed onto the author for his consideration.

Please return to:

Mr. Richard L. Pratt
Data Corporation
7500 Old Xenia Pike
Dayton, Ohio 45432

Your Name _____

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11/09/64

ABSTRACT

LINEAR PROGRAMMING II

by

F. W. Wood

DESCRIPTION

This Linear Programming code is essentially the same as the previous four-phase code, the difference being the addition of an output phase and the reduction in the number of typeouts in the other phases. This writeup assumes familiarity with the four-phase writeup, the difference being what is included here.

DISCUSSION

The revision of the four-phase program to the five-phase program was initiated by the need for extra matrix capacity. Error typeouts were eliminated and only the pause now exists. The output portion of the program, after the optimum solution is reached, was removed from the Solution Phase and from the Right Hand Side Changer Phase and made an Individual Phase. Therefore, to obtain a solution it is necessary to load the Output Phase after the final stop has been encountered in the Right Hand Side Changer or the Solution Phase.

The MAR display number as described in the following sections are all based on FORTRAN with auto-divide and a lowered origin. If the programs are compiled with FORTRAN decks that do not comply with the above, these numbers will differ from those reported below and the correct number must be established from the print off when the program is compiled.

DATA LOADER PHASE

Input

Same as L.P.I.

Output

Same as L.P.I.

Sense Switch Settings

	On	Off
SS 1	For restart problems	For initial start problems
SS 2,3,4	Not used	

Error Stops

None

SOLUTION PHASE

Input

None

Output

Same as L.P. 1 except no headings and no final output.

Sense Switch Settings

	On	Off
SS 4	Punch output for restart at a later time	Continue with Simplex Method
SS 1,2,3	Not used	

Error Stops

MAR Display	Meaning
9039	Problem as stated is unbounded
12011	Problem as stated is infeasible
12023	Optimum solution has been reached

COST CHANGER PHASE

Input

Same as L.P. 1

Output

Same as L.P. 1

Sense Switch Settings

None used

Error Stops

None

RIGHT HAND SIDE CHANGER PHASE

Input

Same as L.P. 1

RIGHT HAND SIDE CHANGER PHASE (Cont'd)

Output

Same as L.P. 1 with the exception of error typeouts and the final solution.

Sense Switch Settings

None used

Error Stops

MAR Display	Meaning
10651	Problem is infeasible
12575	Optimum feasible solution has been reached

An alternate method of input is available without any program change. The original method of input was to punch both the old right hand side element and the new right hand side element into the change card.

It is possible to record only the difference betweenthe elements in card columns 9-18 and leave the rest of the card blank.

The card should then be punched as follows:

cc	
1-4	1) 0000 if the unit vector associated with the change is artificial 2) 0001 if the unit vector associated with the change is slack
5-8	Column number of unit vector associated with the change
9-18	Old right hand minus the new right hand side with a decimal point somewhere in the 10 digit field. Care must be taken with the sign of the resultant of the subtraction. To increase the right hand side element, the number must be negative and to decrease it must be positive.

OUTPUT PHASE

Input

None

Output

Solution, shadow costs, final matrix punch, and solution punch

Sense Switch Settings

	On	Off
SS 1	Print final solution	Do not print final solution
SS 2	Punch final matrix	Do not punch final matrix
SS 3	Print Shadow Costs	Do not print Shadow Costs
SS 4	Punch final solution	Do not punch final solution

In all the above cases the final solution is printed on the typewriter.

Error Stops

None

F. W. Wood
Mathematician

FWW/jd

5

DATA LOADER

```
00000       DIMENSION A(44,99),W(44),L(44),II(1),JJ(1),III(1),X(1)
00000       DIMENSION JK(1),KJ(1),KKK(1),IJ(1),K(1),I(1),J(1),XMIN(1)
00060     1 FORMAT(I4,I4)
00028     2 FORMAT(I4,I4,F20.8)
00060     4 FORMAT(15HLOAD NEXT PHASE)
00114   108 READ 1,II,JJ
00150       III=II+1
00136       DO 10 I=1,III
00198       W(I)=0.0
00246       L(I)=0
00294       DO 10 J=1,JJ
00306    10 A(I,J)=0.0
00462    11 READ 2,I,J,X
00510       IF(I)16,16,18
00566    18 A(I,J)=X
00650       GO TO 11
00658    16 J=JJ
00682    17 READ 2,I,JK,X
00730       IF(I)20,20,19
00786    19 A(I,JJ)=X
00870       L(I)=JK
00918       GO TO 17
00926    20 IF(SENSE SWITCH 1)40,22
00946    22 I=1
00970    23 I=I+1
01006       IF(I-III)24,40,40
01074    24 IF(L(I))23,25,23
01154    25 DO 27 J=1,JJ
01166       IF(A(I,J))26,27,26
01282    26 A(III,J)=A(III,J)-A(I,J)
01493    27 CONTINUE
01534       GO TO 23
01542    40 PRINT 4
01566       PAUSE
01578       END
```

7

6

SOLUTION PHASE

```
02000       DIMENSION A(44,99),W(44),L(44),II(1),JJ(1),III(1),X(1)
02000       DIMENSION JK(1),KJ(1),KKK(1),IJ(1),K(1),I(1),J(1),XMIN(1)
03000   105 FORMAT(I4,F15.2,I4)
03032       KKK=0
03056       K=III
03080    44 J=0
03104       W(K)=0.0
03152       L(K)=0
03200    42 J=J+1
03236       IF(J-JJ)41,45,45
03304    41 IF(A(K,J))43,42,42
03420    43 IF(W(K)-A(K,J))42,42,47
03572    47 W(K)=A(K,J)
03680       L(K)=J
03728       GO TO 42
03736    45 IF(L(K))46,62,46
03816    46 KJ=L(K)
03864       DO 120 I=2,II
03876       IF(A(I,KJ))120,120,121
03992   120 CONTINUE
04028       PAUSE
04040   121 I=1
04064       JK=0
04088    50 I=I+1
04124       IF(I-II)52,52,56
04192    52 IF(A(I,KJ))50,50,51
04308    51 X=A(I,JJ)/A(I,KJ)
04464       IF(JK)55,53,55
04520    55 IF(X-XMIN)53,50,50
04588    53 XMIN=X
04612       JK=I
04636       GO TO 50
04644    56 X=A(JK,KJ)
04728       L(JK)=KJ
04776       DO 57 I=1,III
04788    57 W(I)=A(I,KJ)
04932       IJ=JK-1
04968       DO 59 I=1,IJ
04980       DO 59 J=1,JJ
04992       IF(A(JK,J))58,59,58
05108    58 IF(W(I))580,59,580
05188   580 A(I,J)=A(I,J)-W(I)*(A(JK,J)/X)
05464    59 CONTINUE
05536       IJ=JK+1
05572       DO 61 I=IJ,III
05584       DO 61 J=1,JJ
05596       IF(A(JK,J))60,61,60
05712    60 IF(W(I))600,61,600
05792   600 A(I,J)=A(I,J)-W(I)*(A(JK,J)/X)
06068    61 CONTINUE
```

8

SOLUTION PHASE (CONT)

```
11140       DO 205 J=1,JJ
11152   205 A(JK,J)=A(JK,J)/X
11344       KKK=KKK+1
11380       PRINT 105,KKK,A(K,JJ),L(JK)
11512       IF(SENSE SWITCH 4)70,44
11532    62 IF(K-1)70,70,63
11600    63 IJ=JJ-1
11636       DO 65 J=1,IJ
11648       IF(A(K,J)-.0001)65,65,66
11776    65 CONTINUE
11812       DO 130 J=1,JJ
11824   130 A(III,J)=0.0
11944       K=1
11963       KKK=0
11992       GO TO 44
12000    66 PAUSE
12012    70 PAUSE
12024       END
```


RIGHT HAND SIDE CHANGER

```
00000       DIMENSION A(44,99),W(44),L(44),II(1),JJ(1),III(1),X(1)
00000       DIMENSION JK(1),KJ(1),KKK(1),IJ(1),K(1),I(1),J(1),XMIN(1)
00000     1 FORMAT(I4,I4,F10.5,F10.5)
00038     3 FORMAT(33HITER       FUNCTIONAL       VAR. IN)
00120   100 FORMAT(F20.5,F20.5)
00156   101 FORMAT(32H       OLD RHS             NEW RHS)
00244   104 FORMAT(I4,F15.2,10X,I4)
00304     8 PRINT 101
00328       K=1
00352       KKK=0
00376     4 READ 1,KJ,JK,W(1),W(III)
00460       IF(KJ)81,80,81
00516    80 IF(JK)82,11,82
00572    81 IJ=1
00596       GO TO 5
00604    82 IJ=2
00628     5 PRINT 100,W(1),W(III)
00688       W(1)=W(III)-W(1)
00748       DO 10 I=IJ,II
00760    10 A(I,JJ)=A(I,JJ)+W(1)*A(I,JK)
09024       GO TO 4
09032    11 PRINT 3
09056    15 XMIN=0.0
09080       L(K)=0
09128       I=1
09152    18 I=I+1
09188       IF(I-II)16,16,20
09256    16 IF(A(I,JJ))17,18,18
09372    17 IF(A(I,JJ)-XMIN)19,18,18
09500    19 XMIN=A(I,JJ)
09584       L(K)=I
09632       GO TO 18
09640    20 IF(L(K))21,70,21
09720    21 JK=L(K)
09768       J=0
09792       XMIN=0.0
09816       L(K)=0
09864    26 J=J+1
09900       IF(J-JJ)23,24,24
09968    23 IF(A(JK,J))25,26,26
10084    25 IF(A(1,J))26,26,7
10188     7 X=A(1,J)/A(JK,J)
10332       IF(L(K))6,27,6
10412     6 IF(X-XMIN)26,26,27
10480    27 XMIN=X
10504       L(K)=J
10552       GO TO 26
10560    24 IF(L(K))31,30,31
10640    30 PAUSE
10652    31 KJ=L(K)
```

RIGHT HAND SIDE CHANGER (CONT)

```
10700       L(JK)=KJ
10748       X=A(JK,KJ)
10832       DO 33 I=1,III
10844    33 W(I)=A(I,KJ)
10908       IJ=JK-1
11024       DO 35 I=1,IJ
11036       DO 35 J=1,JJ
11048       IF(A(JK,J))34,35,34
11164    34 IF(W(I))37,35,37
11244    37 A(I,J)=A(I,J)-W(I)*(A(JK,J)/X)
11520    35 CONTINUE
11592       IJ=JK+1
11628       DO 40 I=IJ,III
11640       DO 40 J=1,JJ
11652       IF(A(JK,J))38,40,38
11768    38 IF(W(I))39,40,39
11848    39 A(I,J)=A(I,J)-W(I)*(A(JK,J)/X)
12124    40 CONTINUE
12196       DO 50 J=1,JJ
12208    50 A(JK,J)=A(JK,J)/X
12400       KKK=KKK+1
12436       PRINT 104,KKK,A(1,JJ),L(JK)
12556       GO TO 15
12564    70 PAUSE
12576       GO TO 8
12584       END
```


COST CHANGER

```
00000       DIMENSION A(44,99),W(44),L(44),II(1),JJ(1),III(1),X(1)
00000       DIMENSION JK(1),KJ(1),KKK(1),IJ(1),K(1),I(1),J(1),XMIN(1)
00000     1 FORMAT(I4,F10.5,F10.5)
00032     2 FORMAT(13HSTILL OPTIMAL)
00082     3 FORMAT(10HFUNCTIONAL,F20.8)
00132     4 FORMAT(18HLOAD SOLUTION DECK)
00192   100 FORMAT(25HVAR. OLD COST   NEW COST )
00266     9 PRINT 100
00290    10 READ 1,JK,W(1),W(III)
00362       L(1)=JK
00386       IF(JK)11,50,11
00442    11 PRINT 1,JK,W(1),W(III)
00514       W(1)=W(III)-W(1)
00574       A(1,JK)=A(1,JK)+W(1)
00706       DO 15 I=2,II
00718       IF(L(I)-L(1))15,16,15
00810    15 CONTINUE
00846       GO TO 10
00854    16 DO 20 J=1,JJ
00866       IF(A(I,J))19,20,19
00982    19 A(1,J)=A(1,J)-W(1)*A(I,J)
01198    20 CONTINUE
01234       GO TO 10
01242    50 IJ=JJ-1
01278       DO 55 J=1,IJ
01290       IF(A(1,J))60,55,55
01394    55 CONTINUE
01430       PRINT 2
01454       PRINT 3,A(1,JJ)
01526       PAUSE
01538       GO TO 9
01546    60 PRINT 4
01570       PAUSE
01582       GO TO 9
01590       END
```

//

OUTPUT PHASE

```
00000       DIMENSION A(44,99),W(44),L(44),II(1),JJ(1),III(1),X(1)
00000       DIMENSION JK(1),KJ(1),KKK(1),IJ(1),K(1),I(1),J(1),XMIN(1)
00000     2 FORMAT(I4,I4,F20.8)
00032     5 FORMAT(I4,F20.8)
00060     7 FORMAT(23HVARIABLE          VALUE)
00120     8 FORMAT(10HFUNCTIONAL,F20.8)
00180     9 FORMAT(23HVARIABLE     SHAD. COST)
00250   100 FORMAT(1H )
00276       IF(SENSE SWITCH 1)70,92
00296    70 PRINT 8,A(1,JJ)
00368       PRINT 7
00392       DO 71 I=2,II
00404    71 PRINT 5,L(I),A(I,JJ)
00560    92 IF(SENSE SWITCH 3)72,75
00580    72 PRINT 9
00604       IJ=JJ-1
00640       DO 74 J=1,IJ
00652       IF(A(1,J))73,74,73
00756    73 PRINT 5,J,A(1,J)
00840    74 CONTINUE
00876    75 IF(SENSE SWITCH 2)76,80
00896    76 IJ=JJ-1
00932       DO 77 J=1,IJ
00944       DO 77 I=1,III
00956       IF(A(I,J))78,77,78
09072    78 PUNCH 2,I,J,A(I,J)
09180    77 CONTINUE
09252       PUNCH 100
09276    91 DO 90 I=1,III
09288    90 PUNCH 2,I,L(I),A(I,JJ)
09456    81 PAUSE
09468    80 IF(SENSE SWITCH 4)91,81
09488       END
```