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PURDUE UNIVERSITY
CALLUMET CAMPUS
HAMMOND, IN 46323

1620 GENERAL PROGRAM LIBRARY

Linear Programming

John Flating Kaufman

10.1.013

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1620 USERS GROUP PROGRAM REVIEW AND EVALUATION

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

Please return to:

Mr. Robert J. Robinson (PREP)
Marquette University
Computing Center
1515 W. Wisconsin Avenue
Milwaukee 3, Wisconsin

Your Name _____
Company _____
Address _____
User Group Code _____

THIS REVIEW FORM IS PART OF THE 1620 USER GROUP ORGANIZATION'S PROGRAM REVIEW AND EVALUATION PROCEDURE. NONMEMBERS ARE CORDIALLY INVITED TO PARTICIPATE IN THIS EVALUATION.



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Emporia, Kansas

Title: Linear Programming

Subject Classification: 10.1.013

Author; Organization: Roy Gallup; Kansas State Teachers College

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KSTC Computer Center
Emporia, Kansas, 66801

Phone: DI2-5000 EX. 222

Description: This program solves Linear Programming problems using the simplex algorithm. All the identities, artificial variables and necessary changes to obtain a optimal feasible solution are added by the program. All that the user has to do is enter the coefficients of the variables a_{ij} , the cost coefficients c_j , and the requirements b_i . The optimal feasible solution is punched out along with the cost, basis vectors and the basic variables.

Restrictions: The maximum size problem that can be solved is;
on a 20K machine, 18 equations and 18 variables,
on a 40K machine, 31 equations and 31 variables, and
on a 60K machine, 40 equations and 40 variables.

Equipment Specifications:

1. Card system.
2. Automatic divide.
3. Indirect addressing.
4. Floating point hardware.
5. TNF and TNS instructions.
6. Language; SPS.
7. Subroutines; none.

Running Time: A problem with 4 equations and 4 variables takes approximately 5 seconds per iteration.

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LINEAR PROGRAM

by

ROY GALLUP

KANSAS STATE TEACHERS COLLEGE
COMPUTER CENTER
EMPORIA, KANSAS, 66801

JUNE 1, 1964

DECK KEY

1. Source Card Deck
2. Object Card Deck
3. Sample Data - Input #1
4. Sample Data - Input #2

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I. PROGRAM DESCRIPTION.

This program solves linear programming problems using the simplex algorithm in which all identities and artificial variables are added by the program. The only thing the user has to do is to enter the coefficients of the variables a_{ij} , the cost coefficients c_j , and the requirements b_i .

The optimal feasible solution is punched out along with the cost, basis vectors and basic variables.

The mathematical formulation of a linear programming problem is:

Find values for X_1, X_2, \dots, X_n which satisfy the following conditions;

$$a_{11}X_1 + a_{12}X_2 + \dots + a_{1n}X_n \leq b_1$$

$$a_{21}X_1 + a_{22}X_2 + \dots + a_{2n}X_n \leq b_2$$

$$a_{m1}X_1 + a_{m2}X_2 + \dots + a_{mn}X_n \leq b_m$$

where $X_j \geq 0$ for all values of j and

$$b_i \geq 0 \text{ for all values of } i.$$

$$\max z = c_1X_1 + c_2X_2 + \dots + c_nX_n$$

where a_{ij} , b_i , and c_j are constants.

A. Machine Requirements.

1. Card input and output.
2. Floating point hardware.
3. Automatic divide hardware.
4. Indirect addressing.
5. TNF and TNS instructions.
6. Source language: SPS.
7. Subroutines: none.
8. All computations are in floating point using a 8 digit mantissa.

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9. Any size storage can be used. The size of the problem is restricted by the following relationship:

$$(2j + i + 1)(j + 3) \leq \frac{\text{memory} - 7300}{10}$$

where: i is the number of variables.
 j is the number of equations including the cost row.
memory is 20,000, 40,000, or 60,000.

B. Error Stops and Procedures.

1. If the parameter card is missing, the message "FIRST CARD IS MISSING" will be typed out and the computer will halt. To restart— lift the remaining cards out of the read hopper, depress non-process run out to run cards out of reader. Insert parameter card in front of the data and place it in read hopper. Push START on the console and push READER START on 1622.
2. If a card is missing within a equation or the requirement card is out of order or missing the message "INCORRECT NUMBER OF EQUATIONS" will be typed out and the computer will halt. To restart— lift the remaining cards out of the read hopper, depress non-process run out to run cards out of the reader. Correct the data cards and place them in the read hopper. Push START on the console and push READER START on 1622.

C. To Change the Size of the Matrix.

To change the size of the matrix when using a 1620 with more than 20,000 storage positions, columns 10-11 in the card number 3 (in column 80), which contains j (the number of equations including the cost row), should have 18 for 20,000; 31 for 40,000 and 40 for 60,000 storage positions. It should be noted that the size includes space for the identity and artificial variables.

C-D. Execution Time.

The time depends on the size of the problem to be solved. A problem with 3 variables and 4 equations and two artificial variables takes approximately 3 to 5 seconds per iteration.

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II. THE PROGRAM.

A. Loading and Operating Instructions.

1. Set PROGRAM switches to STOP.
2. Set console switch 1;
ON: Punch out complete matrix for each tableau or iteration.
OFF: Suppress punching.
3. Set console switch 2;
ON: Type value of max z for each tableau or iteration.
OFF: Suppress typing.
4. Place blank cards in punch hopper.
5. Place object deck and data cards in read hopper.
6. Depress LOAD button on 1622 (program has a self-clearing routine)
7. After object deck is loaded, the computer will halt. To begin execution of the program push START on the console.
8. After all the data has been read in and the computations completed, the answers will be punched out. If the solution is unbounded or degenerate, a message card is punched out with "NO FEASIBLE SOLUTION" on it. The program is ready for another set of data.

B. Data Preparation.

1. The first card is the parameter card.
col. 1-2 contains the number of variables (i).
col. 3-4 contains the number of equations including the cost row. (J).
col. 50-80 can be used for identification purposes.
2. The remainder of the data cards contain (one per card) the coefficients of the variables, the coefficients of the cost variables and the coefficients of the requirements in E14.8 format, i.e., $\pm xxxxxxxx E \pm yy$ where the x's are the mantissa and the y's are the exponent.

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- (a). The card format for the coefficients of the variables and the coefficients of the costs variables is;

col. 1	contains the sign of the mantissa.
col. 2	contains a decimal point.
col. 3-10	contains the mantissa.
col. 11	contains the E.
col. 12	contains the sign of the exponent.
col. 13-14	contains the exponent.

Examples;

+62.5	would be	+ .62500000E+02
-62.5	would be	- .62500000E+02
+ .732	would be	+ .73200000E+00
+ .073	would be	+ .73000000E-01
- .0053	would be	- .53000000E-02

- (b). The card format for the requirements is the same with one exception. The equality or inequality sign is placed in column one (1) and the rest of the data is shifted one place to the right. The equality consist of the equal sign "=", which is denoted by a "=" sign or a 3-8 punch. The inequality consist of the less than equal sign " \leq ", which is denoted by a open parenthesis "(", or a 0-4-8 punch and the greater than equal sign " \geq ", which is denoted by a closed parenthesis ")", or a 12-4-8 punch.

col. 1	contains the equality sign.
col. 2	contains the sign of the mantissa.
col. 3	contains the decimal point.
col. 4-11	contains the mantissa.
col. 12	contains the E.
col. 13	contains the sign of the exponent.
col. 14-15	contains the exponent.

Examples;

=+60.5	would be	=+ .60500000E+02
\geq -60.5	would be)-.60500000E+02
\leq + .065	would be	(+.65000000E-01

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3. Sample Equations.

$$\begin{array}{ll}
 3X_1 + 5X_2 \leq 15 & 5X_1 + 10X_2 \leq 50 \\
 -5X_1 - 2X_2 \geq -10^* & X_1 + X_2 \geq 1 \\
 \max z = 5X_1 + 3X_2 & X_2 \leq 4 \\
 & \min z = -X_1 - X_2 \#
 \end{array}$$

0203
 +.30000000E+01
 +.50000000E+01
 (+.15000000E+02
 +.50000000E+01
 +.20000000E+01
 (+.10000000E+02
 +.50000000E+01
 +.30000000E+01

0204
 +.50000000E+01
 +.10000000E+02
 (+.50000000E+02
 +.10000000E+01
 +.10000000E+01
)+.10000000E+01
 +.00000000E+01
 +.10000000E+01
 (+.40000000E+01
 +.10000000E+01
 +.10000000E+01

*Note all requirements must be positive. i.e.,

$$-5X_1 - 2X_2 \geq -10 \quad \text{would be} \quad 5X_1 + 2X_2 \leq 10$$

#Note that $\min z = \max(-z)$ and therefore $\min z = -X_1 - X_2$ has to be multiplied thru by a -1 to give $\max z = X_1 + X_2$.

4. The total number of data cards for a problem can be determined by the following equation.

$$\text{parameter card} + (i)(j) + j - 1$$

where i is the number of variables.

j is the number of equations including the cost row.

C. Interpretation of the results.

1. When console switch 2 is on the MAX Z for each tableau or iteration is typed out except the last one which is punched out as the final answer. For example;

TABLEAU 01 MAX Z = +.00000000E+01
 TABLEAU 02 MAX Z = +.10000000E+02

is typed out while the third tableau is punched out.

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2. Interpretation of a tableau when punch out in the complete matrix is;

```

TABLEAU 01 ..... NUMBER OF TABLEAUX OR ITERATIONS.
+.00000000E+01.....
+.00000000E+01.....
+.00000000E+01.....
+.50000000E+01..... COST ROW COEFFICIENTS.
+.30000000E+01.....
+.00000000E+01.....
+.00000000E+01.....
ROW 02 ..... NUMBER OF THE ROW IN THE TABLEAU.
+.00000000E+01.....
+.00000000E+01.....
+.00000000E+01.....
+.10000000E+01..... BASIS VECTORS.
+.20000000E+01.....
+.30000000E+01.....
+.40000000E+01.....
ROW 03
+.00000000E+01.....
+.30000000E+01.....
+.15000000E+02.....
+.30000000E+01..... COEFFICIENTS OF FIRST EQUATION.
+.50000000E+01.....
+.10000000E+01.....
+.00000000E+01.....
ROW 04
+.00000000E+01.....
+.40000000E+01.....
+.10000000E+02..... COEFFICIENTS OF FIRST EQUATION.
+.50000000E+01 PIVOT POINT ... INDICATES PIVOT POINT FOR NEXT
+.20000000E+01..... ITERATION.
+.00000000E+01.....
+.10000000E+01.....
ROW 05
+.00000000E+01.....
+.00000000E+01.....
+.00000000E+01.....
-.50000000E+01..... LAST ROW IS Z(J) - C(J) FOR EACH
-.30000000E+01..... COLUMN.
+.00000000E+01.....

```


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3. The final answers that are punched out are interpreted as follows.

TABLEAU 03 ---Number of tableaux
or iterations

COST	BASIS VECTORS	BASIC VARIABLES -- heading
+.30000000E+01	2	+.23684210E+01
+.50000000E+01	1	+.10526316E+01

MAX Z = +.12368421E+02

The summation of the COST times the BASIC VARIABLES equals MAX Z.

4. Example of how to put matrix punch out into tableau form. Elements are taken from preceding page.

TABLEAU 1

ROW 1				5	3	0	0
ROW 2	CB	VB	b_1	x_1	x_2	x_3	x_4
ROW 3	0	3	15	3	5	1	0
ROW 4	0	4	10	⑤*	2	0	1
ROW 5		$z_j - c_j$	0	-5	-3	0	0

*Circled element indicates pivot point.

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0203
+.30000000E+01
+.50000000E+01
(+.15000000E+02
+.50000000E+01
+.20000000E+01
(+.10000000E+02
+.50000000E+01
+.30000000E+01

SAMPLE INPUT 1

TABLEAU 01
+.00000000E+01
+.00000000E+01
+.00000000E+01
+.50000000E+01
+.30000000E+01
+.00000000E+01
+.00000000E+01
ROW 02
+.00000000E+01
+.00000000E+01
+.00000000E+01
+.10000000E+01
+.20000000E+01
+.30000000E+01
+.40000000E+01
ROW 03
+.00000000E+01
+.30000000E+01
+.15000000E+02
+.30000000E+01
+.50000000E+01
+.10000000E+01
+.00000000E+01
ROW 04
+.00000000E+01
+.40000000E+01
+.10000000E+02
+.50000000E+01
+.20000000E+01
+.00000000E+01
+.10000000E+01

SAMPLE OUTPUT 1
(MATRIX PUNCHOUT)

PIVOT POINT

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ROW 05
+.00000000E+01
+.00000000E+01
+.00000000E+01
-.50000000E+01
-.30000000E+01
+.00000000E+01
+.00000000E+01
TABLEAU 02
+.00000000E+01
+.00000000E+01
+.00000000E+01
+.50000000E+01
+.30000000E+01
+.00000000E+01
+.00000000E+01
ROW 02
+.00000000E+01
+.00000000E+01
+.00000000E+01
+.10000000E+01
+.20000000E+01
+.30000000E+01
+.40000000E+01
ROW 03
+.00000000E+01
+.30000000E+01
+.90000000E+01
+.00000000E+01
+.38000000E+01
+.10000000E+01
-.60000000E+00
ROW 04
+.50000000E+01
+.10000000E+01
+.20000000E+01
+.10000000E+01
+.40000000E+00
+.00000000E+01
+.20000000E+00
ROW 05
+.00000000E+01
+.00000000E+01
+.10000000E+02
+.00000000E+01
-.10000000E+01
+.00000000E+01
+.10000000E+01

PIVOT POINT

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TABLEAU 03
 +.00000000E+01
 +.00000000E+01
 +.00000000E+01
 +.50000000E+01
 +.30000000E+01
 +.00000000E+01
 +.00000000E+01
 ROW 02
 +.00000000E+01
 +.00000000E+01
 +.00000000E+01
 +.10000000E+01
 +.20000000E+01
 +.30000000E+01
 +.40000000E+01
 ROW 03
 +.30000000E+01
 +.20000000E+01
 +.23684210E+01
 +.00000000E+01
 +.10000000E+01
 +.26315789E+00
 -.15789473E-00
 ROW 04
 +.50000000E+01
 +.10000000E+01
 +.10526316E+01
 +.10000000E+01
 +.00000000E+01
 -.10526315E+00
 +.26315789E+00
 ROW 05
 +.00000000E+01
 +.00000000E+01
 +.12368421E+02
 +.00000000E+01
 +.00000000E+01
 +.26315792E+00
 +.84210530E+00

SAMPLE OUTPUT 1 (ANSWERS)

TABLEAU 03		
PRICE	BASIS VECTORS	BASIC VARIABLES
+.30000000E+01	2	+.23684210E+01
+.50000000E+01	1	+.10526316E+01
MAX Z = +.12368421E+02		

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0204
 +.50000000E+01
 +.10000000E+02
 (+.50000000E+02
 +.10000000E+01
 +.10000000E+01
)+.10000000E+01
 +.00000000E+01
 +.10000000E+01
 (+.40000000E+01
 +.10000000E+01
 +.10000000E+01

SAMPLE INPUT 2

TABLEAU 01
 +.00000000E+01
 +.00000000E+01
 +.00000000E+01
 +.10000000E+01
 +.10000000E+01
 +.00000000E+01
 +.00000000E+01
 +.00000000E+01
 -.10000000E+50
 ROW 02
 +.00000000E+01
 +.00000000E+01
 +.00000000E+01
 +.10000000E+01
 +.20000000E+01
 +.30000000E+01
 +.40000000E+01
 +.50000000E+01
 +.60000000E+01
 ROW 03
 +.00000000E+01
 +.30000000E+01
 +.50000000E+02
 +.50000000E+01
 +.10000000E+02
 +.10000000E+01
 +.00000000E+01
 +.00000000E+01
 +.00000000E+01

SAMPLE OUTPUT 2
(MATRIX PUNCHOUT)

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ROW 04
 +.10000000E+50
 +.60000000E+01
 +.10000000E+01
 +.10000000E+01
 +.10000000E+01
 +.00000000E+01
 -.10000000E+01
 +.00000000E+01
 +.10000000E+01
 ROW 05
 +.00000000E+01
 +.50000000E+01
 +.40000000E+01
 +.00000000E+01
 +.10000000E+01
 +.00000000E+01
 +.10000000E+01
 +.00000000E+01
 +.00000000E+01
 ROW 06
 +.00000000E+01
 +.00000000E+01
 +.00000000E+01
 +.10000000E+01
 +.00000000E+01
 +.00000000E+01
 +.00000000E+01
 TABLEAU 02
 +.00000000E+01
 +.00000000E+01
 +.00000000E+01
 +.10000000E+01
 +.00000000E+01
 +.00000000E+01
 +.00000000E+01
 -.10000000E+50
 ROW 02
 +.00000000E+01
 +.00000000E+01
 +.00000000E+01
 +.10000000E+01
 +.20000000E+01
 +.30000000E+01
 +.40000000E+01
 +.50000000E+01
 +.60000000E+01

PIVOT POINT

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ROW 03
 +.00000000E+01
 +.30000000E+01
 +.45000000E+02
 +.00000000E+01
 +.50000000E+01
 +.10000000E+01
 +.50000000E+01
 +.00000000E+01
 -.50000000E+01
 ROW 04
 +.10000000E+01
 +.10000000E+01
 +.10000000E+01
 +.10000000E+01
 +.10000000E+01
 +.00000000E+01
 -.10000000E+01
 +.00000000E+01
 +.10000000E+01
 ROW 05
 +.00000000E+01
 +.50000000E+01
 +.40000000E+01
 +.00000000E+01
 +.10000000E+01
 +.00000000E+01
 +.00000000E+01
 +.10000000E+01
 +.00000000E+01
 ROW 06
 +.00000000E+01
 +.00000000E+01
 +.10000000E+01
 +.00000000E+01
 +.00000000E+01
 -.10000000E+01
 +.00000000E+01
 +.10000000E+50
 TABLEAU 03
 +.00000000E+01
 +.00000000E+01
 +.00000000E+01
 +.10000000E+01
 +.10000000E+01
 +.00000000E+01
 +.00000000E+01
 +.00000000E+01
 +.00000000E+01
 +.00000000E+01
 +.00000000E+01
 -.10000000E+50

PIVOT POINT

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ROW 02

+ .00000000E+01
+ .00000000E+01
+ .00000000E+01
+ .10000000E+01
+ .20000000E+01
+ .30000000E+01
+ .40000000E+01
+ .50000000E+01
+ .60000000E+01

ROW 03

+ .00000000E+01
+ .40000000E+01
+ .90000000E+01
+ .00000000E+01
+ .10000000E+01
+ .20000000E+00
+ .10000000E+01
+ .00000000E+01
- .10000000E+01

ROW 04

+ .10000000E+01
+ .10000000E+01
+ .10000000E+02
+ .10000000E+01
+ .20000000E+01
+ .20000000E+00
+ .00000000E+01
+ .00000000E+01
+ .00000000E+01

ROW 05

+ .00000000E+01
+ .50000000E+01
+ .40000000E+01
+ .00000000E+01
+ .10000000E+01
+ .00000000E+01
+ .00000000E+01
+ .10000000E+01
+ .00000000E+01

ROW 06

+ .00000000E+01
+ .00000000E+01
+ .10000000E+02
+ .00000000E+01
+ .10000000E+01
+ .20000000E+00
+ .00000000E+01
+ .00000000E+01
+ .10000000E+50

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SAMPLE OUTPUT 2 (ANSWERS)

	TABLEAU 03	
PRICE	BASIS VECTORS	BASIC VARIABLES
+ .00000000E+01	4	+ .90000000E+01
+ .10000000E+01	1	+ .10000000E+02
+ .00000000E+01	5	+ .40000000E+01

MAX Z = +.10000000E+02

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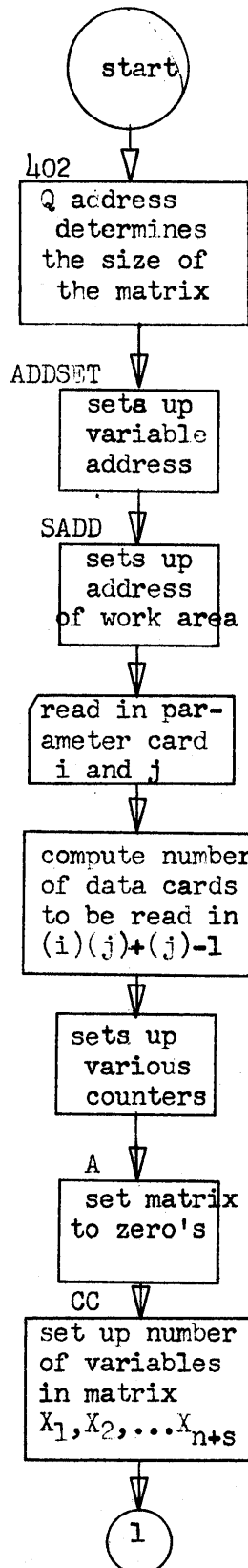
		c_0	c_1	c_2	...	c_j	...	c_n	$-M$...	$-M$
c_B	VB	b	X_1	X_2	...	X_j	...	X_n	X_{n+1}	...	X_{n+s}
c_{B1}	X_1	b_{10}	Y_{11}	Y_{12}	...	Y_{1j}	...	Y_{1n}	$Y_{1,n+1}$...	$Y_{1,n+s}$
c_{B2}	X_2	b_{20}	Y_{21}	Y_{22}	...	Y_{2j}	...	Y_{2n}	$Y_{2,n+1}$...	$Y_{2,n+s}$
.
.
.
c_{Bm}	X_m	b_{m0}	Y_{m1}	Y_{m2}	...	Y_{mj}	...	Y_{mn}	$Y_{m,n+1}$...	$Y_{m,n+s}$
		Z	$z_1 - c_1$	$z_2 - c_2$...	$z_j - c_j$...	$z_n - c_n$

where; j is the number of variables.
 n is the number of identities.
 s is the number of artificial variables.
 m is the number of equations.

The first column of the tableau (c_B), gives the costs which correspond to the vectors in the column.
 The second column (VB), tells which vectors are in the basis.
 The third column gives the current value of the requirement together with the value of the objective function for the basic feasible solution described by the given tableau.
 The remainder of the values are the Y_{ij} for all vectors in X_{n+s} including any artificial variables which may have been added.

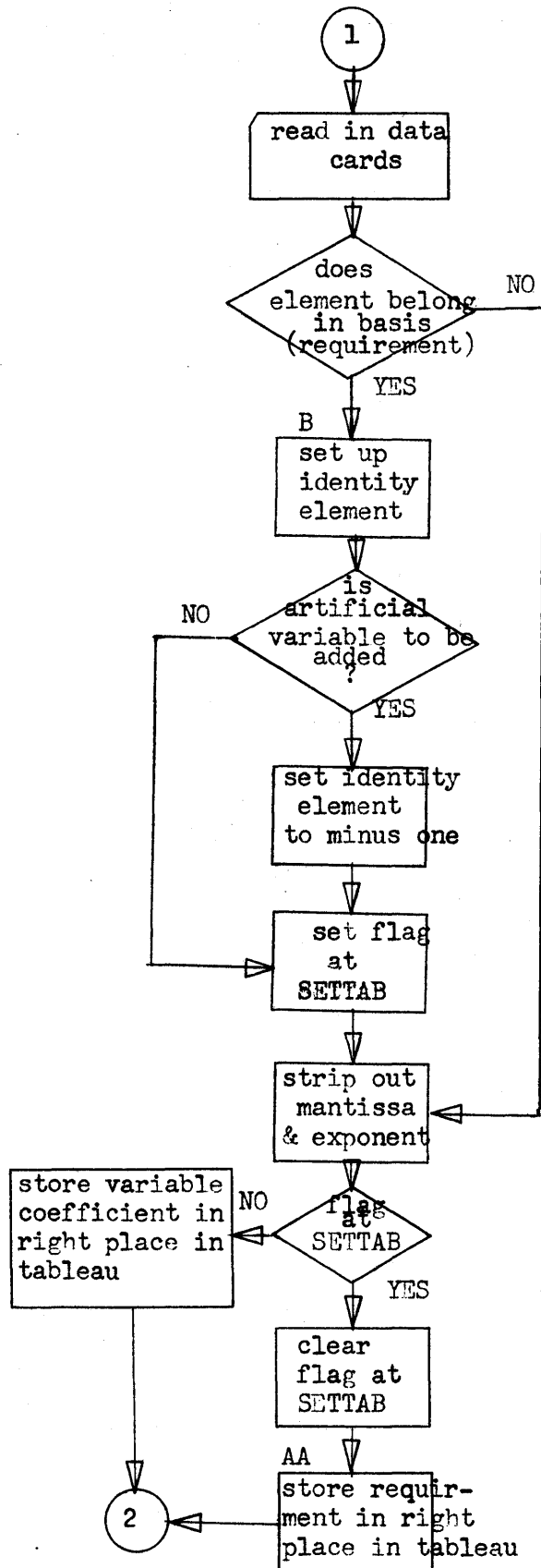
The first row of the tableau gives the costs associated with the vectors. The last entry in each of these columns gives $z_j - c_j$ for each vector.

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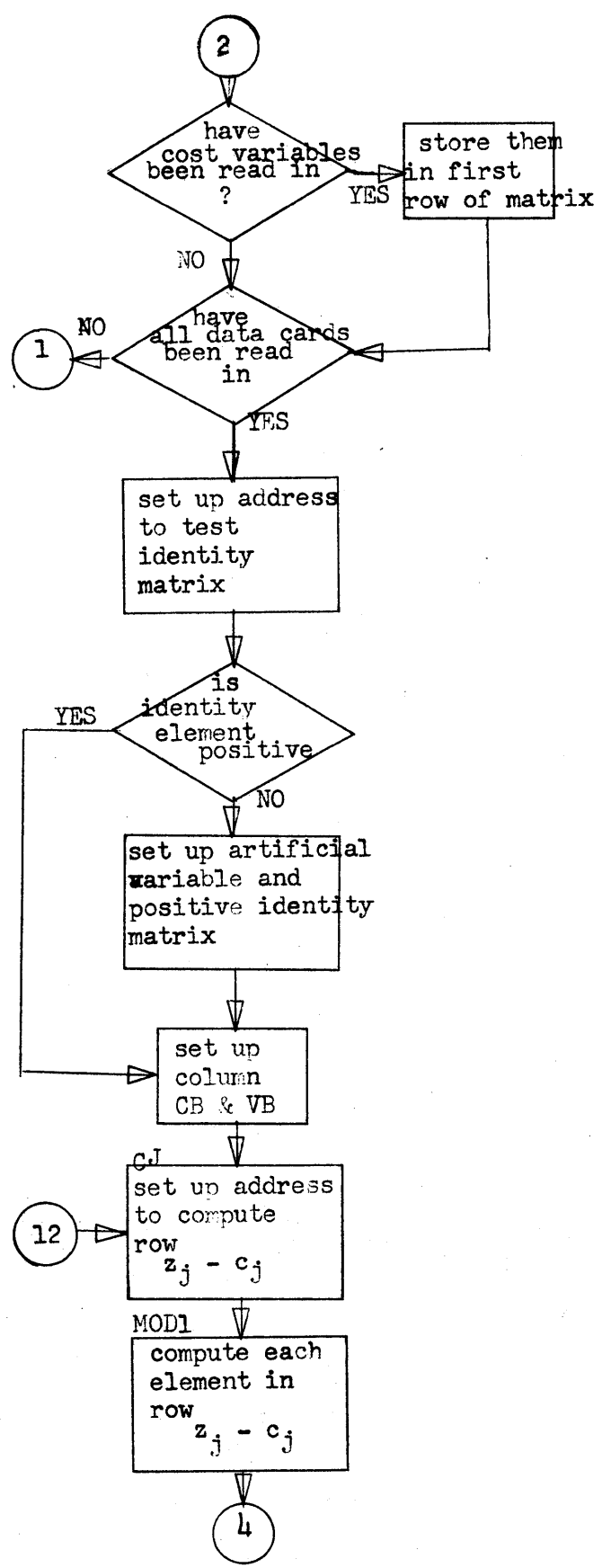


i - columns 1-2 Number of variables.
j - columns 3-4 Number of equations including cost equations.

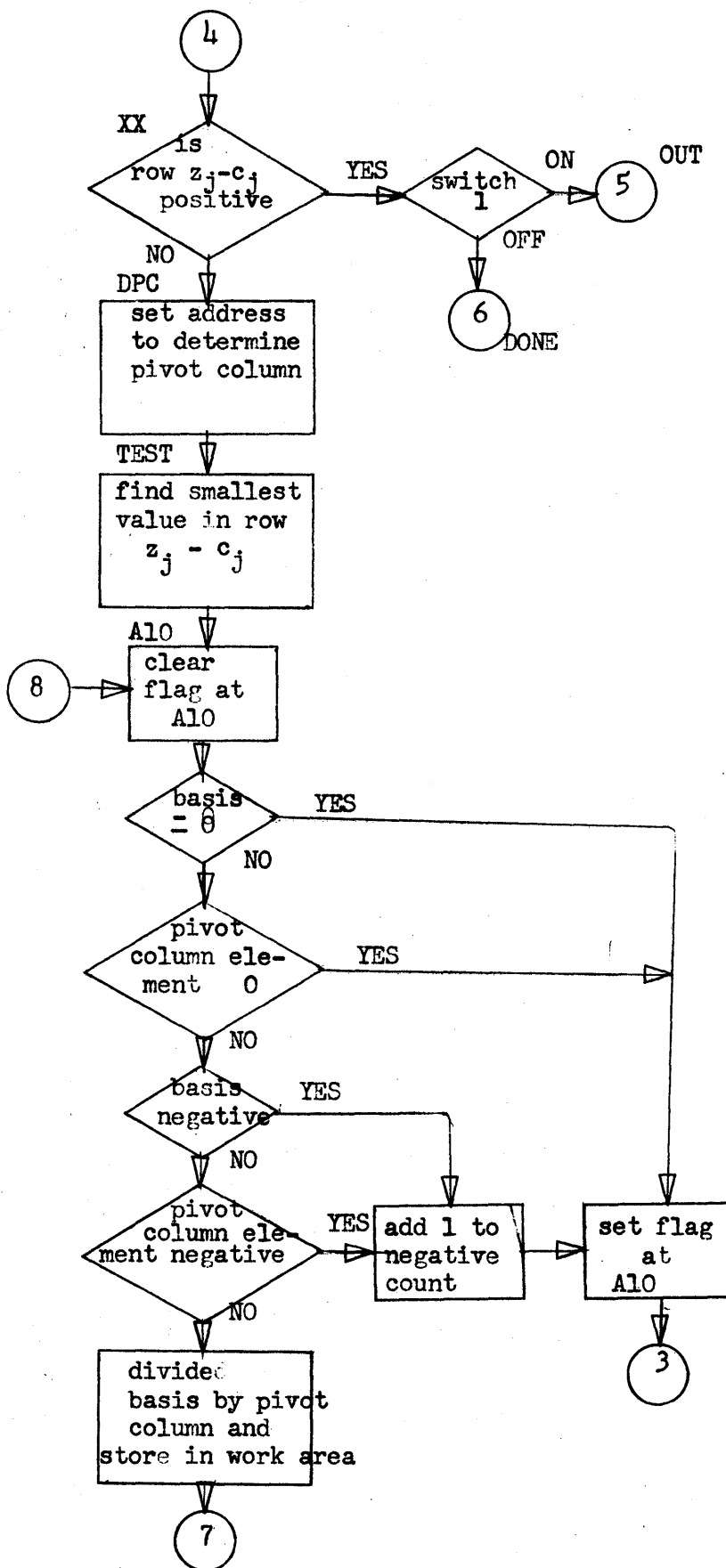
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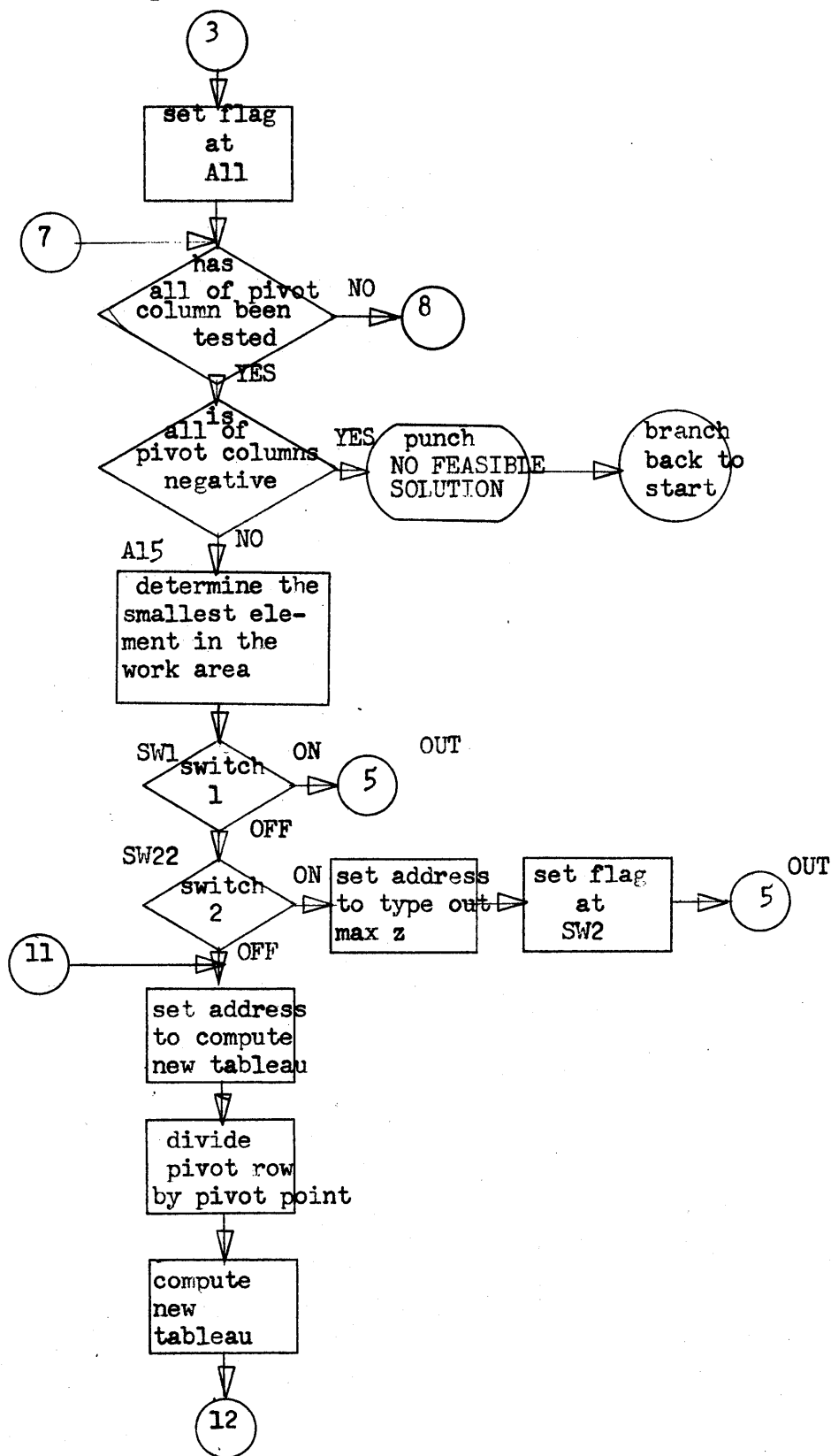
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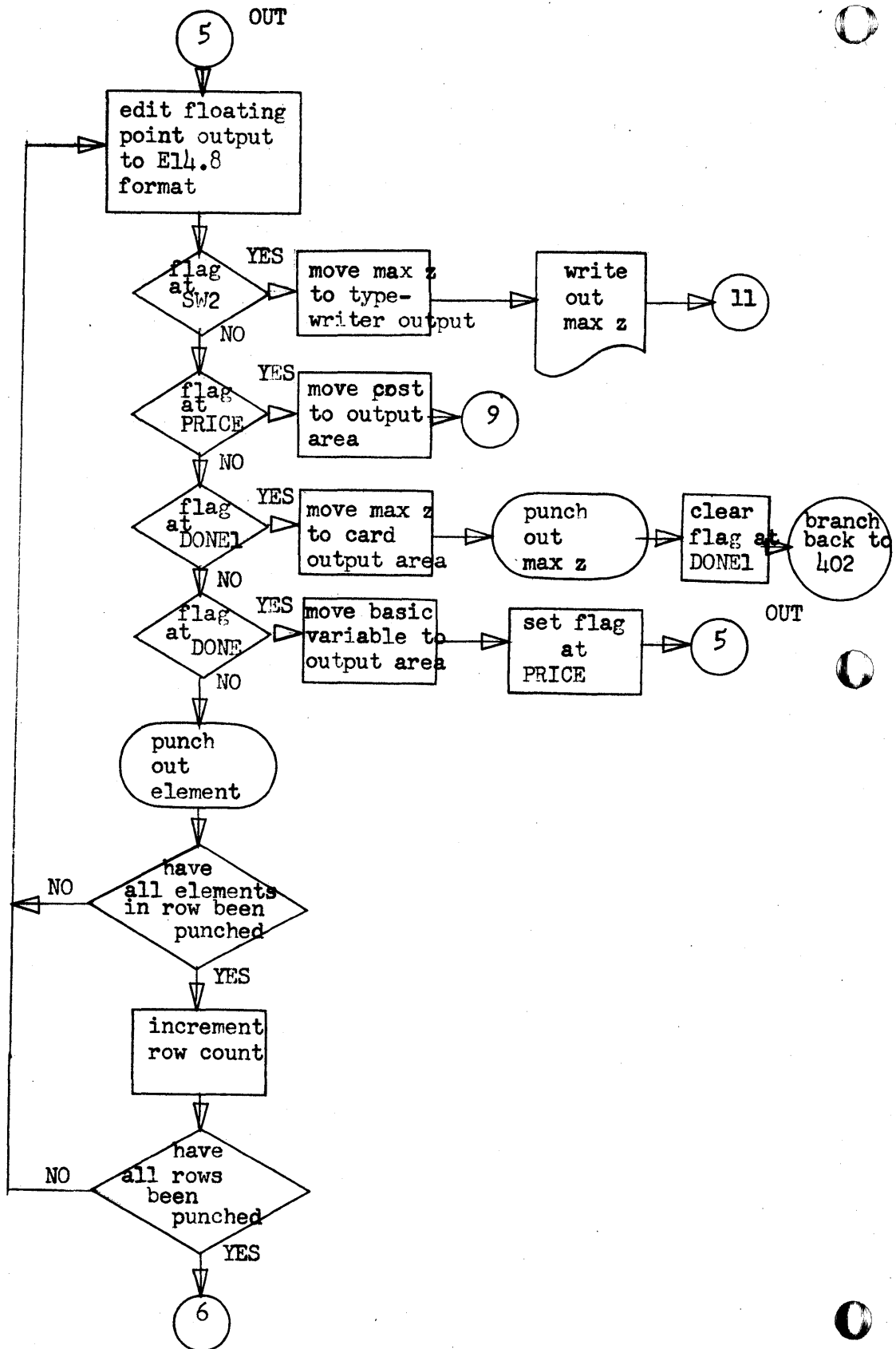
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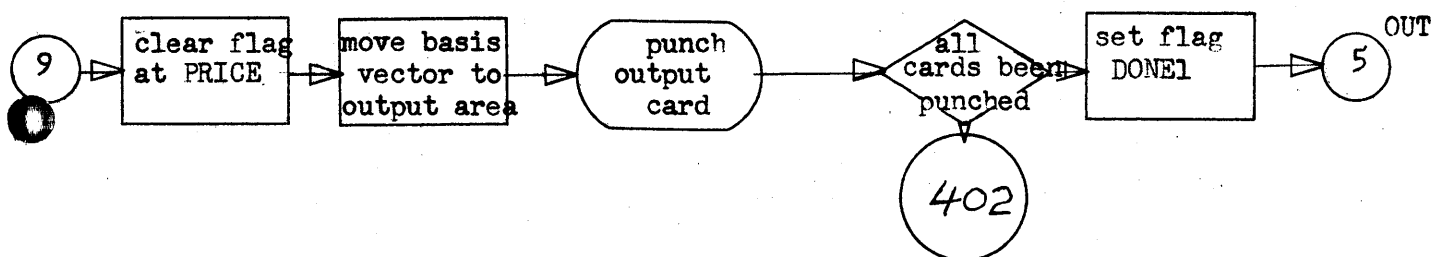
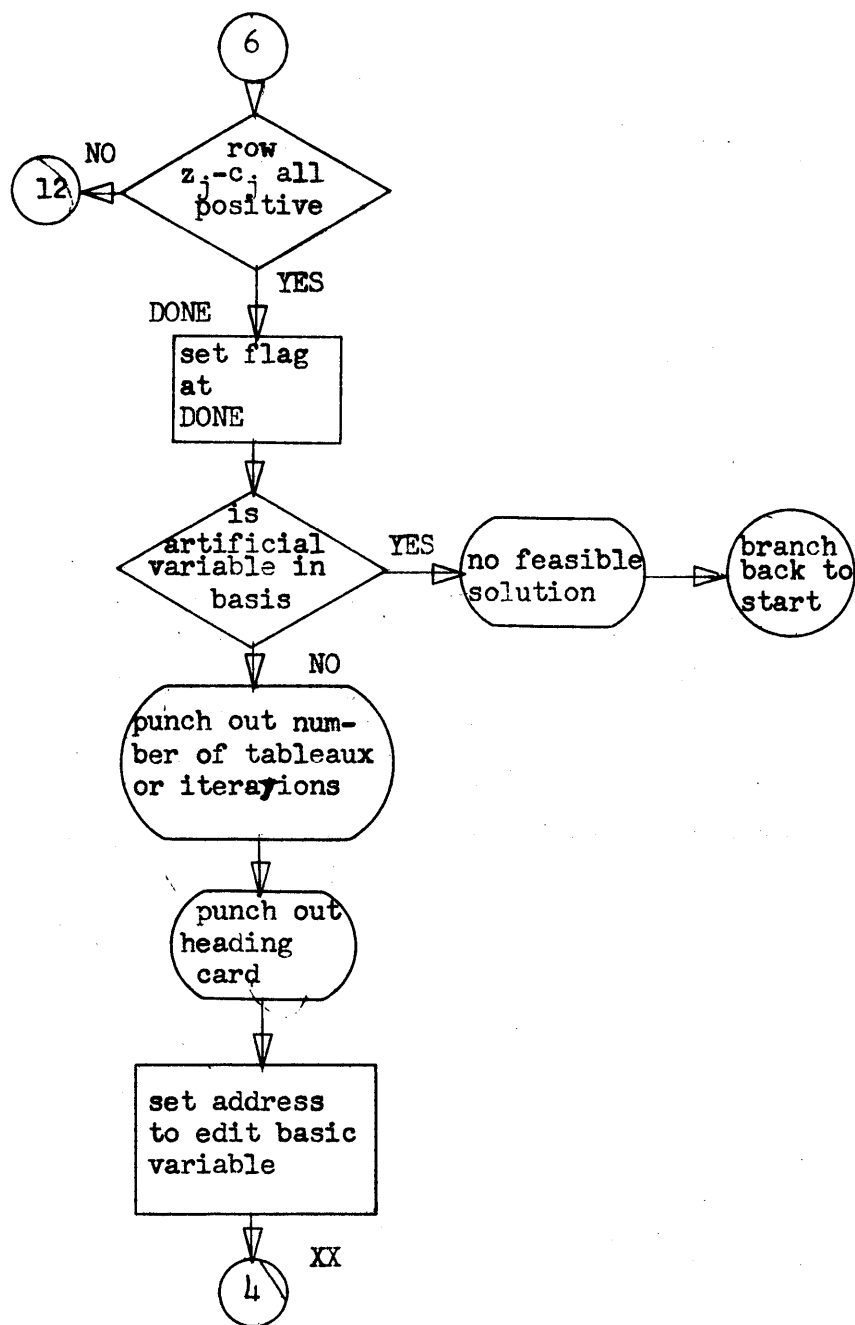
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*          LINEAR PROGRAM SIMPLEX ALGORITHM
*          ROY GALLUP 06/01/64  KSTC
00402 16 00449 -0150      TFM SIZE+11,150,,CHANGE THIS NUMBER TO
00414 13 00449 000-3      MM SIZE+11,03,10,INCREASE SIZE OF MATRIX
00426 11 00099 -0010      AM 99,10
00438 32 00099 00000      SIZE SF 95
00450 26 07157 00000      TF S460,99
00462 16 00540 -7167      TFM ADDSET+6,T461
00474 16 00545 -7237      TFM ADDSET+11,TAB
00486 26 07162 07157      TF S470,S460
00498 11 07162 -0010      AM S470,10
00510 32 00534 00000      SF ADDSET
00522 21 00545 07157      A ADDSET+11,S460
00534 16 07167 -7237      ADDSET TFM T461,TAB,,SETS UP ADDRESSES
00546 11 00540 -0005      AM ADDSET+6,5
00558 14 00540 -7232      CM ADDSET+6,T7820+5
00570 47 00534 01200      BNE ADDSET
00582 44 00630 00534      RNF **48,ADDSET
00594 16 07167 -7192      TFM ADDSET+6,T902
00606 33 00534 00000      CF ADDSET
00618 49 00522 00000      B ADDSET-12
00630 11 07167 -0001      AM T461,1
00642 11 07172 -0002      AM T462,2
00654 11 07177 -0010      AM T470,10
00666 11 07182 -0020      AM T480,20
00678 11 07187 -0030      AM T490,30
00690 12 07192 -0018      SM T902,18
00702 12 07197 -0010      SM T910,10
00714 12 07202 -0002      SM TM2920,2
00726 11 07212 -0010      AM T930,10
00738 11 07217 -0020      AM T940,20
00750 11 07222 -0030      AM T950,30
00762 11 00449 -0020      AM SIZE+11,20
00774 23 07157 00449      M S460,SIZE+11
00786 32 00094 00000      SF 94
00798 21 07227 00099      A T7820,96
00810 12 07157 -0030      SM S460,30
00822 25 01312 07155      TD XVAR+10,S460-2
00834 25 01312 07156      TD XVAR+11,S460-1
00846 11 07157 -0030      AM S460,30
00858 16 00893 -7237      TFM SADD+11,TAB
00870 23 07157 00449      M S460,SIZE+11
00882 32 00094 00000      SADD SF 94
00894 21 00893 00098      A SADD+11,98
00906 36 06248 00500      RNCD IJ,,SIZE OF MATRIX
00918 32 06248 00000      SF IJ
00930 32 06250 00000      SF IJ+2
00942 43 00966 06259      BD **24,IJ+11
00954 49 00978 00000      B **24
00966 17 06080 -6557      BTM FR,FCDMI
00978 23 06249 06251      M I,J
00990 21 00099 06251      A 99,J
01002 12 00099 000-1      SM 99,1,10,LOC 99 CONTAINS NO OF

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01014 16 06453 000-1      TFM I1,1,10,DATA CARDS
01026 21 06453 06249      A I1,I
01038 26 06476 06251      TF J1,J
01050 12 05476 000-1      SM J1,1,10
01062 26 06472 06476      TF JM2,J1
01074 12 06472 000-1      SM JM2,1,10
01086 26 06470 06251      TF J2,J
01098 11 06470 000-2      AM J2,2,10
01110 16 06464 000-0      TFM CTPAR,0,10
01122 16 06462 0-000      TFM CTCD,0,8
01134 16 01152 -7237      TFM A+6,TAB
01146 06 07237 06421      A TFL TAB,FZERO,,SETS MATRIX TO ZEROS
01158 11 01152 -0010      AM A+6,10
01170 24 01152 07227      C A+6,T7820
01182 47 01146 01200      BNE A
01194 26 06458 07182      TF 12,T480
01206 21 06457 06249      A 12-1,I
01218 16 06478 000-0      TFM CT1,0,10
01230 16 06490 000-0      TFM TABCT,0,10
01242 26 07152 07187      TF ADD7,T490
01254 32 01312 00000      SF XVAR+10
01266 01 07199 06441      FADD T910,ONE,5
01278 06 07152 07199      CC TFL ADD7,T910,611,SETS NUMBER OF
01290 11 07152 -0010      AM ADD7,10,,VARIABLES X1,X2,...
01302 14 0719K 000M3      XVAR CM T902,43,610
01314 47 01266 01200      BNE CC-12
01326 16 03965 -7237      TFM OUT+11,TAB
01338 26 07152 07222      TF ADD7,T950
01350 26 07147 07217      TF ADD6,T940
01362 37 06253 00500      READ RACD IN,,DATA CARDS
01374 32 06252 00000      SF IN-1
01386 33 06274 00000      CF IN+21
01398 11 06464 000-1      AM CTPAR,1,10
01410 24 06464 06453      C CTPAR,11
01422 47 01446 01200      BNE **24
01434 27 05864 06281      BT PAR,IN+28
01446 32 06274 00000      SF IN+21
01458 72 06271 06429      TNS IN+18,MANTIS
01470 72 06279 06431      TNS IN+26,EXP
01482 43 01506 06422      BD **24,MANTIS-7
01494 16 06431 000RR      TFM EXP,99,1011
01506 14 06252 000K0      CM IN,20,10
01518 47 01542 01200      BNE **24
01530 32 06429 00000      SF MANTIS
01542 14 06275 000K0      CM IN+22,20,10
01554 47 01578 01200      BNE **24
01566 32 06431 00000      SF EXP
01578 44 01698 01698      BNF SETTAB,SETTAB,,SETS BASIS VARIABLES
01590 33 01698 00000      CF SETTAB
01602 06 07149 06431      AA TFL ADD6,EXP,6
01614 21 07147 07157      A ADD6,S460
01626 26 07152 07147      TF ADD7,ADD6
01638 11 07152 -0010      AM ADD7,10

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01650	24	06478	06476	C	CT1,J1
01662	47	01722	01200	BNF	SETTAB+24
01674	16	07152	-7267	TFM	ADD7,TAB+30
01686	49	01722	00000	B	SETTAB+24
01698	06	0715K	06431	SETTAB TFL	ADD7,EXP,6
01710	11	07152	-0010	AM	ADD7,10
01722	11	06462	0-001	AM	CTCD,1,8
01734	24	06462	00099	C	CTCD,99
01746	47	01362	01200	BNF	READ...END OF READ DATA CARDS
01758	16	06488	-0000	TFM	ADD,0
01770	21	06487	06249	A	ADD-1,I
01782	21	06488	07187	A	ADD,T490
01794	26	07132	06488	TF	ADD3,ADD
01806	21	06487	06476	A	ADD-1,J1
01818	26	07122	06488	TF	ADD1,ADD
01830	21	07122	07157	A	ADD1,S460
01842	26	07127	07212	TF	ADD2,T930
01854	16	06458	-0030	TFM	I2,30
01866	21	06457	06249	A	I2-1,I
01878	21	06458	07202	A	I2,TM2920
01890	16	06478	000-0	TFM	CT1,0,10
01902	44	02046	06450	X BNF	POS,I2,11,SETS UP POSITIVE IDENTITY
01914	06	0712K	06441	TFL	ADD1,ONE,6,MATRIX AND INSERTS
01926	06	0712P	06480	TFL	ADD2,ADD,511,ARTIFICIAL VARIABLES
01938	22	06488	07157	S	ADD,S460
01950	12	07127	-0010	SM	ADD2,10
01962	06	06480	06451	TFL	ADD,M,6,VALUE OF M IS -.1E+51
01974	06	0712P	06480	TFL	ADD2,ADD,611
01986	21	06488	07162	A	ADD,S470
01998	22	07132	07157	S	ADD3,S460
02010	11	07122	-0010	AM	ADD1,10
02022	11	06466	000-1	AM	VARCT,1,10
02034	49	02094	00000	B	POS+48
02046	06	0712P	0713K	POS TFL	ADD2,ADD3,611,SETS COLUMN CR AND VR
02058	12	07127	-0010	SM	ADD2,10
02070	22	07132	07157	S	ADD3,S460
02082	06	0712P	0713K	TFL	ADD2,ADD3,611
02094	21	07127	07162	A	ADD2,S470
02106	21	07132	07162	A	ADD3,S470
02118	21	06458	07162	A	I2,S470
02130	21	07122	07157	A	ADD1,S460
02142	11	06478	000-1	AM	CT1,1,10
02154	24	06478	06476	C	CT1,J1
02166	47	01902	01200	BNF	X
02178	16	06483	-0000	CJ TFM	LAST,0
02190	21	06482	06249	A	LAST-1,I
02202	11	06483	-7267	AM	LAST,TAB+30
02214	21	06482	06476	A	LAST-1,J1
02226	21	06482	06466	A	LAST-1,VARCT
02238	16	06468	000-0	TFM	CT2,0,10
02250	11	06490	000-1	AM	TABCT,1,10
02262	26	07137	07182	TF	ADD4,T480
02274	23	06251	07157	M	J,S460

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02286	32	00095	00000	SF	95
02298	21	07137	00099	A	ADD4,99
02310	26	06488	07137	TF	ADD,ADD4
02322	26	06464	06249	TF	CTPAR,I
02334	21	06464	06476	A	CTPAR,J1
02346	21	06464	06466	A	CTPAR,VARCT
02358	26	07152	07217	TF	ADD7,T940
02370	16	02537	-7257	TFM	AAA+11,TAB+20
02382	16	06478	000-0	AGAIN TFM	CT1,0,10
02394	26	07142	07207	TF	ADD5,T920
02406	06	07107	06421	TFL	WORK1+9,FZERO
02418	26	07147	07152	TF	ADD6,ADD7
02430	06	07117	0714K	MOD1 TFL	WORK+9,ADD5,11,COMPUTES ROW Z(J)-C(J)
02442	03	07117	0714P	FMUL	WORK+9,ADD6,11
02454	01	07107	07117	FADD	WORK1+9,WORK+9
02466	21	07142	07157	A	ADD5,S460
02478	21	07147	07157	A	ADD6,S460
02490	11	06478	000-1	AM	CT1,1,10
02502	24	06478	06476	C	CT1,J1
02514	47	02430	01200	BNF	MOD1
02526	02	07107	-7257	AAA FSUB	WORK1+9,TAB+20,7
02538	06	0713P	07107	TFL	ADD4,WORK1+9,6
02550	11	02537	-0010	AM	AAA+11,10
02562	11	07152	-0010	AM	ADD7,10
02574	11	07137	-0010	AM	ADD4,10
02586	11	06468	000-1	AM	CT2,1,10
02598	24	06468	06464	C	CT2,CTPAR
02610	47	02382	01200	BNF	AGAIN
02622	16	06478	000-1	TFM	CT1,1,10
02634	11	06488	-0008	AM	ADD,8
02646	33	02658	00000	CF	XX
02658	44	02682	06480	XX BNF	**+24,ADD,11,TEST ROW ZJ-CJ TO
02670	32	02658	00000	SF	XX... SEE IF ITS ALL POSITIVE
02682	11	06488	-0010	AM	ADD,10
02694	11	06478	000-1	AM	CT1,1,10
02706	24	06478	06464	C	CT1,CTPAR
02718	47	02658	01200	BNF	XX
02730	44	02754	02658	BNF	**+24,XX
02742	49	02790	00000	B	DPC
02754	16	04277	-0000	TFM	PPADD+11,0
02766	46	03834	00100	BC1	SW1+12
02778	44	04986	02658	BNF	DONE,XX
02790	16	06478	000-0	DPC TFM	CT1,0,10,DETERMINES PIVOT COLUMN
02802	12	06464	000-2	SM	CTPAR,2,10,ADD CONTAINS ADDRESS OF
02814	23	06251	07157	M	J,S460,,SMALLEST VALUE IN ZJ-CJ.
02826	32	00095	00000	SF	95
02838	21	00099	07187	A	99,T490
02850	26	06488	00099	TF	ADD,99
02862	26	07122	00099	TF	ADD1,99
02874	11	07122	-0010	TEST AM	ADD1,10
02886	06	07117	0712K	TFL	WORK+9,ADD1,11
02898	02	07117	06480	FSUB	WORK+9,ADD,11
02910	44	02934	07115	BNF	**+24,WORK+7

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02922	26	06488	07122	TF	ADD,ADD1
02934	11	06478	000-1	AM	CT1,1,10
02946	24	06478	06464	C	CT1,CTPAR
02958	47	02874	01200	BNE	TEST
02970	16	06492	000-0	TFM	NEGCT,0,10,DETERMINES PIVOT POINT
02982	16	06478	000-0	TFM	CT1,0,10,ADD1 CONTAINS ADDRESS
02994	16	06494	000-0	TFM	NEGCT1,0,10,OF PIVOT POINT
03006	23	06476	07157	M	J1,S460
03018	32	00095	00000	SF	95
03030	22	06488	00099	S	ADD,99
03042	26	07127	06488	TF	ADD2,ADD
03054	22	07127	07157	S	ADD2,S460,,CONTAINS ADDRESS OF 8 VECTOR
03066	26	07127	06488	TF	ADD4,ADD
03078	26	07152	07217	TF	ADD7,T940
03090	26	07142	00893	TF	ADD5,SADD+11
03102	33	03342	00000	CF	A11
03114	26	07152	07217	TF	ADD7,T940
03126	33	03138	00000	CF	A10
03138	06	07117	0715K	A10	TFL WORK+9,ADD7,11
03150	06	07107	0648Q	TFL	WORK1+9,ADD,11
03162	43	03186	0710R	BD	**24,WORK
03174	32	03138	00000	SF	A10
03186	44	03222	07115	BNF	**36,WORK+7
03198	11	06492	000-1	AM	NEGCT,1,10
03210	32	03138	00000	SF	A10
03222	43	03246	07098	BD	**24,WORK1
03234	32	03138	00000	SF	A10
03246	44	03282	07105	BNF	**36,WORK1+7
03258	11	06494	000-1	AM	NEGCT1,1,10
03270	32	03138	00000	SF	A10
03282	44	03318	03138	BNF	**36,A10
03294	06	0714K	06421	TFL	ADD5,FZERO,6
03306	49	03354	00000	B	OMIT
03318	09	07117	07107	FDIV	WORK+9,WORK1+9
03330	32	03342	00000	SF	A11
03342	06	0714K	07117	A11	TFL ADD5,WORK+9,6
03354	11	07142	-0010	OMIT	AM ADD5,10
03366	21	07152	07157	A	ADD7,S460
03378	21	06488	07157	A	ADD,S460
03390	11	06478	000-1	AM	CT1,1,10
03402	24	06478	06476	C	CT1,J1
03414	47	03126	01200	BNE	A10-12
03426	44	06124	03342	BNF	ERR,A11
03438	24	06492	06476	C	NEGCT,J1
03450	46	06124	01200	BE	ERR
03462	24	06494	06476	C	NEGCT1,J1
03474	46	06124	01200	BE	ERR
03486	33	03534	00000	CF	A15
03498	16	06478	000-0	TFM	CT1,0,10
03510	26	07122	00893	TF	ADD1,SADD+11
03522	26	07147	07122	TF	ADD6,ADD1
03534	11	07147	-0010	A15	AM ADD6,10
03546	06	07117	0714P	TFL	WORK+9,ADD6,11

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03558	14	0714P	000RR	CM	ADD6,99,61011
03570	46	03678	01200	BE	A14
03582	14	0712K	000RR	CM	ADD1,99,61011
03594	47	03630	01200	BNE	**36
03606	26	07122	07147	TF	ADD1,ADD6
03618	49	03678	00000	B	A14
03630	02	07117	0712K	FSUB	WORK+9,ADD1,11
03642	32	03534	00000	SF	A15
03654	44	03678	07115	RNF	**24,WORK+7
03666	26	07122	07147	TF	ADD1,ADD6
03678	11	06478	000-1	A14	AM CT1,1,10
03690	24	06478	06476	C	CT1,J1
03702	47	03534	01200	RNE	A15
03714	44	06168	03534	BNF	FIND-12,A15
03726	22	07122	00893	S	ADD1,SADD+11
03738	23	07122	07157	M	ADD1,S460
03750	32	00094	00000	SF	94
03762	33	03534	00000	CF	A15
03774	26	07122	00098	TF	ADD1,98
03786	21	00098	07217	A	98,T940
03798	26	07132	00098	TF	ADD3,98
03810	21	07122	07137	A	ADD1,ADD4
03822	26	04277	07122	TF	PPADD+11,ADD1
03834	16	06474	000-1	SW1	TFM ROWCT,1,10
03846	33	04986	00000	CF	DONE
03858	16	06462	0-000	TFM	CTCD,0,8
03870	16	03953	-7237	TFM	MOD+11,TAB
03882	47	05634	00100	BNC1	SW22
03894	26	07027	06927	TF	PCD+98,BL+9R
03906	73	06781	06490	TNF	TABL+18,TABCT
03918	26	06947	06781	TF	PCD+18,TABL+18
03930	39	06929	00400	WACD	PCD
03942	16	03965	-7237	MOD	TFM OUT+11,TAB,7
03954	06	07117	-7237	OUT	TFL WORK+9,TAB,7,OUTPUT CONVERSIONS
03966	15	06800	0000J	TDM	E14.8-1,1,11
03978	44	04014	07115	BNF	**36,WORK+7
03990	33	07115	00000	CF	WORK+7
04002	15	06800	0000K	TDM	E14.8-1,2,11
04014	73	06819	07115	TNF	E14.8+18,WORK+7
04026	15	06822	00001	TDM	E14.8+21,1
04038	14	07117	000RR	CM	WORK+9,99,1011
04050	47	04086	01200	BNE	**36
04062	16	07117	000-1	TFM	WORK+9,01,10
04074	49	04122	00000	B	**48
04086	44	04122	07117	BNF	**36,WORK+9
04098	33	07117	00000	CF	WORK+9
04110	15	06822	00002	TDM	E14.8+21,2
04122	73	06827	07117	TNF	E14.8+26,WORK+9
04134	44	04158	05706	BNF	**24,SW2
04146	49	05742	00000	B	SW2+36
04158	44	04194	05586	BNF	**36,PRICE
04170	26	06955	06827	TF	PCD+26,E14.8+26
04182	49	05478	00000	B	DON

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04194	44	04218	05238	BNF	**24,DONE1
04206	49	05418	00000	B	MAOUT
04218	44	04254	04986	BNF	**36,DONE
04230	26	07027	06827	TF	PCD+98,E14.8+26
04242	49	05586	00000	B	PRICE
04254	26	06955	06827	TF	PCD+26,E14.8+26
04266	14	03965	-0000	PPADD	CM OUT+11.0
04278	47	04302	01200	BNE	**24
04290	26	06981	06667	TF	PCD+52,PP+20
04302	11	03965	-0010	AM	OUT+11.10
04314	39	06929	00400	WACD	PCD
04326	26	07027	06827	TF	PCD+98,BL+98
04338	24	03965	06463	C	OUT+11.LAST
04350	47	03954	01200	BNE	OUT
04362	11	06474	000-1	AM	ROWCT,1.10
04374	73	06645	06474	TNF	R+10,ROWCT
04386	26	06939	06645	TF	PCD+10,P+10
04398	21	06483	07157	A	LAST,S460
04410	21	03953	07157	A	MOD+11,S460
04422	11	06462	000-1	AM	CTCD,1.10
04434	24	06462	06470	C	CTCD,J2
04446	47	03930	01200	BNE	MOD-12
04458	44	04986	02658	BNF	DONE,XX
04470	12	07132	-0010	SWOUT	SM ADD3.10
04482	06	0713K	0712P	TFL	ADD3,ADD2,611
04494	22	07127	07157	S	ADD2,S460
04506	12	07132	-0010	SM	ADD3.10
04518	06	0713K	0712P	TFL	ADD3,ADD2,611
04530	11	07132	-0020	AM	ADD3,20
04542	16	06478	000-0	TFM	CT1,0.10
04554	11	06464	000-3	AM	CTPAR,3.10
04566	26	06488	07132	TF	ADD,ADD3
04578	06	07117	0712K	TFL	WORK+9,ADD1,11
04590	09	0713K	07117	FDIV	ADD3,WORK+9,6,DIVIDES PIVOT
04602	11	07132	-0010	AM	ADD3,10.,ROW BY PIVOT POINT
04614	11	06478	000-1	AM	CT1,1.10
04626	24	06478	06464	C	CT1,CTPAR
04638	47	04590	01200	BNE	*-48
04650	26	07152	07217	TF	ADD7,T940.,VECTOR TRANSFORMATION
04662	16	06468	000-0	TFM	CT2,0.10
04674	26	07122	07137	TF	ADD1,ADD4
04686	26	07127	07152	TF	ADD2,ADD7
04698	16	06478	000-0	TFM	CT1,0.10
04710	26	07137	07122	TF	ADD4,ADD1
04722	26	07132	06488	TF	ADD3,ADD
04734	24	06488	07127	C	ADD,ADD2
04746	47	04806	01200	BNE	SW-24
04758	21	07122	07157	A	ADD1,S460
04770	21	07152	07157	A	ADD7,S460
04782	21	07127	07157	A	ADD2,S460
04794	21	07137	07157	A	ADD4,S460
04806	06	07107	0713P	TFL	WORK1+9,ADD4,11
04818	06	07117	07107	TFL	WORK+9,WORK1+9

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04830	03	07117	0713K	SW	FMUL WORK+9,ADD3,11
04842	02	0712P	07117	FSUB	ADD2,WORK+9.6
04854	11	07127	-0010	AM	ADD2,10
04866	11	07132	-0010	AM	ADD3,10
04878	11	06478	000-1	AM	CT1,1.10
04890	24	06478	06464	C	CT1,CTPAR
04902	47	04818	01200	BNE	SW-12
04914	21	07152	07157	A	ADD7,S460
04926	21	07122	07157	A	ADD1,S460
04938	11	06468	000-1	AM	CT2,1.10
04950	24	06468	06472	C	CT2,JM2
04962	47	04866	01200	BNE	MOD5
04974	49	02178	00000	B	CJ
04986	16	06478	000-0	DONE	TFM CT1,0.10,PUNCHES OUT FINAL ANSWERS
04998	32	04986	00000	SF	DONE
05010	26	07147	07207	TF	ADD6,T920
05022	14	0714P	000N0	NOSOL	CM ADD6,50,610
05034	47	05082	01200	BNE	**48
05046	11	07147	-0011	AM	ADD6,11
05058	43	06124	0714P	BD	ERR,ADD6,11
05070	12	07147	-0011	SM	ADD6,11
05082	21	07147	07157	A	ADD6,S460
05094	11	06478	000-1	AM	CT1,1.10
05106	24	06478	06476	C	CT1,J1
05118	47	05022	01200	BNE	NOSOL
05130	16	06478	000-0	TFM	CT1,0.10
05142	26	06488	07217	TF	ADD,T940
05154	26	07122	07207	TF	ADD1,T920
05166	26	07027	06927	TF	PCD+98,BL+98
05178	73	06781	06490	TNF	TABL+18,TABCT
05190	26	07003	06781	TF	PCD+74,TABL+18
05202	39	06929	00400	WACD	PCD
05214	26	07027	06927	TF	PCD+98,BL+98
05226	26	07027	06761	TF	PCD+98,BV+92
05238	39	06929	00400	DONE1	WACD PCD
05250	26	07027	06927	TF	PCD+98,BL+98
05262	26	03965	06488	TF	OUT+11,ADD
05274	21	06488	07157	A	ADD,S460
05286	21	07177	07157	A	T470,S460
05298	21	07167	07157	A	T461,S460
05310	21	07172	07157	A	T462,S460
05322	11	06478	000-1	AM	CT1,1.10
05334	24	06478	06251	C	CT1,J
05346	47	03954	01200	BNE	OUT
05358	22	06488	07157	S	ADD,S460
05370	32	05238	00000	SF	DONE1
05382	26	07027	06927	TF	PCD+98,BL+98
05394	26	03965	06488	TF	OUT+11,ADD
05406	49	03954	00000	B	OUT
05418	26	07003	06827	MAOUT	TF PCD+74,E14.8+26
05430	26	06975	06799	.TF	PCD+46,MAX+14
05442	39	06929	00400	WACD	PCD
05454	33	05238	00000	CF	DONE1

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05466	49	00402	00000		B	402
05478	15	06467	0000P	DON	TDM	CT2-1,7,11
05490	33	05586	00000		CF	PRICE
05502	14	0717P	000-2	DON1	CM	T470,02,610
05514	46	05562	01200		BE	**48
05526	25	06468	0716P	DON2	TD	CT2,T461,11
05538	26	06977	06468		TF	PCD+48,CT2
05550	49	05238	00000		R	DONE1
05562	73	06977	0717K	DON3	TNF	PCD+48,T462,11
05574	49	05238	00000		B	DONE1
05586	26	03965	07122	PRICE	TF	OUT+11,ADD1
05598	21	07122	07157		A	ADD1,5460
05610	32	05586	00000		SF	PRICE
05622	49	03954	00000		B	OUT
05634	16	06478	000-0	SW22	TFM	CT1,0,10,PUNCHES OUT ROW ZJ-CJ ONLY
05646	47	04470	00200		BNC2	SWOUT
05658	23	06251	07157		M	J,5460
05670	32	00095	00000		SF	95
05682	21	00099	07182		A	99,T480
05694	26	06488	00099		TF	ADD,99
05706	26	03965	06488	SW2	TF	OUT+11,ADD
05718	32	05706	00000		SF	SW2
05730	49	03954	00000		B	OUT
05742	73	06781	06490		TNF	TABL+18,TARCT
05754	34	00000	00102		RCTY	
05766	25	06829	00400		TD	E14,8+28,400
05778	39	06763	00100		WATY	TABL
05790	15	06829	00000		TDM	E14,8+28,0
05802	44	04986	02658		BNF	DONE,XX
05814	33	05706	00000		CF	SW2
05826	49	04470	00000		B	SWOUT
05834					DORG	*-3
05863		00030			DC	30,0
05864	32	05836	00000	PAR	SF	PAR-28
05876	22	06464	06464		S	CTPAR,CTPAR
05888	21	06458	07162	B	A	12,5470,,SETS UP IDENTITY MATRIX
05900	06	06450	06441		TFL	12,ONE,6
05912	11	06478	000-1		AM	CT1,1,10
05924	14	05835	000K4		CM	PAR-29,24,10,DETERMINES WHETHER
05936	46	06044	01200		BE	BACK,,,ARTIFICIAL VARIABLES
05948	14	05835	000L3		CM	PAR-29,33,10,ARE TO BE ADDED
05960	46	06044	01200		BE	BACK
05972	14	05835	000-4		CM	PAR-29,04,10
05984	46	06008	01200		BE	**24
05996	17	06080	-6497		BTM	ER,EREQ
06008	26	06043	06458		TF	**35,12
06020	12	06043	-0002		SM	**23,2
06032	32	0604L	00000		SF	*+11,,6
06044	26	06279	05863	BACK	TF	IN+26,PAR-1
06056	32	01698	00000		SF	SETTAB
06068	42	00000	00000		RB	
06080	34	00000	00102	ER	RCTY	
06092	39	0607R	00100		WATY	ER-1,,6

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06104	48	00000	00000		H	
06116	49	00402	00000		B	402
06124					DORG	*-3
06124	26	07027	06927	ERR	TF	PCD+98,BL+98
06136	26	06967	06633		TF	PCD+38,ERNOFE+38
06148	39	06929	00400		WACD	PCD
06160	49	00402	00000		B	402
06168					DORG	*-3
06168	26	07142	00893		TF	ADD5,SADD+11
06180	14	0714K	000RR	FIND	CM	ADD5,99,61011
06192	47	06228	01200		BNE	**36
06204	11	07142	-0010		AM	ADD5,10
06216	49	06180	00000		B	FIND
06228	26	07122	07142		TF	ADD1,ADD5
06240	49	03726	00000		B	A14+48
06248					DORG	*-3
06248		00004		IJ	DSS	4
06253		00080		IN	DAS	80
06249		00000		I	DS	*IJ+1,NUMBER OF VARIABLES X1,X2,...X1
06251		00000		J	DS	*IJ+3,NUMBER OF ROWS INCLUDING MAXZ
06419		00008			DC	8,0
06421		00002		FZERO	DC	2,-99
06429		00008		MANTIS	DC	8,0
06431		00002		EXP	DC	2,0
06439		00008			DC	8,10000000
06441		00002		ONE	DC	2,01
06449		00008			DC	8,-10000000
06451		00002		M	DC	2,50
06453		00002		I1	DC	2,01
06458		00005		I2	DC	5,0
06462		00004		CTCD	DC	4,0
06464		00002		CTPAR	DC	2,0
06466		00002		VARCT	DC	2,0
06468		00002		CT2	DC	2,0
06470		00002		J2	DC	2,0
06472		00002		JM2	DC	2,0
06474		00002		ROWCT	DC	2,0
06476		00002		J1	DC	2,0
06478		00002		CT1	DC	2,0
06483		00005		LAST	DC	5,0
06488		00005		ADD	DC	5,0
06490		00002		TABCT	DC	2,0
06492		00002		NEGCT	DC	2,0
06494		00002		NEGCT1	DC	2,0
06497		00030		EREQ	DAC	30,INCORRECT NUMBER OF EQUATIONS
06557		00019		FCDMI	DAC	19,FIRST CARD MISSING
06595		00020		ERNOFE	DAC	20,NO FEASIBLE SOLUTION
06635		00006		R	DAC	6,ROW 00
06647		00011		PP	DAC	11,PIVOT POINT
06669		00047		BV	DAC	47, COST BASIS VECTORS BASIC VARIA
06763		00011		TABL	DAC	11,TABLEAU 00
06785		00008		MAX	DAC	8,MAX Z =
06801		00014		E14,8	DAC	14,.00000000E 00,
06829		00050		BL	DAC	50,

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6929	00040	PCD	DAC	40.
07009	00040		DAC	40.
07088	00010	WORK2	DSS	10
07098	00010	WORK1	DSS	10
07108	00010	WORK	DSS	10
07122	00005	ADD1	DS	5
07127	00005	ADD2	DS	5
07132	00005	ADD3	DS	5
07137	00005	ADD4	DS	5
07142	00005	ADD5	DS	5
07147	00005	ADD6	DS	5
07152	00005	ADD7	DS	5
07157	00005	S460	DS	5
07162	00005	S470	DS	5
07167	00005	T461	DS	5
07172	00005	T462	DS	5
07177	00005	T470	DS	5
07182	00005	T480	DS	5
07187	00005	T490	DS	5
07192	00005	T902	DS	5
07197	00005	T910	DS	5
07202	00005	TM2920	DS	5
07207	00005	T920	DS	5
07212	00005	T930	DS	5
07217	00005	T940	DS	5
7222	00005	T950	DS	5
07227	00005	T7820	DS	5
07237	00010	TAR	DSB	10,782
00402			DEND	402

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