17

External Transmittal Authorized
ORNL
Central Files Number
59-4-37

A CRYSTALLOGRAPHIC LEAST SQUARES
REFINEMENT PROGRAM FOR THE IBM 704

LEGAL NOTICE

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

NOTICE

This document contains information of a preliminary nature and was prepared primarily for internal use at the Oak Ridge National Laboratory. It is subject to revision or correction and therefore does not represent a final report. The information is not to be abstracted, reprinted or otherwise given public dissemination without the approval of the ORNL patent branch, Legal and Information Control Department.

OAK RIDGE NATIONAL LABORATORY

operated by

UNION CARBIDE CORPORATION

for the

U.S. ATOMIC ENERGY COMMISSION

846-001

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

LEGAL NOTICE

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

- A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or
- B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

DO NOT PHOTOSTAT

A CRYSTALLOGRAPHIC LEAST SQUARES REFINEMENT

PROGRAM FOR THE IBM 704

By

William R. Busing and Henri A. Levy
Chemistry Division, Oak Ridge National Laboratory
Oak Ridge, Tennessee

April, 1959

IDENTIFICATION

Symbolic decks OR XLS, OR XLS 1, 2, 3, 4, 5, 6.

Binary decks OR XLS A, B, C, D, E, F, G, H, J,
K, L, M, N.

DATE ISSUED

MAY - 4 1959

TABLE OF CONTENTS

	Page
General description	2
Overall schematic flow chart	3
Machine requirements	4
Capacity	4
Mathematical method	4
Symmetry considerations	9
Section of OR XLS2 relevant to symmetry considerations (flow chart)	18
Procedure when singular matrix is found	19
Data processing and weight calculation with OR XLS1	20
Rejecting observations by means of a rejection test	21
Utility routines	22
Data decks	22
Details of data input	23
Operating procedure	33
Preliminary time estimates	38
Instructions for assembling	39
Binary card decks supplied	39
Arrangement of records on binary output tape	42
Arrangement on tape of binary data for each observation	43
SAP listing of programs	44

GENERAL DESCRIPTION

OR XLS1-5 is a program for structure factor calculation and for the least squares refinement of crystal structures using X-ray or neutron diffraction data. The code is divided into five segments and the purpose of each will be described briefly:

OR XLS1 is the preliminary data processing segment. Its input data include the reciprocal cell parameters, the form factor tables (unless problem is a neutron one), and the data for each observation. The latter consist of the indices, the observed structure factor or its square, the estimated standard error of the observation, and an indication of which of several scale factors is to be applied. The output of this segment consists of a binary tape with the input data together with $(\sin \theta/\lambda)^2$ and the interpolated form factors for each reflection. The same information may also be put out in BCD form for off-line printing.

OR XLS2 is the main segment for least squares and structure factor calculations. Its input data consist of a sense card which specifies several options available to the user, symmetry information, reciprocal cell data, and trial parameters including an arbitrary number of scale factors, overall temperature factor coefficient, and, for each atom, the position parameters and one or six temperature factor coefficients. Also used as input is the binary tape from OR XLS1. The primary output of this segment when it is used for least squares is a binary tape on which are stored the derivatives of F_c or F_c^2 with respect to the parameters for each observation. The calculated structure factors may also be put out during this part of the calculation.

For a structure factor calculation this completes the problem. For least squares OR XLS2 calls for the input of parameter selection cards which specify the parameters to be adjusted. OR XLS3 then uses the derivatives from the binary output tape to set up the matrix and vector of the normal equations. OR XLS4 inverts this matrix, and OR XLS5 multiplies the resulting inverse by the vector to obtain the parameter changes.

Control is then returned to OR XLS2 which adjusts the parameters and puts them out off-line and optionally on-line.

During each cycle the input data for each reflection is copied onto the binary output tape as are the programs and input data for OR XLS2-5 so that this tape may serve as the main input for the next cycle.

An optional output of the matrix of the normal equations or its inverse is provided.

MACHINE REQUIREMENTS

Minimum 704 with

1. 8192 word core storage or more
2. 3 on-line tape units
3. CAD instruction
4. Off-line tape printer.

CAPACITY

Core storage	Maximum number of parameters varied simultaneously
8,192	120
16,384	175
32,768	251

MATHEMATICAL METHOD

In this section the details of the computation will be briefly outlined.

OR XLS1

For each reflection this segment computes

$$p = (\sin\theta/\lambda)^2 = (.25)(h^2a^{*2} + k^2b^{*2} + l^2c^{*2} + 2hka^*b^*\cos\gamma^* + 2hla^*c^*\cos\beta^* + 2klb^*c^*\cos\alpha^*)$$

where a^* , b^* , c^* , $\cos\alpha^*$, $\cos\beta^*$, and $\cos\gamma^*$ are the reciprocal cell constants and h , k , and l are the indices of the reflection.

Also computed for each reflection is $\sqrt{w} = 1/\sigma$ where σ is the standard error of the observed $|F|$ or F^2 , whichever is being refined, and w is the least squares weight of the observation. (If $\sigma = 0$ the program sets $\sqrt{w} = 0$.)

For X-ray problems the atomic form factors for each observation are obtained by linear interpolation in the form factor tables which are stored at intervals of 0.05 in $\sin \theta/\lambda$.

The fixed atom contributions, A_0 and B_0 , (see below) are set at zero.

OR XLS2

Included in the data for this segment are the r scale factors s_q , overall temperature factor coefficient T_0 , and the individual atom parameters. The latter are f_i , x_i , y_i , z_i , and T_i if symmetric temperature factors are to be used or f_i , x_i , y_i , z_i , β_{11i} , β_{22i} , β_{33i} , β_{12i} , β_{13i} , and β_{23i} for anisotropic temperature factors. For X-ray work f_i is an integer which indicates which form factor is to be used, while for neutron work it is the scattering factor itself.

If the sense card indicates that symmetric temperature factors are to be converted to anisotropic form the routine computes for each atom

$$\beta_{11i} = T_{ia}^2/4$$

$$\beta_{12i} = T_{ia}^2 b^2 \cos^2 \gamma / 4$$

etc.,

relocates the parameters in anisotropic form, and resets the program on this basis.

The expressions for the scaled structure factor or its square and the derivatives of these with respect to the parameters are summarized in the following table:

	Centrosymmetric with origin at symmetry center	Acentric
$(s_q F)$	$2s_q \exp(-T_o \rho) A$	$s_q \exp(-T_o \rho) (A^2 + B^2)^{1/2}$
$\partial(s_q F)/\partial s_q$	$(s_q F)/s_q$	$(s_q F)/s_q$
$\partial(s_q F)/\partial T_o$	$-\rho(s_q F)$	$-\rho(s_q F)$
$\partial(s_q F)/\partial p$	$2s_q \exp(-T_o \rho) (\partial A/\partial p)$	$s_q \exp(-T_o \rho) (A^2 + B^2)^{-1/2} [A(\partial A/\partial p) + B(\partial B/\partial p)]$
$(s_q F)^2$	$4s_q^2 \exp(-2T_o \rho) A^2$	$s_q^2 \exp(-2T_o \rho) (A^2 + B^2)$
$\partial(s_q F)^2/\partial s_q$	$2(s_q F)^2/s_q$	$2(s_q F)^2/s_q$
$\partial(s_q F)^2/\partial T_o$	$-2\rho(s_q F)^2$	$-2\rho(s_q F)^2$
$\partial(s_q F)^2/\partial p$	$8s_q^2 \exp(-2T_o \rho) A(\partial A/\partial p)$	$2s_q^2 \exp(-2T_o \rho) [A(\partial A/\partial p) + B(\partial B/\partial p)]$

Here F is the structure factor, s_q is the scale factor, T_o is the overall temperature factor coefficient, ρ is $\sin^2 \theta / \lambda^2$, A and B are the real and imaginary components of the structure factor, and p is any individual atom parameter.

The expressions for A and B and their derivatives are summarized as follows:

	Symmetric temperature factor	Anisotropic temperature factor
A	$A_o + \sum_i f_i \exp(-T_i \rho) \sum_j \cos_{ij}$	$A_o + \sum_i f_i \sum_j \exp_{ij} \cos_{ij}$
B	$B_o + \sum_i f_i \exp(-T_i \rho) \sum_j \sin_{ij}$	$B_o + \sum_i f_i \sum_j \exp_{ij} \sin_{ij}$
$\partial A/\partial f_i$	$\exp(-T_i \rho) \sum_j \cos_{ij}$	$\sum_j \exp_{ij} \cos_{ij}$
$\partial B/\partial f_i$	$\exp(-T_i \rho) \sum_j \sin_{ij}$	$\sum_j \exp_{ij} \sin_{ij}$

	Symmetric temperature factor	Anisotropic temperature factor
$\partial A / \partial T_i$	$-\rho f_i \exp(-T_i \rho) \sum_j \cos_{ij}$	-----
$\partial B / \partial T_i$	$-\rho f_i \exp(-T_i \rho) \sum_j \sin_{ij}$	-----
$\partial A / \partial x_i$	$-2\pi f_i \exp(-T_i \rho) \sum_j h_j^i \sin_{ij}$	$-2\pi f_i \sum_j h_j^i \exp_{ij} \sin_{ij}$
$\partial B / \partial x_i$	$2\pi f_i \exp(-T_i \rho) \sum_j h_j^i \cos_{ij}$	$2\pi f_i \sum_j h_j^i \exp_{ij} \cos_{ij}$
$\partial A / \partial \beta_{12i}$	-----	$-f_i \sum_j (2hk)_j^i \exp_{ij} \cos_{ij}$
$\partial B / \partial \beta_{12i}$	-----	$-f_i \sum_j (2hk)_j^i \exp_{ij} \sin_{ij}$

Here the subscripts i and j refer to the various atoms in the asymmetric unit and to the different equivalent positions, respectively. The terms $\cos_{ij}$, $\sin_{ij}$, and $\exp_{ij}$ are the trigonometric contributions and the anisotropic temperature factor of atom i in equivalent position j. The expressions h_j^i and $(2hk)_j^i$ are representative of the transformed indices and index products. All of these terms are discussed in detail in the section on Symmetry Considerations.

T_i and f_i are the symmetric temperature factor coefficient and scattering factor, respectively, of atom i. A_0 and B_0 are the contributions to A and B of fixed atoms, i.e., atoms not represented in the parameter table, and which are therefore not to be adjusted by the least squares procedure. For each reflection these terms are taken from the binary input tape, and they will be zero unless they have been computed using mode 1. Mode 1 is in every way similar to a structure factor calculation except that initially A_0 and B_0 are set to zero and finally they are set to equal to computed A and B. These computed values are then copied from tape to tape during the various least squares or structure factor computations until they are replaced by a new mode 1 calculation.

The program does the computation for each reflection in three steps. First the sums over j are accumulated. These are then converted to the derivatives of A and B with respect to the atomic parameters, and A and B are obtained. Finally the scaled structure factor or its square and the derivatives of this quantity

are computed. In determining which expressions to evaluate the program considers whether derivatives are needed or not, whether centrosymmetric or acentric computation is specified on the sense card, and whether the temperature factors are symmetric or anisotropic. Note that, except for the above restrictions, the program evaluates and stores on the binary output tape derivatives with respect to all the parameters regardless of which ones are to be varied.

A mode of operation (mode 4) is available in which the derivatives are not computed but rather are copied from the input tape where they were stored on a previous cycle. It is possible that this mode of operation will permit the running of several cycles in a minimum amount of time.

The following table gives the expressions for Δ , the difference between the observed and calculated structure factors or their squares, and for the various discrepancy factors which are computed while the structure factors and derivatives are being obtained.

	Refining of F	Refining on F^2
Δ	$[(\text{sign of } s_q F) F_o] - s_q F$	$F_o^2 - (s_q F)^2$
R	$\sum \Delta / \sum F_o $	$\sum \Delta / \sum F_o^2 $
Weighted R	$\sqrt{\sum (\sqrt{w} \Delta)^2} / \sqrt{\sum (\sqrt{w} F_o)^2}$	$\sqrt{\sum (\sqrt{w} \Delta)^2} / \sqrt{\sum (\sqrt{w} F_o^2)^2}$
Error of fit	$\sqrt{\sum (\sqrt{w} \Delta)^2} / \sqrt{(m-n)}$	$\sqrt{\sum (\sqrt{w} \Delta)^2} / \sqrt{(m-n)}$

For the two R factors the summations are made both over all observations and over all non-zero observations. For the error of fit the summation is made over all reflections used in the least squares refinement, i.e., those with non-zero weight which pass the rejection test (if such a test is supplied by the user). The number of such observations is m and the number of parameters adjusted is n. (Before any refinement has been performed the program considers that n = 0.) These discrepancy factors refer, of course, to the input parameters.

Δ and $\sqrt{w} \Delta$ are put out with the structure factors under the headings OBS-CALC and (OBS-CALC)/SIGMA, respectively. Reflections for which the latter is greater than 2 (the constant stored at C7) are marked with a double asterisk (**).

OR XLS3

The function of this segment is to store the matrix $\underline{a}$ and the vector $\underline{y}$ of the normal equations. The elements of these are

$$a_{ij} = \sum (\sqrt{w} D_i)(\sqrt{w} D_j)$$

$$v_i = \sum (\sqrt{w} D_i)(\sqrt{w} \Delta)$$

where the summations are over the un-rejected observations of non-zero weight. For each reflection the n derivatives, D_i , are selected from the binary output tape and correspond to those parameters which are to be adjusted.

When operating in mode 4 only the vector $\underline{y}$ is computed.

OR XLS4

This segment produces the inverse matrix $\underline{b} = \underline{a}^{-1}$ by a method to be described elsewhere (SHARE ROUTINE OR-SMI).

When mode 4 is specified the program copies the inverse matrix of the previous cycle from the binary input tape instead of inverting the matrix. In either case the resulting inverse is copied onto the binary output tape for use in the next cycle if needed.

OR XLS5

In this segment the parameter changes $\Delta p_i = \sum_j b_{ij} v_j$ are computed and stored on the binary output tape along with the diagonal elements b_{ii} of the inverse matrix. Also computed is $\sum_i \Delta p_i v_i$, the estimated decrease of $\sum (\sqrt{w} \Delta)^2$ produced by these parameter changes.

OR XLS2

Control is then returned to this segment and an estimated new value of the standard error of fit,

$$\sqrt{\left[\sum (\sqrt{w} \Delta)^2 - \sum_i \Delta p_i v_i \right]} / \sqrt{(m-n)},$$

is computed. The parameters p_i are corrected by Δp_i and their standard errors computed as

$$\sigma(p_i) = \sqrt{b_{ii} \left[\sum (\sqrt{w} \Delta)^2 - \sum_i \Delta p_i v_i \right]}.$$

At this point the program puts out the old and new parameters with the parameter changes and standard errors for those which have been adjusted.

If the overall temperature factor T_0 is not zero the program now adds it to the individual atom temperature factors so that $T_i = T_i + T_0$ for symmetric temperature factors or

$$\begin{aligned}\beta_{11}' &= \beta_{11} + T_0 a^{*2}/4 \\ \beta_{12}' &= \beta_{12} + T_0 a^* b^* \cos \gamma^*/4 \\ \text{etc.}\end{aligned}$$

for anisotropic temperature factors. T_0 is then set to zero. These operations are performed so that the temperature factor coefficients may be tested for positive definite character as described below. Note that the result is not strictly correct if fixed atom contributions are used so that it is probably desirable to hold T_0 at zero in this case.

The temperature factor coefficients are then tested to insure that the following conditions hold. For symmetric temperature factors:

$$T_i \geq +0.$$

For anisotropic temperature factors:

$$\begin{aligned}\beta_{11} \geq +0, \beta_{22} \geq +0, \beta_{33} \geq +0, \\ \begin{vmatrix} \beta_{22} & \beta_{23} \\ \beta_{23} & \beta_{33} \end{vmatrix} \geq +0, \quad \begin{vmatrix} \beta_{11} & \beta_{13} \\ \beta_{13} & \beta_{33} \end{vmatrix} \geq +0, \quad \begin{vmatrix} \beta_{11} & \beta_{12} \\ \beta_{12} & \beta_{22} \end{vmatrix} \geq +0, \\ \begin{vmatrix} \beta_{11} & \beta_{12} & \beta_{13} \\ \beta_{12} & \beta_{22} & \beta_{23} \\ \beta_{13} & \beta_{23} & \beta_{33} \end{vmatrix} \geq +0.\end{aligned}$$

Failure of one of these tests means that the coefficients do not represent physical reality. The use of these parameters in subsequent calculations may cause a programmed stop indicating a negative argument for the temperature factor. When a test fails the program prints out an indication of this failure, and at the end of the calculation the programmed stop is at KI rather than at KH.

SYMMETRY CONSIDERATIONS

General positions

OR XLS2 computes structure factors or their squares in one of the following ways:

$$\begin{aligned}s_q F &= 2s_q \exp(-T_0 \rho) A \\ (s_q F)^2 &= 4s_q^2 \exp(-2T_0 \rho) A^2 \\ s_q F &= s_q \exp(-T_0 \rho) (A^2 + B^2)^{1/2} \\ (s_q F)^2 &= s_q^2 \exp(2T_0 \rho) (A^2 + B^2)\end{aligned} \quad \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} \begin{array}{l} \text{Centrosymmetric, origin at center} \\ \\ \text{Acentric} \end{array}$$

Here s_q is the scale factor, T_0 is the overall temperature factor coefficient, and ρ is $(\sin\theta/\lambda)^2$.

A and B are computed in space groups $P1$ or $P\bar{1}$ as follows:

$$A = A_0 + \sum_i f_i \exp(-T_i \rho) \sum_j \exp i j \cos i j$$

$$B = B_0 + \sum_i f_i \exp(-T_i \rho) \sum_j \exp i j \sin i j$$

Here A_0 and B_0 are fixed atom contributions which may have been computed previously or which may be zero. The subscript i refers to the different atoms in the asymmetric unit while the subscript j refers to the symmetrically equivalent positions to which each i th atom may be transformed. (In the centrosymmetric case j numbers only half the equivalent positions). T_i and f_i are the symmetric temperature factor coefficient and the form factor for each atom. The terms $\cos i j$ and $\sin i j$ are the trigonometric contributions of the i th atom transformed to the j th equivalent position, and $\exp i j$ is the anisotropic temperature factor for this atom. OR XLS2 sets either $\exp(-T_i \rho)$ or $\exp i j$ at unity depending on which kind of temperature factor is to be used.

The trigonometric contribution $\cos i j$ could be computed as

$\cos i j = \cos 2\pi(hx'_{ij} + ky'_{ij} + lz'_{ij})$ with a similar expression for $\sin i j$. Here h , k , and l are the indices and x'_{ij} , y'_{ij} , and z'_{ij} are the coordinates of the i th atom in the asymmetric unit transformed (as indicated by the primes) to the j th equivalent position. OR XLS2 does not do this, however. Instead of transforming the coordinates, the indices h , k , and l are transformed in a way which makes the result identical with the above:

$\cos i j = \cos 2\pi(h'_j x_i + k'_j y_i + l'_j z_i + t_j)$ with a similar expression for $\sin i j$. Here x_i , y_i , and z_i are the (untransformed) coordinates for the i th atom in the asymmetric unit, h'_j , k'_j , and l'_j are the transformed indices, and t_j is a translational term. As an example we will illustrate the transformations used for the general positions of space group $C3_2$.

j	x'_j	y'_j	z'_j	h'_j	k'_j	l'_j	t_j
1	x	y	z	h	k	l	0
2	$x-y$	$-y$	$-z$	h	$-h-k$	$-l$	0
3	$y-x$	$-x$	$1/3 + z$	$-h-k$	h	l	$l/3$
4	$-x$	$y-x$	$1/3 - z$	$-h-k$	k	$-l$	$l/3$
5	$-y$	$x-y$	$2/3 + z$	k	$-h-k$	l	$2l/3$
6	y	x	$2/3 - z$	k	h	$-l$	$2l/3$

Substitution of these quantities in the two expressions for $\cos i j$ will give identical results.

OR XLS2 permits this symmetry to be introduced in one of two ways: (1) A generalized symmetry routine is used which takes its instructions from symmetry cards which are supplied as data. There is one such card for each j value, and it consists of a statement of the coordinate transformations (as in the left half of the above table). The program then automatically performs the transformations on the indices which are equivalent to the coordinate transformations specified. (2) The user may elect to write his own symmetry routines to transform the indices. Specifications for such routines will be given below. It may be expected that some speed will be gained in this way.

The anisotropic temperature factor, $\exp_{ij}$, is handled similarly. The fundamental expression is

$$\exp_{ij} = \exp \left\{ - \left[h^2 \beta_{11}^{ij} + k^2 \beta_{22}^{ij} + l^2 \beta_{33}^{ij} + 2hk \beta_{12}^{ij} + 2hl \beta_{13}^{ij} + 2kl \beta_{23}^{ij} \right] \right\}$$

where β_{11}^{ij} , etc. are the six temperature factor coefficients for the i th atom of the asymmetric unit transformed to the j th equivalent position. Again the program makes the computation by transforming the index products rather than the coefficients themselves so that

$$\exp_{ij} = \exp \left\{ - \left[(h^2)_j \beta_{11}^{ij} + (k^2)_j \beta_{22}^{ij} + (l^2)_j \beta_{33}^{ij} + (2hk)_j \beta_{12}^{ij} + (2hl)_j \beta_{13}^{ij} + (2kl)_j \beta_{23}^{ij} \right] \right\}.$$

Here $(h^2)_j$, etc. are the transformed index products which make the two expressions identical.

Rules for obtaining the transformed coefficients β_{11}^{ij} , etc. for any space group have been given by H. A. Levy (Acta Cryst. (1956) 2, 679). From these rules it may be deduced that for atoms in general positions $(h^2)_j = (h_j^i)^2$, etc. so that the transformed index products are simply the products of the transformed indices. This is not necessarily true for atoms in special positions, however. The generalized symmetry routine of OR XLS2 computes the products of transformed indices and assumes that $(h^2)_j = (h_j^i)^2$, etc., and therefore the computed anisotropic temperature factor may not be valid for atoms in special positions.

Cells with translational symmetry (centering)

The specification of symmetry in the case of face, end, or body centered cells can be simplified (and the computing time reduced) provided that the reflections which are extinguished by centering are not computed. Similar considerations apply to a rhombohedral cell described by hexagonal coordinates.

In these cases, symmetry cards or routines need be supplied only for positions not related by translation. The scattering factors should then be multiplied by the appropriate integer in the way described below (page 14).

Special positions

We must now consider the ways of handling the computation when atoms are in special positions. The important effects of an atom being in special positions are (a) that the number of these atoms is smaller than if they were in general positions, (b) that there are certain restrictions on the position parameters, and (c) that there may be some restrictions on the anisotropic temperature factor coefficients. No restrictions on symmetric temperature factors are introduced, however.

The ways of handling special positions with OR XLS2 depend on several factors: (1) whether all the atoms are in the same kind of special position, (2) whether the position parameters have a fixed value or whether there is a relationship between two or more coordinates, (3) whether anisotropic temperature factors are used or not, and (4) if used, whether there are (a) no restrictions on the coefficients, (b) certain coefficients fixed at zero, or (c) a relationship between two or more coefficients. H. A. Levy (loc. cit.) has given a rule for determining the restrictions on the anisotropic temperature factor coefficients of atoms in special positions.

Fixed parameters. When coordinates or temperature factor coefficients have fixed values then these values may be put into the list of trial parameters. The parameter selection words are then written so that these parameters are not varied. The symmetry cards are written for the general positions so that anisotropic temperature factors are correctly computed.

Symmetry cards for special positions. If all atoms are in the same kind of special position, and if anisotropic temperature factors are not used, then the correct result will be obtained by using symmetry cards for the special positions. For example, the space group $C_{32}2$ mentioned above has special positions for $y = x$, $z = 1/3$ with the transformations:

j	x_j	y_j	z_j
1	x	x	1/3
2	0	-x	2/3
3	-x	0	0

This information can be punched on three symmetry cards instead of using the six general positions as data. All coordinates y and z in the parameter input are then irrelevant, and no attempt must be made to vary them.

Writing special patches. It is possible to handle any symmetry situation which can arise by using symmetry cards for the general positions, allowing the generalized symmetry routine to compute the transformed indices and the index products which would be valid for these general positions, and then transferring to a specially written section of code which modifies these transformed indices appropriately. Consider, for example, the special positions mentioned above. The generalized symmetry routine alone would produce the trigonometric argument

$$h'_j x_1 + k'_j y_1 + l'_j z_1 + t_j.$$

Now let us make x_1 the independent variable and require that $y_1 = x_1$, $z_1 = 1/3$. Substituting in the argument we have

$$h'_j x_1 + k'_j x_1 + l'_j/3 + t_j.$$

Now the program will produce this result if we replace h'_j by $h''_j = h'_j + k'_j$, k'_j by $k''_j = 0$, l'_j by $l''_j = 0$, and t_j by $t''_j = t_j + l'_j/3$. Instructions for programming such a patch will be given below. The parameters y and z will again be irrelevant and must not be varied.

The restrictions on the anisotropic temperature factor coefficients may be handled in a similar way. For the atoms in the above example, Levy's rule shows that $\beta_{22} = \beta_{11}$, $\beta_{23} = -\beta_{13}$. Taking β_{11} and β_{13} as independent the required transformations are:

$$\begin{aligned} (h^2)_j'' &= (h^2)_j' + (k^2)_j' \\ (k^2)_j'' &= 0 \\ (l^2)_j'' &= (l^2)_j' \\ (2hk)_j'' &= (2hk)_j' \\ (2hl)_j'' &= (2hl)_j' - (2kl)_j' \\ (2kl)_j'' &= 0 \end{aligned}$$

Again β_{22} and β_{23} are irrelevant and must not be varied. It is desirable, however, after the parameters have been adjusted to reset $\beta_{22} = \beta_{11}$ and $\beta_{23} = -\beta_{13}$. This is necessary if the test for positive definite temperature factor coefficients is to be valid. Specifications for the code patch to do this re-setting are given below.

Note that there is no reason why a combination of the fixed parameter and special patch methods may not be used. In the above example the z parameters could be fixed at $1/3$ while the patch handles the $y = x$ restriction. Note also that it may be possible to choose a coordinate system which simplifies the restrictions on the parameters.

Correcting the number of atoms. The program as written always sums over all the equivalent positions as specified by the symmetry cards. Thus the effective number of times an atom is included is equal to the number of symmetry cards (or the number of user's symmetry routines) for acentric structures and twice that number for centrosymmetric structures. If the symmetry cards (or routines) describe the general positions then atoms in special positions may be put in correctly by scaling their scattering factors by the appropriate integer. In the X-ray case this may be done when the form factor tables are prepared, and in the neutron case the scattering factor in the parameter table is adjusted. When the symmetry cards are written for the special positions directly then no modification of the scattering factor is necessary.

Specifications for user's symmetry routines

1. Entry at XD1. OR XLS2 automatically transfers to XD1 if sense card specifies "symmetry routine supplied by user".
2. Write μ routines where μ is the number of equivalent positions for acentric computation or one half this number for centrosymmetric computation.
3. The program transfers to XD1 μ times for each reflection and the user must arrange to enter each of his routines once per reflection. For this purpose Index 4 contains $\mu, \mu-1, \mu-2 \dots 1$ on the first and subsequent entries.
4. The indices (floating point) of the reflection are found at M1, M2, and M3 (see program listing for addresses).
5. The j th routine must store $t_j, h_j^i, k_j^i, \text{ and } l_j^i$ (floating point) at T12-T15.
6. If anisotropic temperature factors are to be used the routine must also store $(h^2)_j^i, (k^2)_j^i \dots (2kl)_j^i$ (floating point) at T16-T21.
7. OR XLS2 does not destroy the transformed indices so that subsequent entries may make use of the values previously obtained.
8. Index 2 is available. If indices 1 or 4 are used they must be saved and restored.
9. Return to XE.
10. Set the address in T5 to that of the last location used by the symmetry routines or other additions to the code.
11. Assemble routines and insert in the binary deck between OR XLSD and OR XLSE.
12. On the Sense Card specify that user's symmetry routines are to be used.

The following example illustrates the symmetry routines for space group $C_{32}2$ using symmetric temperature factors. The required transformations have been tabulated above.

	REM ØRG PZE TRA TRA TRA TRA TRA TRA TRA STZ LXA CLA STØ TIX TRA CLS FSB STØ CLS STØ TRA CLA STØ CLA STØ LDQ STQ FMP STØ TRA CLA STØ CLS STØ TRA CLA STØ CLA STØ CLA STØ CLA STØ FAD STØ TRA CLA STØ CLA STØ CLS STØ TRA	EXAMPLE OF USERS SYMMETRY ROUTINES (Fill in address) THIRD A, 4 A B C D E F TJ I3, 2 H + 3, 2 HJ + 3, 2 A1, 2, 1 XE H K KJ L LJ XE KJ HJ H KJ L LJ THIRD TJ XE K KJ L LJ XE HJ KJ K HJ L LJ TJ TJ TJ XE K HJ H KJ L LJ XE	LAST ADDRESS USED ENTRY
T5			
XD1			
A			
A1			
B			
C			
D			
E			
F			

THIRD	DEC	0.333333	
H	EQU		M1
K	EQU		M2
L	EQU		M3
TJ	EQU		T12
HJ	EQU	(Fill in	T13
KJ	EQU	addresses)	T14
LJ	EQU		T15
I3	EQU		
XE	EQU		
	END	0	

Specifications for patch to handle special positions.

1. Insert a transfer at XI.
2. Patch is probably located somewhere after T5 at end of program. XD1 has no significance if general symmetry routine is used.
3. The program reaches XI ν times for each of the μ values of j . Here ν is the number of atoms in the asymmetric unit and μ is the number of symmetry cards. At each of the ν entries for a given j index 4 contains $i = \nu, \nu - 1, \nu - 2, \dots, 2, 1$.
4. Before reaching XI with a new j value the transformed indices t_j, h_j^i, k_j^i , and l_j^i have been stored in locations T12-T15 by the generalized symmetry routine in accordance with the symmetry cards. If anisotropic temperature factors are specified then the products of these transformed indices, $(h_j^i)^2, (k_j^i)^2, \dots, 2(h_j^i)(l_j^i)$, and $2(k_j^i)(l_j^i)$, have been stored in locations T16-T21.
5. The patch must modify these transformed indices according to the restrictions placed on the parameters by having atoms in special positions. Note that on subsequent entries for a given j value the transformed indices have not been changed but are as they were at the previous exit from the patch. Only when the value of j changes is the generalized symmetry routine re-entered. At this time the transformed indices and products are reset according to the next symmetry card.
6. If any index registers are used they must be saved and restored.
7. Return to XI + 1.
8. Set the address in T5 to that of the last location used by the patch or any other additions.
9. Assemble the patch and insert in the binary deck between OR XLSD and OR XLSE.
10. On the sense card specify that the generalized symmetry routine is to be used (unless user's routines have also been written).

The following example illustrates the use of the patch for a hypothetical structure with one kind of atom in the general positions of $C_{3v}2$ and two more kinds of atoms in the special positions with $y = x$ and $z = 1/3$ mentioned above. The atoms in general positions will be listed first in the parameter table with the other two following. We select x as the independent variable for the atoms in special positions and fix their z parameters at $1/3$. For these atoms the effect on the transformed indices has been discussed above.

	REM	SYMMETRY PATCH FOR SPECIAL POSITIONS	
	ORG	(Fill in address)	
XI	TXL	A, 4, 2	DO NOT TRANSFER ON FIRST ATOM
	ORG	(Fill in address)	
T5	PZE	B	LAST ADDRESS USED
A	TXL	XI + 1, 4, 1	RETURN FOR THIRD ATOM
	CLA	HJ	
	FAD	KJ	
	STO	HJ	
	STZ	KJ	
	CLA	HHJ	
	FAD	KKJ	
	STO	HHJ	
	STZ	KKJ	
	CLA	2HLJ	
	FSB	2KLJ	
	STO	2HLJ	
	STZ	2KLJ	
B	TRA	XI + 1	
HJ	EQU		T13
KJ	EQU		T14
HHJ	EQU	(Fill in	T16
KKJ	EQU	addresses)	T17
2HLJ	EQU		T20
2KLJ	EQU		T21
	END	0	

Specifications for patch to reset relationships between parameters.

1. At XWP insert transfer to reset position coordinates. Such resetting serves no essential purpose in the program as now written.
2. At XWQ insert transfer to reset anisotropic temperature factor coefficients. If symmetric temperature factors are used this transfer will automatically be bypassed.
3. Start these patches at end of program after T5 in locations which do not interfere with other patches.
4. On first entry to either patch index 1 contains ν , the number of atoms in the asymmetric unit. On subsequent entries it contains $\nu - 1, \nu - 2, \dots, 2, 1$. Index 2 contains the complemented address of the form factor or form factor indicator for each atom so that the parameters of the atom under consideration are found as follows:

<u>Parameter</u>	<u>Address and tag</u>
x_i	1,2
y_i	2,2
z_i	3,2
β_{11i}	4,2
$\vdots$	$\vdots$
β_{13i}	8,2
β_{23i}	9,2

μ is number of equivalent positions
(or half that number).
 ν is number of atoms in asymmetric unit.

SECTION OF OR XLS2 RELEVANT TO SYMMETRY CONSIDERATIONS

843 020

5. Write the patch to reset the relationships between the parameters of atoms in special positions. Parameters are in floating point. Index 4 is free.
6. Return to XWP + 1 and XWQ + 1 after each patch.
7. Set the address in T5 to that of last location used by any patch or symmetry routine.
8. Assemble patches and insert in the binary deck between OR XLSD and OR XLSE.

The following is an example of the patches which would be used with the structure of the previous example. Note that this resetting is done after the parameters are printed but before the test for positive definite temperature factors is made.

	REM	PATCH TO RESET PARAMETERS
	ORG	(Fill in address)
XWP	TXL	C, 1, 2
	ORG	(Fill in address)
XWQ	TXL	D, 1, 2
	ORG	(Fill in address)
T5	PZE	E
	ORG	(Fill in address)
C	CLA	1, 2
	STO	2, 2
	TRA	XWP + 1
D	CLA	4, 2
	STO	5, 2
	CLS	8, 2
	STO	9, 2
E	TRA	XWQ + 1
	END	0

PROCEDURE WHEN SINGULAR MATRIX IS FOUND

The programmed stop in XMC of OR XLS4 indicates that the matrix of the normal equations is singular. This means that the program is attempting to adjust more parameters than are uniquely determined by the observations. Some of the ways in which this can occur will be listed:

1. Error in preparing parameter selection cards.
2. Attempting to vary more parameters than there are observations. An error in the weighting scheme or rejection test could cause this difficulty.
3. Attempting to vary some undetermined parameter (e.g., a z coordinate when hk0 data alone is used).
4. Attempting to vary a parameter which should be fixed because an atom is in a special position.
5. Attempting to vary redundant parameters (e.g., varying the overall temperature factor when all individual atom temperature factors are also varied, or varying the coordinates of all atoms when the origin is not fixed by the symmetry).

6. Attempting to vary parameters which are redundant because of overlapping atoms when data is for a projection. (Unless the overlap is exact this would be expected to produce very large parameter changes rather than a singularity stop.)

Operating procedure when matrix is singular.

1. Take octal dump of last 300 words of core storage.
2. Get off machine.
3. Hold tapes 4 and 5.
4. List tape 3.
5. After locating trouble get back on the machine using operating procedures B, C, D, or E.

Locating the trouble

The matrix as taken from a core dump at this point has been partially inverted. The original matrix may be taken from tape 5 if desired by means of OR XLSN (see page 38). However the vector of the normal equations is available in the dump at the location specified in K12. A zero element in this vector very probably means that the corresponding derivative was zero for all the observations. This could occur for reasons 1, 3, or 4 listed above. If all elements are zero this could mean an error in the weighting scheme or rejection test.

The parameter selection words can also be found in the dump at a location specified in K15. There are two parameter selection words for each parameter selection card, and each binary digit of the former corresponds to one card column.

DATA PROCESSING AND WEIGHT CALCULATION WITH OR XLS1

If the user wishes to compute estimated standard errors according to some formula or to perform on each reflection other preliminary data reduction operations such as scaling, taking a square root, etc., he may do so by writing a section of code according to the following specifications. Note that some of the symbols used in XLS1 are reused with different meaning in XLS2. The programmer should be careful to refer to addresses obtained from the listing of XLS1.

1. Start code at XH.
2. Available space includes 64 locations at XI with additional space at the end of the memory if required.
3. The following data is available in binary floating point:
 - a. Cell data at D2-D7.

- b. Data from observation card at M1-M5 (unchanged).
- c. $(\sin \theta/\lambda)^2$ at M7.
- d. Any desired floating point data typed in columns 55-63 and 64-71 of each observation card are found at T13 and T14, respectively.
4. To function as a weight calculator the code must store the standard error (not the weight) of F or F^2 at M5. The program later computes $\sqrt{w} = 1/\sigma$ for $\sigma \neq 0$ ($w = 0$ if $\sigma = 0$).
5. Exit to XJ.
6. Code should be assembled on absolute binary cards and inserted between OR XLSA and OR XLSB.

REJECTING OBSERVATIONS BY MEANS OF A REJECTION TEST

If it is desired to omit from the least squares treatment observations which fail to satisfy some criterion (e.g., reflections with $F(\text{calc})$ much smaller than $F(\text{obs})$) the user may write a rejection test according to the specifications given below. Reflections rejected by this test will be marked with a single asterisk (*) in the structure factor output. The only effect of this test is to cause the reflection to be ignored when the normal equations are set up. If the reflection passes the test in subsequent cycles it will be reincluded.

Specifications for rejection test

1. Start rejection test at XAX. There are 66 locations available. If more space is needed use the area following T5 and change the address in T5 accordingly.
2. Data available for each observation includes the information in locations M1-M13, part of which is the input data and part of which has just been computed. In the listing of these locations "OBS" and "CALC" refer to $F(\text{obs})$ and $sF(\text{calc})$ or $F^2(\text{obs})$ and $s^2F^2(\text{calc})$, whichever is being used. M14 contains the rejection indicator from the previous cycle, if any.
3. All index registers are available to the programmer.
4. If the reflection is to be accepted (i.e., included in setting up the normal equations) store a zero at M14. If the reflection is to be rejected store something other than zero at M14.
5. Return to XAXX.
6. The test should be assembled on absolute binary cards and inserted between OR XLSD and OR XLSE.

UTILITY ROUTINES

OR XLS1-5 includes several routines which may be of interest to the user. A few of them will be described here.

RCD. Card programmer transfer. This routine reads the 9L word from a card and transfers to that word. This 9L word may be a transfer order, and such transfer cards are used to direct the course of the program. The location to which 9L is copied is RCD-1 so that a sequence of non-transfer instructions may be performed from a sequence of cards. Most of the programmed stops in OR XLS1-5 are coded to HTR RCD.

LDCD. Load self-loading cards. This routine clears the index registers and simulates the function of the load card button on the console.

DUMP is an octal and floating decimal off-line dump of the temporaries of OR XLS1-2. It is not available for use with OR XLS3-5. Transfer cards labeled OR XLSM are available, and these may be inserted in the deck at points where they will be read by the RCD routine, i.e., immediately preceeding another such transfer card. After the dump is completed control is returned to the RCD routine, and the next transfer card is read so that the program proceeds without stops. Some of the positions where OR XLSM may be inserted in the card decks are given in the section on operating procedure (pages 33-38). Attempting to dump when OR XLS3-5 are in the memory cause the program to return to RCD and read the next card without dumping.

The initial and final addresses to be dumped are fixed by the program, but they can be changed by means of binary correction cards.

DATA DECKS

Data deck 1. Input for the preliminary processing segment, OR XLS1.

1. Title
2. Reciprocal cell data.
3. Form factor tables unless problem is a neutron diffraction one.
4. Reflection data unless this is on BCD tape. In either case this data is terminated either by a blank field (but with "R" in column 72) or an end of file (i.e., an empty hopper in card reader).

Data deck 2. Input for OR XLS2 when data is not in memory.

1. Title
2. Sense card
3. Symmetry cards if general symmetry routine is used
4. Reciprocal cell data
5. Trial parameters
6. Key card and parameter selection cards if least squares refinement is being made.

Data deck 3. Input for OR XLS2 when some of the data is already in the memory from previous cycles.

1. Title
2. Sense card. Any individual sense card field which is left blank will cause that sense indicator to keep its value from the previous cycle.
- *3. Symmetry cards if general symmetry routine is used
- *4. Reciprocal cell data
- *5. Trial parameters
- *6. Key card and parameter selection cards if least squares refinement is being made.

*Note: If the data from the previous cycle is to remain unchanged each of these groups of data cards may be replaced by one card which is blank except for the correct identification in column 72. CAUTION: Changing the number of scale factors changes the memory location of the parameters and of the symmetry data so that these cards must be supplied in this case.

DETAILS OF DATA INPUT

All input data except the parameter selection cards are converted by means of GL FILE to fixed point integers or floating point numbers with the form of conversion defined by the program. The field in which each entry is to be punched is specified below. The format in which a number should be punched is indicated by the following paragraphs from the GL FILE write-up:

Fixed point integers

The routine examines the characters in the field, working from left to right, and discards all characters until a digit or a minus sign is encountered. This defines the beginning of the number and the next non-digit character (or the end of the field) defines the end of the number. Thus minus signs should immediately precede the number; plus signs may be omitted.

Floating point numbers

Working from left to right the first minus sign, decimal point, or digit encountered defines the beginning of the mantissa; the next non-digit (other than a point) defines the end of the mantissa. The routines then proceed to examine the rest of the field for an exponent in the manner described under the integer operation. If no exponent appears in the field, the routine assumes an exponent of zero. Thus minus signs should immediately precede both mantissa and exponent; plus signs may be omitted.

Examples

1							7
2							
					-	4	
	1	2	5				
-	5						

Fixed Point Integers

1								9
		4						
					2	.	6	6
	-	7	7	E	-	2		
8	.	5	0	1	(	5	)	

Floating Point Numbers

Card identification

Each data card except for the parameter selection cards has an identifying letter punched in column 72. As each data card is read this letter is checked before any of the data is converted. An incorrect letter causes a stop which is monitored on the printer. If the error is located it is only necessary to put the deck back in the reader starting with the corrected data card. Pushing START causes the program to transfer back to the read order on which it stopped.

If it is the identification letter and not the card which is in error the test can be bypassed by turning on sense switch 6. It will then be necessary to put back in the reader the card on which the stop occurred and to START. Subsequent tests will be bypassed as long as sense switch 6 is left on.

Title card

The first card in each data deck.

Columns

- 1-71 The Hollerith information from these 71 columns is used unchanged as a heading for the output.
- 72 The identifying letter T.

Example:

1	2/20/59 HYDROGEN PEROXIDE, CYCLE 1	71	72
			T

Reciprocal cell data card

One card included in each of data decks 1 and 2.

Columns

- 1-9 Integer n_f , the number of different X-ray form factor tables to be used. For neutron diffraction make $n_f = 0$. This field is relevant only in data deck 1. It must be the same as columns 19-21 of the sense card (see below).
- 10-18 Floating point a^* , the reciprocal lattice constant defined so that $a \cdot a^* = 1$ (not $a \cdot a^* = \lambda$).
- 19-27 Floating point b^* .
- 28-36 Floating point c^* .
- 37-45 Floating point $\cos \alpha^*$.
- 46-54 Floating point $\cos \beta^*$.
- 55-63 Floating point $\cos \gamma^*$.
- 72 The identifying letter C.

Example:

1	910	1818	2728	3637	4548	5455	63	72
3	.2451	.5103	.4422	0	.1751	0		C

Form factor tables for X-ray problems

Each table consists of four cards and the program reads n_f such tables where n_f is given in columns 1-9 of the reciprocal cell data card. No form factor tables are used for neutron problems. The 32 form factors for $\sin \theta/\lambda$ from 0.00 to 1.55 in intervals of 0.05 are listed in reverse order. Values of the form factor for $\sin \theta/\lambda$ out of range of the problem may be inserted as zeros.

Card Columns

- 1
 - 1-9 Floating point form factor for $\sin \theta/\lambda = 1.55$
 - 10-18 Floating point form factor for $\sin \theta/\lambda = 1.50$
 - 19-27 Floating point form factor for $\sin \theta/\lambda = 1.45$
 - 28-36 Floating point form factor for $\sin \theta/\lambda = 1.40$
 - 37-45 Floating point form factor for $\sin \theta/\lambda = 1.35$
 - 46-54 Floating point form factor for $\sin \theta/\lambda = 1.30$
 - 55-63 Floating point form factor for $\sin \theta/\lambda = 1.25$
 - 64-71 Floating point form factor for $\sin \theta/\lambda = 1.20$. (Note that this field is one column narrower than the others.)

Card	Columns	
.	72	The identifying letter F.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
4	55-63	Floating point form factor for $\sin \theta/\lambda = 0.05$
	64-71	Floating point form factor for $\sin \theta/\lambda = 0.00$
	72	The identifying letter F.

Example:

1	910	1819	2728	3637	4546	5455	6364	7172
0	0	0	0	0	1.104	1.182	1.220	F
1.258	1.296	1.335	1.374	1.418	1.462	1.514	1.566	F
1.634	1.714	1.813	1.944	2.112	2.338	2.631	3.010	F
3.492	4.094	4.814	5.634	6.482	7.250	7.796	8.000	F

Reflection data cards

One card for each reflection observed or for each structure factor to be computed. These reflections may be put in in any desired sequence. The cards may be included in data deck 1, or they may be copied onto BCD tape before loading. In either case this set of data is terminated either by a card blank except for an R in column 72 or by an end of file (i.e., an empty hopper in the card reader).

Columns

- 1-9 Floating point index h.
- 10-18 Floating point index k.
- 19-27 Floating point index l.
- 28-36 Floating point observed values of $|F|$ or F^2 , whichever is being refined. For structure factor calculations this field need not be punched. If it is omitted then a 2 should be punched on the sense card (see below) in columns 16-18 to indicate that this field is to be ignored.
- 37-45 Floating point σ , the standard error of $|F|$ or F^2 , whichever is being refined. The least squares weight of a reflection will be $w = 1/\sigma^2$ for $\sigma \neq 0$ (or $w = 0$ for $\sigma = 0$). If an error computing program has been added by the user then an error need not be punched. Nor need an error be punched for structure factor calculations.

Column

- 46-54 Integer q where $q = 1, 2, 3 \dots r$ and s_q is the scale factor to be used in computing this reflection. If this field is left blank the program will make q the same as for the previous reflection. This field must not be blank on the first reflection card read.
- 55-63 Floating point extra input 1. Any data punched in this field will be stored at T13 for use by an error calculating or data processing routine written by the user.
- 64-71 Floating point extra input 2. Any data punched in this field will be stored at T14 for the purpose described above.
- 72 The identifying letter R.

Example:

1	910	1819	2728	3637	4546	5455	6364	7172
2	3	-5	17.2	2.5	2			R
10	0	0	4.5	1.0				R
5	4	1	3.1	1.0				R
-3	1	1	0	1.0	1			R
2	5	0	7.2	1.5				R
								R

Sense card

One such control card is read at the beginning of each cycle of least squares. Directly after reading this card the program prints on-line a summary of the control instructions which serves as an immediate check and which may be saved for reference.

Columns

- 1-3 Integer 1, 2, 3, or 4, the mode number:
 (1) Compute fixed atom contributions.
 (2) Compute structure factors $s_q F$ or $(s_q F)^2$.
 (3) Conventional least squares.
 (4) Least squares cycle using derivatives and inverse matrix from previous mode 3 cycle. When this mode is used the kind of temperature factor and the parameter selection cards must be the same as those of the previous mode 3 cycle. Any number of mode 4 cycles may follow one mode 3 cycle.
- 4-6 Integer 1 or 2:
 (1) Compute and base refinement on $s_q F$.
 (2) Compute and base refinement on $(s_q F)^2$.
- 7-9 Integer 1, 2, or 3, the type of individual atom temperature factor.
 (1) Isotropic or symmetric.
 (2) Anisotropic.

Columns

- (3) Start with symmetric temperature factors and convert to anisotropic form before refining. The symmetric coefficients may be left from the previous cycle or they may be read from the parameter cards. The parameter selection cards should be made up on the basis of six anisotropic coefficients per atom.
- 10-12 Integer 1, 2, or 3, the extent of BCD structure factor output desired:
 (1) List results for all reflections.
 (2) List results only for reflections which fail rejection test (supplied by user) or for which (obs-calc)/(error) > 2.
 (3) No structure factor output.
- 13-15 Integer 1 or 2, but this field is irrelevant except in mode 2:
 (1) Binary output tape is to be written.
 (2) No binary output tape to be written.
- 16-18 Integer 1 or 2, but this field is irrelevant except in mode 2:
 (1) F(obs) or F²(obs) has been punched on reflection cards and is to be put out with the computed structure factors and used to compute the R factors.
 (2) F(obs) or F²(obs) is to be ignored if punched and no R factors are to be computed.
- 19-21 Integer n_f, the number of kinds of X-ray form factors. This must be zero for neutron diffraction, and n_f must be the same as that punched in columns 1-9 of the reciprocal cell data card, data deck 1.
- 22-24 Integer ν, the number of atoms in the asymmetric unit.
- 25-27 Integer 1 or 2, the kind of symmetry:
 (1) Centrosymmetric with origin at symmetry center.
 (2) Acentric.
- 28-30 Integer μ, the number of symmetrically equivalent positions for acentric computations or half that number for centrosymmetric computations. This is the number of symmetry cards or user's symmetry routines.
- 31-33 Integer 1 or 2, choice of symmetry routines:
 (1) Use the general symmetry routine which is built into program and define symmetry with μ symmetry cards. Integer 1 should be specified even if code patches are written to handle special positions.
 (2) Only the μ symmetry routines supplied by the user are to be applied. No symmetry cards are to be read.
- 34-36 Integer r, the number of scale factors. This must be at least one. There is no harm in including more scale factors than are actually used provided that no attempt is made to adjust the irrelevant ones.
- 72 The identifying letter S.

Example:

1	34	67	910	1213	1516	1819	2122	2425	2728	3031	3334	36	72
3	1	2	1			0	5	1	2	1	3		S

Symmetry cards

When the general symmetry routine is to be used μ symmetry cards are included in data deck 2. Each card describes one transformation of the atomic coordinates. For acentric structures μ is the number of equivalent positions. For centrosymmetric structures μ is half this number with pairs of positions related by a center being included only once.

CAUTION: The general symmetry routine can be assumed to give correct results (a) if all atoms are in general positions, or (b) if all atoms are in the same kind of special positions and only symmetric temperature factors are used. In all other cases consult the section on Symmetry Considerations for the correct procedure.

Column

- 1-15 The expression for the transformed coordinate x' as follows:
- 1-11 Floating point translational part of x' or blank.
- 12 Hollerith -, +, or blank. The sign associated with the symbol in column 13. Blank and + are equivalent.
- 13 Hollerith X, Y, Z, or blank.
- 14 Hollerith -, +, or blank. The sign associated with the symbol in column 15. Blank and + are equivalent.
- 15 Hollerith X, Y, Z, or blank. Note that columns 12 and 13 are exactly equivalent to 14 and 15. Thus the transformation $x' = 1/2 - x$ may be punched

1	11	12	13	14	15	or	1	11	12	13	14	15
.5		-	X				.5			-	X	

Note that the expression $x' = 2x$ must be treated as $x' = x + x$.

- 16-30 The expression for the transformed coordinate y' as follows:
- 16-26 Floating point translational part of y' or blank.
- 27-30 Hollerith sign, symbol, sign, symbol as described above.
- 31-45 The expression for the transformed coordinate z' as follows:
- 31-41 Floating point translational part of z' or blank.
- 42-45 Hollerith sign, symbol, sign, symbol as described above.
- 72 The identifying letter M.

Example: The six symmetry cards for space group $C_{32}2$ (see page 10) may be punched as follows:

	1	11	12	13	14	15	16	26	27	28	29	30	31	41	42	43	44	45	72
		X						Y							Z				M
		X	-	Y				-	Y						-	Z			M
		Y	-	X				-	X			.333333			+	Z			M
		-	X					Y	-	X		.333333			-	Z			M
		-	Y					X	-	Y		.666667			+	Z			M
		Y						X				.666667			-	Z			M

Trial parameter cards

These include r scale factor cards, one overall temperature factor card, and ν atom parameter cards where ν and r are punched on the sense card (see above). These cards will be described separately.

Scale factor cards

Cards are read in the order $s_1, s_2, \dots, s_q, \dots, s_r$ where q is the scale factor identification punched in columns 46-54 of the reflection data cards. Note that s_q multiplies the calculated F , not the observed F .

Column

- 1-9 Floating point scale factor, s_q .
72 The identifying letter P.

Overall temperature factor card

Column

- 1-9 Floating-point T_0 , the coefficient for the overall temperature factor $\exp(-T_0 \sin^2 \theta / \lambda^2)$. T_0 may be zero or any positive number. Do not leave blank.
- 72 The identifying letter P.

Atom parameter cards

One card for each atom in the asymmetric unit.

Column

- 1-7 For X-ray problems ($n_f \neq 0$) this is an integer from one to n_f which identifies the form factor to be used. The form factors are numbered in the order in which the form factor tables were read from data deck 1.
- For neutron problems ($n_f = 0$) this is the floating point neutron scattering factor itself.
- 8-14 Floating point coordinate x_1 .
- 15-21 Floating point coordinate y_1 .
- 22-28 Floating point coordinate z_1 .

For symmetric temperature factors (or for symmetric converted to anisotropic before refining):

Columns

- 29-35 Floating point T_1 , the coefficient for the individual atoms isotropic temperature factor $\exp(-T_1 \sin^2 \theta / \lambda^2)$. T_1 may be zero or any positive number.
- 36-70 Irrelevant.
- 72 The identifying letter P.

For anisotropic temperature factors:

Columns

- 29-35 Floating point β_{111} , a coefficient in the expression for the anisotropic temperature factor
- $$\exp \left[-(\beta_{11}h^2 + \beta_{22}k^2 + \beta_{33}l^2 + 2\beta_{12}hk + 2\beta_{13}hl + 2\beta_{23}kl) \right].$$
- 36-42 Floating point β_{22} .
- 43-49 Floating point β_{33} .
- 50-56 Floating point β_{12} .
- 57-63 Floating point β_{13} .
- 64-70 Floating point β_{23} .
- 72 The identifying letter P.

Example: The parameter cards for an X-ray problem with two scale factors, three atoms in the asymmetric unit, and symmetric temperature factors might be as follows:

1	9	72
.954		P
1.015		P
0		P

1	78	1415	2122	2829	35	72
2	.4713	-.2521	.9412	1.75		P
2	.5433	.1112	-.1043	1.25		P
1	.2710	.4544	.3315	.70		P

Key card

One card included in data deck 2 for least squares (modes 3 or 4). This card is not used in the calculation of fixed atom contributions or structure factors (modes 1 or 2).

Columns

- 1-6 Integer n, the number of parameters to be adjusted. This is equal to the number of ones punched on the parameter selection cards. This number must be greater than zero and must not exceed the limit set by the memory capacity (see page 4).
- 7-12 Integer, the number of parameter selection cards which follow.
- 72 The identifying letter K.

Example:

1	67	12	72
57	2		K

Parameter selection cards

These cards follow the key card (see above) and the number of parameter selection cards must be the integer punched in columns 7-12 of that card. Their purpose is to specify the parameters which are to be adjusted by least squares.

Consider the entire list of parameters including the r scale factors, the overall temperature factor coefficient, and the individual atom parameters to be arranged in that order. There are either five or ten atom parameters per atom including the form factor, the three coordinates, and the one or six temperature factor coefficients (depending on whether symmetric or anisotropic temperature factors are being used). Each column of a parameter selection card corresponds to one parameter, the first scale factor to column one, the next to column two, etc., for the first 72 parameters. If there are more than 72 parameters the association is continued on the next card, parameter 73 corresponding to column one, etc.

If a parameter is to be varied a one is punched in the corresponding column, otherwise a zero or blank is punched. (Actually, all rows but the 1 row are ignored by the program.)

There is no identifying letter to be punched in column 72.

Note that in both the X-ray and neutron case the scattering factor is considered to be a parameter. The neutron scattering factor may be adjusted by least squares, but varying an X-ray scattering factor must not be attempted.

Examples: Consider an X-ray problem with three scale factors, two atoms in the asymmetric unit, and symmetric temperature factors. Only hk0 zone data are to be used and only the first scale factor will be adjusted. The parameter list and corresponding parameter selection card is:

s ₁	s ₂	s ₃	T ₀	f ₁	x ₁	y ₁	z ₁	B ₁	f ₂	x ₂	y ₂	z ₂	B ₂
1					6	7					12	13	
1	0	0	0	0	1	1	0	1	0	1	1	0	1

If the same problem were set up for anisotropic temperature factors the parameter list and the corresponding parameter selection card might be:

β_{ij1}														β_{ij2}									
s_1	s_2	s_3	T_0	f_1	x_1	y_1	z_1	11	22	33	12	13	23	f_2	x_2	y_2	z_2	11	22	33	12	13	23
1					6	7					12	13					18	19				24	
1	0	0	0	0	1	1	0	1	1	0	1	0	0	0	1	1	0	1	1	0	1	0	0

OPERATING PROCEDURE

* Inserting OR XLSM immediately preceding a deck marked with an asterisk will cause the program to put out via tape unit 3 an octal and floating decimal dump of the temporaries from the preceeding calculation. This does not interfere with the computation in any way.

A. Data processing following by least squares or by structure factor calculation.

Card deck

1. OR XLSA, B (red)
2. Data deck 1
- *3. OR XLSC, D, E (orange)
4. Data deck 2

For calculating only structure factors (mode 2) the cards after this point are not needed.

- *5. OR XLSF (yellow)

If only one cycle is to be run the cards after this point are not needed.

6. OR XLSG (brown)
7. Data deck 3
- *8. OR XLSH (blue)
9. For each additional cycle repeat decks 6, 7, and 8.

Operating Instructions for Case A

1. If tape input of reflection data is to be used mount it on unit 4.
2. Blank tapes on units 3 and 5.
3. Sense switch 1: Off for tape input,
On for card input.
4. Sense switch 2: Off if BCD output from XLS1 is desired,
On to suppress this output.

5. Sense switch 3: Off for on-line output of F or F^2 ,
On to suppress this on-line output.
(Off-line output is unaffected by this setting.)
 6. Sense switch 4: Off for on-line output of parameters,
On to suppress this on-line output.
(Off-line output is unaffected by this setting.)
 7. Sense switch 6: Off normally,
On to bypass data identification check.
 8. Ready printer with SHARE II board.
 9. Clear and load cards. Programmed stop at 157g. This completes OR XLS1.
Observations are now on logical tape 5.
 10. Switch the tape unit that was 5 to 4. Put a blank tape on unit 5.
Start.
 11. Programmed stop at 160g. This is the end of the cycle. Observations,
derivatives, and programs are now on logical tape 5 and this may be
used as the sole tape input for further cycles. Information on logi-
cal tape 4 is unchanged.
 12. To start a new cycle switch tape unit that was 5 to 4. Put a blank
tape on unit 5. Start. Stops as in step 11 above.
 13. Repeat step 12 for as many cycles as desired.
 14. List logical tape 3. Program control. Automatic overflow.
 15. Hold logical tape 5 to use as the input for further cycles. If for
some reason the problem was stopped in mid-cycle it is desirable to
hold also logical tape 4. If structure factors were calculated with
no binary output then logical tape 4 should be held if further calcu-
lations are to be made.
- B. Least squares or structure factor calculation when output of OR XLS1 is used
as input.

Card deck

1. OR XLSK (red stripe)
2. OR XLSC, D, E (orange)
3. Data deck 2
For calculating only structure factors (mode 2) the cards after this
point are not needed.
- *4. OR XLSF (yellow)
If only one cycle is to be run the cards after this point are not
needed.
5. OR XLSC (brown)
6. Data deck 3
- *7. OR XLSH (blue)
8. For each additional cycle repeat decks 5, 6, and 7.

- C. Least squares or structure factor calculation when the output of a previous least squares cycle is used as the input.

Card deck

1. OR XLSJ (green)

2. Data deck 3

For calculating only structure factors (mode 2) the cards after this point are not needed.

*3. OR XLSH (blue)

4. OR XLSG (brown)

5. Data deck 3

*6. OR XLSH (blue)

7. For each additional cycle repeat decks 4, 5, and 6.

- D. Least squares or structure factor calculation when the output of a previous structure factor or fixed atom contribution calculation is used as the input.

Card deck

1. OR XLSJ (green)

2. Data deck 3 (except that new parameters will be needed if input is from fixed atom contribution calculation)

For calculating only structure factors (mode 2) the cards after this point are not needed.

*3. OR XLSF (yellow)

If only one cycle is to be run the cards after this point are not needed.

4. OR XLSG (brown)

5. Data deck 3

*6. OR XLSH (blue)

7. For each additional cycle repeat decks 4, 5, and 6.

Operating Instructions for Cases B, C, or D.

1. Mount binary input tape on unit 4.

2. Blank tapes on units 3 and 5.

3. Sense switch 3: Off for on-line output of F or F^2 ,
On to suppress this on-line output.
(Off-line output is unaffected by this setting.)

4. Sense switch 4: Off for on-line output of parameters,
On to suppress this on-line output.
(Off-line output is unaffected by this setting.)

5. Sense switch 6: Off normally,
On to bypass data identification check.

6. Ready printer with SHARE II board.

7. Clear and load cards.
 8. Programmed stop at 160_g. This is the end of the cycle. Observations, derivatives, and programs are now on logical tape 5 and this may be used as the sole tape input for further cycles. Information on logical tape 4 is unchanged.
 9. To start a new cycle switch tape unit that was 5 to 4. Put a blank tape on unit 5. Start. Stops as in step 8 above.
 10. Repeat step 9 for as many cycles as desired.
 11. List logical tape 3. Program control. Automatic overflow.
 12. Hold logical tape 5 to use as the input for further cycles. If for some reason the problem was stopped in mid-cycle it is desirable to hold also logical tape 4. If structure factors were calculated with no binary output then logical tape 4 should be held if further calculations are to be made.
- E. To get back onto the machine when least squares has given wrong results because wrong parameters were varied.

Card deck

1. OR XLSL (green stripe)
2. Key card and parameter selection cards
- *3. OR XLSF (yellow)
If only one cycle is to be run the cards after this point are not needed.
4. OR XLSG (brown)
5. Data deck 3
- *6. OR XLSH (blue)
7. For each additional cycle repeat decks 4, 5, and 6.

Operating Instructions for Case E.

1. Mount output from faulty cycle on tape unit 5.
 2. Blanks on units 3 and 4. Tape 4 is not written on, but it will receive a rewind order.
 3. Follow steps 3 to 12 of the Instructions for Cases B, C, and D.
- F. Data processing followed by calculation of fixed atom contribution and then by least squares.

Card deck

1. OR XLSA, B (red)
2. Data deck 1 including form factor tables for fixed and non-fixed atoms.
- *3. OR XLSC, D, E (orange)
4. Data deck 2 with parameters of only the fixed atoms and with no key card or parameter selection card.
- *5. OR XLSG (brown)

6. Data deck 2 with parameters of only the non-fixed atoms.
- *7. OR XLSF (yellow)
If only one cycle is to be run the cards after this point are not needed.
8. OR XLSG (brown)
9. Data deck 3
- *10. OR XLSH (blue)
11. For each additional cycle repeat decks 8, 9, and 10.

Operating Instructions for Case F.

1. If tape input of reflection data is to be used mount it on unit 4.
2. Blank tapes on units 3 and 5.
3. Sense switch 1: Off for tape input,
On for card input.
4. Sense switch 2: Off if BCD output from XLS1 is desired,
On to suppress this output.
5. Sense switch 3: Off for on-line output of F or F²,
On to suppress this on-line output.
(Off-line output is unaffected by this setting.)
6. Sense switch 4: Off for on-line output of parameters,
On to suppress this on-line output.
(Off-line output is unaffected by this setting.)
7. Sense switch 6: Off normally,
On to bypass data identification check.
8. Ready printer with SHARE II board.
9. Clear and load cards. Programmed stop at 157_B. This completes OR XLS1. Observations are now on logical tape 5.
10. Switch the tape unit that was 5 to 4. Put a blank tape on unit 5. Start.
11. Programmed stop at 160_B. Observations and fixed atom contributions are now on logical tape 5. Information on logical tape 4 is unchanged.
12. Switch the tape that was 5 to 4. Put a blank tape on unit 5. Start.
13. Programmed stop at 160_B. This is the end of the cycle. Observations, fixed atom contributions, derivatives, and programs are now on logical tape 5 and this may be used as the sole tape input for further cycles. Information on logical tape 4 is unchanged.
14. To start a new cycle switch tape unit that was 5 to 4. Put a blank tape on unit 5. Start. Stops as in step 13 above.
15. Repeat step 14 for as many cycles as desired.
16. List logical tape 3. Program control. Automatic overflow.

17. Hold logical tape 5 to use as the input for further cycles. If for some reason the problem was stopped in mid-cycle it is desirable to hold also logical tape 4. If structure factors were calculated with no binary output then logical tape 4 should be held if further calculations are to be made.

G. Output of matrix of normal equations or its inverse.

Card deck

1. OR XLSN (orange stripe). (If tape 5 is the output of an incomplete cycle, e.g., after a singular matrix is found, it will be necessary to insert a single absolute binary card immediately preceding the transfer card of OR XLSN. This card should load N, the order of the matrix, in binary into the address part of location 1314₈.)

Operating Instructions for Case G.

1. Mount on unit 5 the binary output tape from a least squares cycle, mode 3. (If the tape is from a mode 4 cycle only the inverse matrix can be put out.)
2. Blank tape on unit 3 or this may be the same output tape used for the least squares cycle. It is not rewound before using.
3. Sense switch 5: Off for direct matrix of normal equations,
On for inverse matrix.
4. Clear and load cards. Stops at 342₈.
5. If more than one matrix is to be put out repeat steps 1 to 4. The program does not reset itself.
6. List tape 3. Program control. Automatic overflow. Hold tape 5 if desired. It has not been written on.

PRELIMINARY TIME ESTIMATES

OR XLS1 with card input of data.

$$\text{Time} = (\text{No. of observations} + 50) (7.2 \times 10^{-3} \text{ minutes}).$$

OR XLS2 derivative calculation with off-line BCD output.

$$\begin{aligned} \text{Time} &= (\text{No. of observations})(\text{No. of atoms in asymmetric unit}) \\ &\times (\text{No. of symmetry cards})(1 \text{ for centrosymmetric, } 2 \text{ for acentric}) \\ &\times (1 \text{ for symmetric temp. fact., } 2 \text{ for anisotropic})(2.9 \times 10^{-4} \text{ minutes}). \end{aligned}$$

OR XLS3 setting up matrix.

$$\text{Time} = (\text{No. of observations})(\text{No. of parameters varied})^2 (4.3 \times 10^{-6} \text{ minutes}).$$

OR XLS4 inverting matrix.

$$\text{Time} = (\text{No. of parameters varied})^3 (3.6 \times 10^{-6} \text{ minutes}).$$

INSTRUCTIONS FOR ASSEMBLING

Binary decks ready for use are available so that it should not often be necessary to assemble the program from the symbolic cards. If such an assembly is made, however, it will be necessary to add to the resulting binary cards certain loaders, relocatable subroutines, tables, and transfer cards which can be obtained from the available binary decks. Reference should be made to the table of binary card decks supplied (pages 39 to 41).

Assembly of OR XLS using SAP3-7 produces only the Utility programs.

Assembly of OR XLS1 produces the program and origin cards for the relocatable subroutines DBD1, FILE, SQRT3, and OUT3 in that order.

Assembly of OR XLS2 produces the program, origin cards for DBD1, FILE, SQRT3, OUT3, and SINEXP, and the loader MU SBL2 with the correct shifting increment.

Assembly of OR XLS3 produces only the program.

Assembly of OR XLS4 produces the program and an origin card for the relocatable subroutine OR SMI.

Assembly of OR XLS5 produces only the program.

Assembly of OR XLS6 produces the program, an origin card for OUT3, and a transfer card.

The various transfer cards will need to be changed only if the memory locations of the first few words in each segment are changed.

BINARY CARD DECKS SUPPLIED

<u>OR XLSA, B (red*)</u>	<u>Type of card</u>	<u>Identification</u>
1. NY RBL1	Self-loading	OR XLSA 00-04
2. UTILITY	Absolute	OR XLSA 05-11
3. OR XLS1	Absolute	OR XLSA 12-36
4. Changes for OR XLS1 (if any)	Absolute	
5. Origin and NY DBD1	Relocatable	OR XLSB 00-08
6. Origin and GL FILE	Relocatable	OR XLSB 09-19
7. Origin and CL SQRT3	Relocatable	OR XLSB 20-22
8. Origin and NY OUT3	Relocatable	OR XLSB 23-41
9. HTR RCD	Transfer	OR XLSB 42
10. TXI START	Transfer	OR XLSB 43

* It is suggested that the user reproduce the cards in the indicated colors.

<u>OR XLSC, D, E (orange)</u>	<u>Type of card</u>	<u>Identification</u>
1. TXI LDCD	Transfer	OR XLSC 00
2. NY RBL1	Self-loading	OR XLSC 01-05
3. OR XLS2	Absolute	{ OR XLSC 06-99
4. Changes for OR XLS2 (if any)	Absolute	
5. User's symmetry routines (if any)	Absolute	OR XLSD 00-27
6. Origin and NY DBD1	Relocatable	OR XLSE 00-08
7. Origin and GL FILE	Relocatable	OR XLSE 09-19
8. Origin and CL SQRT3	Relocatable	OR XLSE 20-22
9. Origin and NY OUT3	Relocatable	OR XLSE 23-41
10. Origin and SINEXP subroutines	Relocatable	OR XLSE 42-45
11. HTR RCD	Transfer	OR XLSE 46
12. TXI LDCD	Transfer	OR XLSE 47
13. MU SBL2 for TABLES	Self-loading	OR XLSE 48
14. TABLES used by SINEXP	Absolute with nominal origin zero	OR XLSE 49-78
15. TXI START	Transfer	OR XLSE 79
<u>OR XLSF (yellow)</u>		
1. TXI LDCD	Transfer	OR XLSF 00
2. NY RBL1	Self-loading	OR XLSF 01-05
3. OR XLS3	Absolute	OR XLSF 06-13
4. Changes for OR XLS3 (if any)	Absolute	
5. HTR RCD	Transfer	OR XLSF 14
6. TXI START	Transfer	OR XLSF 15
7. TXI LDCD	Transfer	OR XLSF 16
8. NY RBL1	Self-loading	OR XLSF 17-21
9. OR XLS4	Absolute	OR XLSF 22-23
10. Changes for OR XLS4 (if any)	Absolute	
11. Origin and OR SMI	Relocatable	OR XLSF 24-36
12. HTR RCD	Transfer	OR XLSF 37
13. TXI START	Transfer	OR XLSF 38
14. TXI LDCD	Transfer	OR XLSF 39
15. NY RBL1	Self-loading	OR XLSF 40-44
16. OR XLS5	Absolute	OR XLSF 45-48
17. Changes for OR XLS5 (if any)	Absolute	
18. HTR RCD	Transfer	OR XLSF 49
19. TXI START	Transfer	OR XLSF 50
<u>OR XLSG (brown)</u>		
1. TXI START	Transfer	OR XLSG 00
<u>OR XLSH (blue)</u>		
1. TXI KB	Transfer	OR XLSH 00
2. TXI KC	Transfer	OR XLSH 01
3. TXI KD	Transfer	OR XLSH 02

OR XLSJ (green)

1. NY RBL1
2. UTILITY
3. HTR RCD
4. TXI KA

Type of card

- Self-loading
Absolute
Transfer
Transfer

Identification

- OR XLSJ 00-04
OR XLSJ 05-11
OR XLSJ 12
OR XLSJ 13

OR XLSK (red stripe)

1. NY RBL1
2. UTILITY
3. HTR RCD

- Self-loading
Absolute
Transfer

- OR XLSK 00-04
OR XLSK 05-11
OR XLSK 12

OR XLSL (green stripe)

1. NY RBL1
2. UTILITY
3. HTR RCD
4. TXI KF

- Self-loading
Absolute
Transfer
Transfer

- OR XLSL 00-04
OR XLSL 05-11
OR XLSL 12
OR XLSL 13

OR XLSM (Manila)

1. TXI DUMP

- Transfer

- OR XLSM 00

OR XLSN (orange stripe)

1. NY RBL1
2. OR XLS6
3. Origin and NY OUT3
4. HTR MA

- Self-loading
Absolute
Relocatable
Transfer

- OR XLSN 00-04
OR XLSN 05-15
OR XLSN 16-34
OR XLSN 35

ARRANGEMENT OF RECORDS ON BINARY OUTPUT TAPE

From OR XLS1	End of Mode 1 or 2 (if used)	Before loading OR XLS3	Before loading OR XLS4	Before loading OR XLS5	Before correcting parameters	End of cycle
Dummy record	Dump of OR XLS2 program through parameters	Dummy record	→	→	→	Dump of OR XLS2 through corrected parameters
Dummy record	→	→	→	→	→	→
Dummy record	Dump of last 256 words in memory	Dummy record	→	→	→	Dump of last 256 words in memory
Dummy record	→	→	→	→	→	→
Binary data, one record per observation. See next page	→	→	→	→	→	→
End of file	→	→	→	→	→	→
End of file	→	OR XLS2 thru input parameters	→	→	→	→
			OR XLS3 program	→	→	→
			Matrix	→	→	→
				OR XLS4 program	→	→
				Inverse matrix	→	→
					OR XLS5 program	→
					Parameter changes + diagonal elements of inverse	→
					End of file	→

ARRANGEMENT ON TAPE OF BINARY DATA FOR EACH OBSERVATION

	Output of OR XLS1	Output of OR XLS2 Mode 1	Output of OR XLS2 Mode 2	Output of OR XLS2 Mode 3	Output of OR XLS2 Mode 4
M1 h	Copied	Copied	Copied	Copied	Copied
M2 k					
M3 l					
M4 Observed F or F ²					
M5 $1/\sigma = \sqrt{w}$	Computed	Copied	Copied	Copied	Copied
M6 Scale factor identification, q	Copied				
M7 $(\sin\theta/\lambda)^2$ Form factors unless problem is a neutron one	Computed				
M8 Fixed atom A ₀	Zero	Computed	Computed	Computed	Computed
M9 Fixed atom B ₀	Zero				
M10 A	Computed	Computed	Computed	Computed	Computed
M11 B					
M12 Calculated s _q F or (s _q F) ²					
M13 Observed - calculated					
M14 Rejection indicator					
M15 $\partial/\partial s$ M16 $\partial/\partial T_0$ Derivatives with respect to atomic parameters (5 or 10 per atom).					

OR-XLS1-5
OR-XLS

CRYSTALLOGRAPHIC LEAST SQUARES REFINEMENT
UTILITY ROUTINES AND INTERSEGMENT PROGRAM

NUMBER OF BINARY INPUT TAPE
NUMBER OF BINARY OUTPUT TAPE

00004 U1
00005 U3

EQU 4
EQU 5
ORG 100

00144 0 02000 0 00165
00145 0 02000 0 00171
00146 0 02000 0 00201
00147 0 02000 0 00241

TRA RCD
TRA LDGD
TRA WTB
TRA RTB

00150 0 00000 0 00000

PZE

00151 0 02000 0 00353

TRA KA

00152 0 02000 0 00304

TRA KB

00153 0 02000 0 00316

TRA KC

00154 0 02000 0 00324

TRA KD

00155 0 02000 0 00332

TRA KE

00156 0 02000 0 00355

TRA KF

00157 0 00000 0 00165

KG

HTR RCD

END OF OR XLS1

00160 0 00000 0 00165

KH

HTR RCD

END OF CYCLE. TEMP FACTORS OK.

00161 0 00000 0 00162

KI

HTR KI1

END OF CYCLE. TEMP FACTORS NO GOOD.

00162 0 00000 0 00163

KI1

HTR KI2

DITTO

00163 0 00000 0 00165

KI2

HTR RCD

DITTO

CARD PROGRAMMED TRANSFER

00164 0 00000 0 00000

PZE

00165 0 76200 0 00321

RCD

RCD

00166 0 70000 0 00164

CPY RCD-1

00167 0 02000 0 00164

TRA RCD-1

00170 0 00000 0 00165

HTR RCD

LOAD SELF-LOADING CARDS

00171 0 76200 0 00321

LDGD

RCD

T 00172 -0 73400 0 00000

PDX

00173 -0 75400 7 00000

PXD 0.7

00174 0 70000 0 00000

GPY 0

TD 00175 1 00000 0 00177

TXI LDGD+6

00176 0 00000 0 00171

HTR LDGD

END OF FILE

00177 0 70000 0 00001

GPY 1

TD 00200 1 00000 0 00000

TXI 0

SUBROUTINE TO STORE BLOCK ON TAPE

00201 0 50000 4 00001

WTB

CLA 1.4

00202 0 40000 0 00237

ADD WTB12

00203 0 62100 0 00215

STA WTB3

00204 0 62100 0 00222

STA WTB7

00205 0 50000 4 00001

CLA 1.4

00206 0 40000 0 00240

ADD WTB13

810
047

00207	0	62100	0	00221	STA	WTB6	
00210	0	62100	0	00234	STA	WTB11	
00211	-0	53400	1	00226	WTB1	LXD	WTB9,1
00212	0	50000	4	00002	WTB2	CLA	2,4
00213	0	73400	2	00000		PAX	0,2
00214	0	62200	0	00220		STD	WTB5
00215	0	76600	0	00220	WTB3	WTB	0
00216	0	70000	2	00000	WTB4	CPY	0,2
00217	1	77777	2	00220		TXI	WTB5,2,-1
00220	3	00000	2	00216	WTB5	TXH	WTB4,2,0
00221	0	76400	0	00200	WTB6	BST	0
00222	0	76200	0	00220	WTB7	RTB	0
00223	-0	76000	0	00012		RTT	
00224	0	76100	0	00000		NOP	
00225	0	70000	0	00227	WTB8	CPY	WTB10
00226	1	00003	0	00225	WTB9	TXI	WTB8,0,3
00227	0	00000	0	00000	WTB10	PZE	
00230	0	76600	0	00333		IOD	
00231	-0	76000	0	00012		RTT	
00232	0	02000	0	00234		TRA	WTB11
00233	0	02000	4	00003		TRA	3,4
00234	0	76400	0	00200	WTB11	BST	0
00235	2	00001	1	00212		TIX	WTB2,1,1
00236	0	00000	0	00211		HTR	WTB1
00237	0	76600	0	00220	WTB12	WTB	0
00240	0	76400	0	00200	WTB13	BST	0
SUBROUTINE TO READ RECORD FROM TAPE							
00241	0	50000	4	00001	RTB	CLA	1,4
00242	0	40000	0	00267		ADD	RTB7
00243	0	60100	0	00252		STO	RTB3
00244	0	50000	4	00001		CLA	1,4
00245	0	40000	0	00270		ADD	RTB8
00246	0	60100	0	00264		STO	RTB6
00247	-0	53400	1	00262	RTB1	LXD	RTB5,1
00250	0	50000	4	00002	RTB2	CLA	2,4
00251	0	73400	2	00000		PAX	0,2
00252	0	76200	0	00220	RTB3	RTB	0
00253	-0	76000	0	00012		RTT	
00254	0	76100	0	00000		NOP	
00255	0	70000	2	00000	RTB4	CPY	0,2
00256	1	77777	2	00255		TXI	RTB4,2,-1
00257	0	02000	4	00003		TRA	3,4
00260	0	76600	0	00333		IOD	

ADDRESS TO BESET

DECREMENT TO BE SET
ADDRESS TO BE SET
ADDRESS TO BE SET

READ-BACK COPIED HERE

ADDRESS TO BE SET

RTT FAILS 3 TIMES. START TO TRY AGAIN
CONSTANT
CONSTANT

SUBROUTINE TO READ RECORD FROM TAPE

TO BE SET

1451
-45-

8-5
048

00261	-0	76000	0	00012		RTT	
00262	1	00003	0	00264	RTB5	TXI	RTB6,0,3
00263	0	02000	4	00004		TRA	4,4
00264	0	76400	0	00200	RTB6	BST	0
00265	2	00001	1	00250		TIX	RTB2,1,1
00266	0	00000	0	00247		HTR	RTB1
00267	0	76200	0	00220	RTB7	RTB	0
00270	0	76400	0	00200	RTB8	BST	0
TO BE SET							
RTT FAILS 3 TIMES. START TO TRY AGAIN.							
CONSTANT							
CONSTANT							
TAKE DUMP FROM TAPE AND START CYCLE							
00271	0	07400	4	00241	[KA1]	TSX	RTB,4
00272	0	00000	0	00004		PZE	U1
00273	0	00000	0	77323		PZE	-START
00274	0	00000	0	00165		HTR	RCD
00275	0	76200	0	00224		RTB	U1
00276	0	07400	4	00241		TSX	RTB,4
00277	0	00000	0	00004		PZE	U1
00300	0	00000	0	00400		PZE	-32512
00301	0	00000	0	00165		HTR	RCD
00302	0	77200	0	00204		REW	U1
00303	0	02000	0	00455		TRA	START
TAKE OR XLS3 FROM TAPE AND ENTER							
00304	0	76200	0	00224	KB	RTB	U1
00305	0	70000	0	00315		CPY	KB2
00306	0	02000	0	00310		TRA	KB1
00307	0	00000	0	00165		HTR	RCD
00310	0	07400	4	00241	KB1	TSX	RTB,4
00311	0	00000	0	00004		PZE	U1
00312	0	00000	0	77323		PZE	-START
00313	0	00000	0	00165		HTR	RCD
00314	0	02000	0	00455		TRA	START
00315	0	00000	0	00000	KB2	PZE	
DISCARD COPIED HERE							
TAKE OR XLS4 FROM TAPE AND ENTER							
00316	0	76200	0	00224	KG	RTB	U1
00317	0	07400	4	00241		TSX	RTB,4
00320	0	00000	0	00004		PZE	U1
00321	0	00000	0	77323		PZE	-START
00322	0	00000	0	00165		HTR	RCD
00323	0	02000	0	00455		TRA	START
END OF FILE							
TAKE OR XLS5 FROM TAPE AND ENTER							
00324	0	76200	0	00224	KD	RTB	U1
00325	0	07400	4	00241		TSX	RTB,4
00326	0	00000	0	00004		PZE	U1
00327	0	00000	0	77323		PZE	-START

END OF FILE

OR XLS3 NOT ON TAPE. USE CARDS.

END OF FILE

CIS 049

00330	0	00000	0	00165		HTR RCD	END OF FILE
00331	0	02000	0	00455		TRA START	
						TAKE OR XLS2 FROM TAPE AND ENTER SECOND TIME	
00332	0	07400	4	00241	KE	TSX RTB,4	
00333	0	00000	0	00005		PZE U3	
00334	0	00000	0	77323		PZE -START	
00335	0	00000	0	00165		HTR RCD	END OF FILE
00336	0	02000	0	00456		TRA START+1	
						GET BACK ON WITH NEW PARAMETER SELECTION CARDS	
00337	0	76200	0	00225	KF4	RTB U3	
00340	0	76200	0	00225	KF1	RTB U3	
00341	0	70000	0	00352		GPY KF3	
00342	0	02000	0	00340		TRA KF1	
00343	0	02000	0	00345		TRA KF2	
00344	0	02000	0	00340		TRA KF1	
00345	0	07400	4	00241	KF2	TSX RTB,4	
00346	0	00000	0	00005		PZE U3	
00347	0	00000	0	77323		PZE -START	
00350	0	00000	0	00165		HTR RCD	OR-XLS2 IS NOT ON TAPE
00351	0	02000	0	00460		TRA START+3	
00352	0	00000	0	00000	KF3	PZE	DISCARDS COPIED HERE
				00455		START EQU 301	
				00000		END 0	

00353	0	77200	0	00204	KA	REW U1
00354	0	02000	0	00271		TRA KA1
00355	0	77200	0	00205	KF	REW U3
00356	0	76200	0	00225		RTB U3
00357	0	76200	0	00225		RTB U3
00360	0	76200	0	00225		RTB U3
00361	0	02000	0	00337		TRA KF4

1471

OR-XLS1 SEGMENT FOR PRELIMINARY DATA PROCESSING

00004	U1	EQU 4	INPUT TAPE NUMBER
00040	U2	EQU 32	NO OF ENTRIES IN EACH TABLE
00005	U3	EQU 5	BINARY OUTPUT TAPE
00003	U4	EQU 3	BGD OUTPUT TAPE NUMBER
00144	RCD	EQU 100	
00157	KG	EQU 111	
00455	ORG	301	
00455	0 02000 0	00461 START TRA XA	
00456	0 00000 0	00144 HTR RCD	NO ENTRY HERE
00457	0 02000 0	01404 TRA DUMP	
00460	0 00000 0	00144 HTR RCD	NO ENTRY HERE
00461	0 76200 0	00321 XA RCD	
00462	0 07400 4	01542 TSX DBD1,4	
00463	0 00000 0	03200 PZE T12	
00464	0 00000 0	00461 HTR XA	END OF FILE
00465	0 07400 4	01261 TSX IFF,4	
00466	0 01217 0	03213 PZE T12+11,0,IT	
00467	0 02000 0	00461 TRA XA	
00470	0 76200 0	00321 XA1 RCD	
00471	0 07400 4	01542 TSX DBD1,4	
00472	0 00000 0	02257 PZE BUFFER	
00473	0 00000 0	00144 HTR RCD	END OF FILE
00474	0 07400 4	01261 TSX IFF,4	
00475	0 01214 0	02272 PZE BUFFER+11,0,IC	
00476	0 02000 0	00470 TRA XA1	
00477	0 07400 4	01752 TSX FILE,4	
00500	-1 00155 0	03156 MON D1,0,109	
00501	-2 01772 0	03157 MTW D2,0,1018	
00502	-2 03607 0	03160 MTW D3,0,1927	
00503	-2 05424 0	03161 MTW D4,0,2836	
00504	-2 07241 0	03162 MTW D5,0,3745	
00505	-2 11056 0	03163 MTW D6,0,4654	
00506	-2 12673 0	03164 MTW D7,0,5563	
00507	0 00000 0	00144 HTR RCD	ERROR RETURN FROM FILE
00510	0 50000 0	03156 XB CLA D1	
00511	0 10000 0	00554 TZE XG	
00512	0 56000 0	03156 LDQ D1	
00513	0 20000 0	01221 MPY C2	
00514	-0 60000 0	03165 STQ T1	
00515	0 50000 0	01222 CLA C3	
00516	0 40000 0	03165 ADD T1	
00517	0 62100 0	01121 STA XQ2	

00520	0	62100	0	01124	STA	XQ3
00521	0	40200	0	01203	SUB	I1
00522	0	62100	0	01120	STA	XQ1
00523	0	50000	0	03165	CLA	T1
00524	0	40200	0	01221	SUB	C2
00525	0	40000	0	01203	ADD	I1
00526	0	60100	0	03176	STO	T10
00527	0	53400	1	01202	LXA	I0,1
00530	0	53400	2	03165	LXA	T1,2
00531	0	76200	0	00321	XB1	RCD
00532	0	07400	4	01542	TSX	DBD1,4
00533	0	00000	0	02257	PZE	BUFFER
00534	0	00000	0	00144	HTR	RCD
00535	0	07400	4	01261	TSX	IFF,4
00536	0	01215	0	02272	PZE	BUFFER+11,0,IF
00537	0	02000	0	00531	TRA	XB1
00540	0	07400	4	01752	TSX	FILE,4
00541	-2	00155	1	03371	MTW	M8+100,1,109
00542	-2	01772	1	03372	MTW	M8+101,1,1018
00543	-2	03607	1	03373	MTW	M8+102,1,1927
00544	-2	05424	1	03374	MTW	M8+103,1,2836
00545	-2	07241	1	03375	MTW	M8+104,1,3745
00546	-2	11056	1	03376	MTW	M8+105,1,4654
00547	-2	12673	1	03377	MTW	M8+106,1,5563
00550	-2	14507	1	03400	MTW	M8+107,1,6471
00551	0	00000	0	00144	HTR	RCD
00552	-2	00010	2	00554	TNX	XC,2,8
00553	1	77770	1	00531	TXI	XB1,1,-8
00554	0	77200	0	00205	XC	REW U3
00555	0	53400	4	01205	LXA	I4,4
00556	0	76600	0	00225	XC1	WTB U3
00557	0	70000	0	01202	CPY	I0
00560	2	00001	4	00556	TIX	XC1,4,1
00561	0	76600	0	00333	IOD	
00562	0	76000	0	00162	XAA	SWT 2
00563	1	00000	0	00565	TXI	XBB
00564	1	00000	0	00635	TXI	XD
00565	0	53400	1	01202	XBB	LXA I0,1
00566	0	53400	2	03156	LXA	D1,2
00567	-3	00000	2	00577	TXL	XBB4,2,0
00570	-3	00013	2	00572	TXL	XBB1,2,11
00571	0	53400	2	01212	LXA	I11,2
00572	0	50000	0	01230	XBB1	CLA C14

END OF FILE

ERROR RETURN FROM FILE

00000000

TD

00573	0	60100	1	01160	XBB2	STO XT1,1
00574	0	40200	0	01231		SUB C15
00575	1	77777	1	00576		TXI XBB3,1,-1
00576	2	00001	2	00573	XBB3	TIX XBB2,2,1
00577	0	50000	0	01232	XBB4	CLA C16
00600	0	60100	1	01160		STO XT1,1
00601	0	50000	0	01233		CLA C17
00602	0	60100	1	01161		STO XT1+1,1
00603	0	07400	4	02326	XCC	TSX OUT,4
00604	0	07400	4	01505		TSX ECHO,4
00605	3	27451	0	03200		PTH T12,0,12073
00606	3	02066	0	01220		PTH C1,0,1078
00607	1	00001	0	00003		PON U4,0,1
00610	0	07400	4	02326		TSX OUT,4
00611	0	07400	4	01505		TSX ECHO,4
00612	3	13625	0	01234		PTH C18,0,6037
00613	1	00000	0	00003		PON U4,0,0
00614	0	07400	4	02326		TSX OUT,4
00615	0	07400	4	01505		TSX ECHO,4
00616	3	05713	0	01242		PTH C19,0,3019
00617	-3	15564	0	03157		SVN D2,0,7028
00620	-3	15576	0	03160		SVN D3,0,7038
00621	-3	15610	0	03161		SVN D4,0,7048
00622	-3	15622	0	03162		SVN D5,0,7058
00623	-3	15634	0	03163		SVN D6,0,7068
00624	-3	15646	0	03164		SVN D7,0,7078
00625	1	00000	0	00003		PON U4,0,0
00626	0	07400	4	02326		TSX OUT,4
00627	0	07400	4	01505		TSX ECHO,4
00630	3	23516	0	01245		PTH C21,0,10062
00631	1	00000	0	00003		PON U4,0,0
00632	0	07400	4	02326		TSX OUT,4
00633	0	07400	4	01505		TSX ECHO,4
00634	1	00060	0	00003		PON U4,0,48
00635	0	76000	0	00161	XD	SWT 1
00636	1	00000	0	00652		TXI XF
00637	0	76200	0	00321	XE	RCD
00640	0	07400	4	01542		TSX DBD1,4
00641	0	00000	0	02257		PZE BUFFER
00642	0	02000	0	01176		TRA XV
00643	0	07400	4	01261		TSX IFF,4
00644	0	01216	0	02272		PZE BUFFER+11,0,IR
00645	0	02000	0	00637		TRA XE

	00646	0	07400	4	01366		TSX	BLNK,4
	00647	0	00011	0	02270		PZE	BUFFER+9,0,9
	00650	0	02000	0	01176		TRA	XV
	00651	0	02000	0	00677		TRA	XEF
	00652	0	53400	1	01204	XF	LXA	I3,1
	00653	0	76200	0	00204	XF1	RTD	U1
	00654	0	53400	2	01213		LXA	I14,2
	00655	0	70000	2	02275	XF2	CPY	BUFFER+14,2
TD	00656	1	00000	0	00660		TXI	XF3
TD	00657	1	00000	0	01175		TXI	XU
	00660	2	00001	2	00655	XF3	TIX	XF2,2,1
	00661	0	76600	0	00333		IOD	
	00662	-0	76000	0	00012		RTT	
TD	00663	1	00000	0	00665		TXI	XF4
	00664	0	02000	0	00671		TRA	XF5
	00665	0	76400	0	00204	XF4	BST	U1
	00666	2	00001	1	00653		TIX	XF1,1,1
	00667	0	76200	0	00204		RTD	U1
	00670	0	00000	0	00652		HTR	XF
	00671	0	07400	4	01261	XF5	TSX	IFF,4
	00672	0	01216	0	02272		PZE	BUFFER+11,0,IR
	00673	0	00000	0	00144		HTR	RCD
	00674	0	07400	4	01366		TSX	BLNK,4
	00675	0	00013	0	02272		PZE	BUFFER+11,0,11
	00676	0	02000	0	01175		TRA	XU
	00677	0	07400	4	01752	XEF	TSX	FILE,4
	00700	-2	00155	0	03216		MTW	M1,0,109
	00701	-2	01772	0	03217		MTW	M2,0,1018
	00702	-2	03607	0	03220		MTW	M3,0,1927
	00703	-2	05424	0	03221		MTW	M4,0,2836
	00704	-2	07241	0	03222		MTW	M5,0,3745
	00705	-1	11056	0	03223		MON	M6,0,4654
	00706	-2	12673	0	03214		MTW	T13,0,5563
	00707	-2	14507	0	03215		MTW	T14,0,6471
	00710	0	00000	0	00144		HTR	RCD
	00711	0	14000	0	00712	XG	TQV	XG1
	00712	0	16100	0	00713	XG1	TQO	XG2
	00713	0	53400	1	01204	XG2	LXA	I3,1
	00714	0	56000	1	03162	XG3	LDQ	D5,1
	00715	0	26000	1	03221		FMP	M4,1
	00716	0	60100	1	03171		STO	T5,1
	00717	2	00001	1	00714		TIX	XG3,1,1
	00720	0	56000	0	03162		LDQ	D5

RTT FAILS 3 TIMES. START TO SKIP RECORD

INCORRECT SYMBOL WAS ON TAPE

ERROR RETURN FROM FILE

00721	0	26000	0	03167	FMP	T3
00722	0	76500	0	00043	LRS	35
00723	0	26000	0	03170	FMP	T4
00724	0	60100	0	03171	STO	T5
00725	0	56000	0	03163	LDQ	D6
00726	0	26000	0	03166	FMP	T2
00727	0	76500	0	00043	LRS	35
00730	0	26000	0	03170	FMP	T4
00731	0	30000	0	03171	FAD	T5
00732	0	60100	0	03171	STO	T5
00733	0	56000	0	03164	LDQ	D7
00734	0	26000	0	03166	FMP	T2
00735	0	76500	0	00043	LRS	35
00736	0	26000	0	03167	FMP	T3
00737	0	30000	0	03171	FAD	T5
00740	0	60100	0	03171	STO	T5
00741	0	30000	0	03171	FAD	T5
00742	0	60100	0	03171	STO	T5
00743	0	53400	1	01204	LXA	I3,1
00744	0	56000	1	03171	LDQ	T5,1
00745	0	26000	1	03171	FMP	T5,1
00746	0	30000	0	03171	FAD	T5
00747	0	60100	0	03171	STO	T5
00750	2	00001	1	00744	TIX	XG4,1,1
00751	0	56000	0	03171	LDQ	T5
00752	0	26000	0	01223	FMP	G9
00753	0	60100	0	03224	STO	M7
00754	0	16100	0	00756	TQO	XG5
00755	-0	14000	0	00757	TNO	XH
00756	0	00000	0	00144	HTR	RCD
00757	0	02000	0	01060	TRA	XJ
				00760	BSS	64
01060	0	50000	0	03222	CLA	M5
01061	0	60100	0	03172	STO	T6
01062	0	10000	0	01066	TZE	XK
01063	0	50000	0	01224	CLA	G10
01064	0	24000	0	03222	FDH	M5
01065	-0	60000	0	03222	STQ	M5
01066	0	50000	0	03223	CLA	M6
01067	-0	10000	0	01073	TNZ	XM
01070	0	50000	0	03173	CLA	T7
01071	0	60100	0	03223	STO	M6
01072	1	00000	0	01074	TXI	XN

XG4

XG5

XH

XI

XJ

XK

XL

SIN THETA/LAMBDA SQUARED OVERFLOWS

TD

01073	0	60100	0	03173	XM	STO T7
01074	0	50000	0	03156	XN	CLA D1
01075	0	10000	0	01130		TZE XR
01076	0	50000	0	03224	XO	CLA M7
01077	0	07400	4	02275		TSX SQRT,4
01100	0	00000	0	00144		HTR RGD
01101	0	60100	0	03174		STO T8
01102	0	56000	0	03174	XP	LDQ T8
01103	0	26000	0	01227		FMP C13
01104	0	60100	0	03175		STO T9
01105	-0	30000	0	01225		UFA C11
01106	0	73400	1	00000		PAX 0,1
01107	-3	00037	1	01111		TXL XP1,1,U2-1
01110	0	00000	0	00144		HTR RGD
01111	0	40000	0	03176	XP1	ADD T10
01112	0	73400	1	00000		PAX 0,1
01113	-0	60000	0	03177		STQ T11
01114	0	50000	0	03177		CLA T11
01115	0	30000	0	01226		FAD C12
01116	0	60100	0	03177		STO T11
01117	0	53400	2	01202	XQ	LXA 10,2
01120	0	50000	1	00000	XQ1	CLA 0,1
01121	0	30200	1	00000	XQ2	FSB 0,1
01122	0	76500	0	00043		LRS 35
01123	0	26000	0	03177		FMP T11
01124	0	30000	1	00000	XQ3	FAD 0,1
01125	0	60100	2	03225		STO M8,2
01126	1	77777	2	01127		TXI XQ4,2,-1
01127	2	00040	1	01120	XQ4	TIX XQ1,1,U2
01130	0	76600	0	00225	XR	WTB U3
01131	0	50000	0	03156		CLA D1
01132	0	40000	0	01210		ADD I7
01133	0	73400	1	00000		PAX 0,1
01134	0	53400	2	01202		LXA 10,2
01135	0	70000	2	03216	XR1	CPY M1,2
01136	1	77777	2	01137		TXI XR2,2,-1
01137	2	00001	1	01135	XR2	TIX XR1,1,1
01140	0	70000	0	01202		CPY 10
01141	0	70000	0	01202		CPY 10
01142	0	76600	0	00333		IOD
01143	0	76000	0	00162	XS	SWT 2
01144	1	00000	0	01146		TXI XT
01145	1	00000	0	00635		TXI XD

NEGATIVE RADICAND

OUT OF RANGE OF F TABLE

01146	0	07400	4	02326	XT	TSX OUT,4
01147	0	07400	4	01505		TSX EGH0,4
01150	3	03734	0	01257		PTH G22,0,2012
01151	-3	00004	0	03216		SVN M1,0,4
01152	-3	00010	0	03217		SVN M2,0,8
01153	-3	00014	0	03220		SVN M3,0,12
01154	-3	05716	0	03221		SVN M4,0,3022
01155	-3	05730	0	03172		SVN T6,0,3032
01156	-0	00043	0	03223		FOR M6,0,35
01157	-3	11663	0	03224		SVN M7,0,5043

				01160	XT1	BSS 13
01175	0	77200	0	00204	XU	REW U1
01176	0	77000	0	00205	XV	WEF U3
01177	0	77000	0	00205		WEF U3
01200	0	77200	0	00205		REW U3
01201	0	02000	0	00157		TRA KG

CONSTANTS

01202	0	00000	0	00000	I0	PZE 0
01203	0	00000	0	00001	I1	PZE 1
01204	0	00000	0	00003	I3	PZE 3
01205	0	00000	0	00004	I4	PZE 4
01206	0	00000	0	00005	I5	PZE 5
01207	0	00000	0	00006	I6	PZE 6
01210	0	00000	0	00007	I7	PZE 7
01211	0	00000	0	00010	I8	PZE 8
01212	0	00000	0	00013	I11	PZE 11
01213	0	00000	0	00016	I14	PZE 14
01214	0000000000023			IC		BCD 100000G
01215	0000000000026			IF		BCD 100000F
01216	0000000000051			IR		BCD 100000R
01217	0000000000063			IT		BCD 100000T
01220	606060606060			C1		BCD 1
01221	0 00000 0 00040			C2		PZE U2
01222	0 00000 0 03371			C3		PZE M8+100
01223	+177400000000			C9		DEC .25
01224	+201400000000			C10		DEC 1.
01225	+233000000000			C11		OCT 233000000000
01226	+200000000000			C12		OCT 200000000000
01227	+205500000000			C13		DEC 20.
01230	-3 05752 0 03225			C14		SVN M8,0,3050
01231	0 00007 0 00001			C15		PZE 1,0,7
01232	1 00060 0 00003			C16		PON U4,0,48
01233	1 00000 0 00635			C17		TXI XD

NUMBER OF ENTRIES IN EACH F TABLE
 ADDRESS OF FIRST F TABLE
 FLOATING ONE QUARTER
 FLOATING CONSTANT ONE
 FIXER TO GET INTEGER
 FIXER TO NORMALIZE FRACTION
 1/DELTA
 INITIAL LINK WORDS FOR OUTPUT
 CONSTANT TO ADVANCE LINK WORD
 TAPE WRITE ORDER
 TRANSFER AFTER OUTPUT

TD

846 057

01234	314547646360	C18	BCD 6INPUT DATA AS PROCESSED BY OR-XLS1								
01235	242163216021										
01236	626047514623										
01237	256262252460										
01240	227060465140										
01241	674362016060										
01242	232543436023	C19	BCD 3CELL CONSTANTS								
01243	464562632145										
01244	636260606060										
01245	603060606042	C21	BCD	H	K	L	OBSERVED	SIGMA	Q	RHO	FORM FACTORS
01246	606060436060										
01247	462262255165										
01250	252460606060										
01251	623127442160										
01252	606050606060										
01253	513046606060										
01254	606060264651										
01255	446026212363										
01256	465162606060										
01257	606060006060	C22	BCD	2	0	0	0				
01260	600060606000										
SUBROUTINE TO CHECK IDENTIFICATION LETTER											
01261	0 76000 0 00166	IFF	SWT 6								
01262	0 02000 0 01264		TRA IFF1								
01263	0 02000 4 00003		TRA 3,4								
01264	0 50000 4 00001	IFF1	CLA 1,4								
01265	0 62100 0 01271		STA IFF2								
01266	0 77100 0 00022		ARS 18								
01267	0 62100 0 01274		STA IFF3								
01270	0 62100 0 01307		STA IFF6								
01271	0 50000 0 00000	IFF2	CLA 0								
01272	-0 32000 0 01364		ANA IFF11								
01273	0 60100 0 01365		STO IFF12								
01274	0 34000 0 00000	IFF3	GAS 0								
01275	1 00000 0 01277	IFF4	TXI IFF5,0,0								
01276	0 02000 4 00003		TRA 3,4								
01277	-0 63400 4 01275	IFF5	SXD IFF4,4								
01300	0 07400 4 02326		TSX OUT,4								
01301	0 07400 4 01505		TSX ECHO,4								
01302	3 02015 0 01365		PTH IFF12,0,1037								
01303	3 13624 0 01327		PTH IFF7,0,6036								
01304	-1 00000 0 00364		FVE 244								
01305	0 07400 4 02326		TSX OUT,4								

ADDRESS TO BE SET

ADDRESS TO BE SET

01306 0 07400 4 01505
 01307 3 02015 0 00000
 01310 3 13624 0 01335
 01311 -1 00000 0 00364
 01312 0 07400 4 02326
 01313 0 07400 4 01505
 01314 3 15602 0 01343
 01315 -1 00000 0 00364
 01316 0 07400 4 02326
 01317 0 07400 4 01505
 01320 3 23514 0 01352
 01321 -1 00000 0 00364
 01322 0 07400 4 02326
 01323 0 07400 4 01505
 01324 -1 00000 0 00361
 01325 -0 53400 4 01275
 01326 0 00000 4 00002
 01327 602421632160
 01330 232151246031
 01331 242545633126
 01332 312321633146
 01333 456043256363
 01334 255160316260
 01335 604751462751
 01336 214460232143
 01337 436260264651
 01340 602321512460
 01341 663163306043
 01342 256363255160
 01343 604764636023
 01344 465151252363
 01345 602321512460
 01346 314560512521
 01347 242551602145
 01350 246047514623
 01351 252524336060
 01352 606346602270
 01353 472162626021
 01354 434360312425
 01355 456331263123
 01356 216331464560
 01357 632562636260
 01360 636451456046

TSX EGH0,4
 IFF6 PTH 0,0,1037 ADDRESS TO BE SET
 PTH IFF8,0,6036
 FVE 244
 TSX OUT,4
 TSX EGH0,4
 PTH IFF9,0,7042
 FVE 244
 TSX OUT,4
 TSX EGH0,4
 PTH IFF10,0,10060
 FVE 244
 TSX OUT,4
 TSX EGH0,4
 FVE 241
 LXD IFF4,4
 HTR 2,4

IFF7 BCD 6 DATA CARD IDENTIFICATION LETTER IS

IFF8 BCD 6 PROGRAM CALLS FOR CARD WITH LETTER

IFF9 BCD 7 PUT CORRECT CARD IN READER AND PROCEED.

IFF10 BCD TO BYPASS ALL IDENTIFICATION TESTS TURN ON SENSE SWITCH 6.

846
058

01361 456062254562

01362 256062663163

01363 233060063360

01364 0 00000 0 00077

01365 0 00000 0 00000

IFF11 PZE 63

IFF12

MASK

LETTER FROM CARD

SUBROUTINE TO TEST FOR BLANK FIELD

01366 -0 63400 1 01374

BLNK SXD BLNK2,1

01367 0 50000 4 00001

CLA 1,4

01370 0 62100 0 01372

STA BLNK1

01371 -0 73400 1 00000

PDX 0,1

01372 0 50000 1 00000

BLNK1 CLA 0,1

ADDRESS TO BE SET

01373 0 34000 0 01403

CAS BLNK5

01374 1 00000 0 01376

BLNK2 TXI BLNK3,0,0

01375 0 02000 0 01400

TRA BLNK4

01376 -0 53400 1 01374

BLNK3 LXD BLNK2,1

01377 0 02000 4 00003

TRA 3,4

01400 2 00001 1 01372

BLNK4 TIX BLNK1,1,1

01401 -0 53400 1 01374

LXD BLNK2,1

01402 0 02000 4 00002

TRA 2,4

01403 606060606060

BLNK5 BCD 1

OCTAL AND FLOATING DECIMAL DUMP FOR TEST PURPOSES

01404 0 07400 4 02326

DUMP TSX OUT,4

01405 0 07400 4 01505

TSX ECHO,4

01406 3 27451 0 03200

PTH T12,0,12073

01407 3 02066 0 01220

PTH G1,0,1078

01410 1 00001 0 00003

PON U4,0,1

01411 0 53400 1 01503

LXA DUMP7,1

01412 0 07400 4 02326

DUMP1 TSX OUT,4

01413 0 07400 4 01505

TSX ECHO,4

01414 -2 17531 1 00000

SIX 0,1,8025

01415 -2 17562 1 00001

SIX 1,1,8050

01416 -2 17613 1 00002

SIX 2,1,8075

01417 -2 17644 1 00003

SIX 3,1,8100

01420 1 00000 0 00003

PON U4,0,0

01421 -0 75400 1 00000

PXD 0,1

01422 0 77100 0 00022

ARS 18

01423 0 76000 0 00006

GOM

01424 0 40000 0 01203

ADD 11

01425 0 73400 2 00000

PAX 0,2

01426 -0 75400 2 00000

PXD 0,2

01427 0 76500 0 00043

LRS 35

01430 0 53400 4 01207

LXA 16,4

01431 0 76700 0 00003

DUMP8 ALS 3

01432 -0 76300 0 00003 LGL 3
01433 2 00001 4 01431 TIX DUMP8,4,1
01434 -0 50100 0 01504 ORA DUMP9
01435 0 60200 0 01502 SLW DUMP6+8
01436 0 53400 2 01211 LXA 18,2
01437 0 56000 1 00000 DUMP2 LDQ 0,1
01440 0 53400 4 01207 LXA 16,4
01441 0 76700 0 00003 DUMP3 ALS 3
01442 -0 76300 0 00003 LGL 3
01443 2 00001 4 01441 TIX DUMP3,4,1
01444 0 60200 2 01502 SLW DUMP6+8,2
01445 0 53400 4 01207 LXA 16,4
01446 0 76700 0 00003 DUMP4 ALS 3
01447 -0 76300 0 00003 LGL 3
01450 2 00001 4 01446 TIX DUMP4,4,1
01451 0 60200 2 01503 SLW DUMP6+9,2
01452 1 77777 1 01453 TXI DUMP5,1,-1
01453 2 00002 2 01437 DUMP5 TIX DUMP2,2,2
01454 0 07400 4 02326 TSX OUT,4
01455 0 07400 4 01505 TSX ECHO,4
01456 3 01756 0 01502 PTH DUMP6+8,0,1006
01457 3 01772 0 01472 PTH DUMP6,0,1018
01460 3 02001 0 01473 PTH DUMP6+1,0,1025
01461 3 02023 0 01474 PTH DUMP6+2,0,1043
01462 3 02032 0 01475 PTH DUMP6+3,0,1050
01463 3 02054 0 01476 PTH DUMP6+4,0,1068
01464 3 02063 0 01477 PTH DUMP6+5,0,1075
01465 3 02105 0 01500 PTH DUMP6+6,0,1093
01466 3 02114 0 01501 PTH DUMP6+7,0,1100
01467 1 00060 0 00003 PON U4,0,48
01470 3 74541 1 01412 TXH DUMP1,1,-M8-10 DECREMENT IS -(FINAL ADDRESS+1)
01471 0 02000 0 00144 TRA RCD
01472 DUMP6 BSS 9
01503 0 00000 0 74622 DUMP7 PZE -D1 -(INITIAL ADDRESS)
01504 6000000000000 DUMP9 BGD 1 00000
SUBROUTINE TO TEST NATURE OF ERROR RETURN FROM NY OUTB
01505 0 12000 0 01523 ECHO TPL EGH04
01506 -0 10000 0 01523 TNZ EGH04
01507 -0 63400 4 01541 SXD EGH07,4
01510 0 07400 4 02326 TSX OUT,4
01511 0 02000 0 01514 TRA ECH02
01512 3 15602 0 01532 PTH ECH06,0,7042
01513 -1 00000 0 00000 ECH01 FVE

01514 0 53400 4 01541 ECH02 LXD ECH07,4
 01515 0 50000 4 00001 ECH03 CAL 1,4
 01516 0 77100 0 00001 ARS 33
 01517 0 34000 0 01531 CAS ECH05
 01520 1 77777 4 01515 TXI ECH03,4,=1
 01521 0 02000 4 00002 TRA 2,4
 01522 1 77777 4 01515 TXI ECH03,4,=1
 01523 =0 75400 4 00000 ECH04 PXD 0,4
 01524 0 76000 0 00006 COM
 01525 =0 73400 4 00000 PDX 0,4
 01526 =0 75400 4 00000 PXD 0,4
 01527 0 77100 0 00022 ARS 18
 01530 0 00000 0 00144 HTR RCD
 01531 0 00000 0 00005 ECH05 PSE 5
 01532 605454546047 ECH06 BCD 7 *** PRINTER ERROR IN PREVIOUS LINE ***
 01533 513145632551
 01534 602551514651
 01535 603145604751
 01536 256531466462
 01537 604331452560
 01540 545454606060
 01541 0 00000 0 00000 ECH07 PZE

TO NORMAL RETURN OF NY OUT3

CALLING SEQUENCE ERROR. ADDRESS IN ACC.

INDEX SAVED IN DECREMENT
 THE FOLLOWING SUBROUTINES ARE ON RELOCATABLE CARDS

01542 DBD1 BSS 136
 01752 FILE BSS 197
 02257 BUFFER BSS 14
 02275 SQRT BSS 25
 02326 OUT BSS 408

DATA STORAGE

03156 0 00000 0 00000 D1
 03157 0 00000 0 00000 D2
 03160 0 00000 0 00000 D3
 03161 0 00000 0 00000 D4
 03162 0 00000 0 00000 D5
 03163 0 00000 0 00000 D6
 03164 0 00000 0 00000 D7

NUMBER OF FORM FACTOR TABLES

A*
 B*
 C*
 COS ALPHA*
 COS BETA*
 COS GAMMA*

TEMPORARY STORAGE

03165 0 00000 0 00000 T1
 03166 0 00000 0 00000 T2
 03167 0 00000 0 00000 T3
 03170 0 00000 0 00000 T4
 03171 0 00000 0 00000 T5
 03172 0 00000 0 00000 T6

TOTAL NO OF ENTRIES IN TABLES

HA*
 KB*
 LC*
 4(SIN THETA/LAMBDA)**2=Q
 SIGMA FOR BCD OUTPUT

03173 0 00000 0 00000 T7
 03174 0 00000 0 00000 T8
 03175 0 00000 0 00000 T9
 03176 0 00000 0 00000 T10
 03177 0 00000 0 00000 T11
 03200 T12
 03214 0 00000 0 00000 T13
 03215 0 00000 0 00000 T14

BSS 12

STORAGE FOR BINARY OUTPUT

03216 0 00000 0 00000 M1
 03217 0 00000 0 00000 M2
 03220 0 00000 0 00000 M3
 03221 0 00000 0 00000 M4
 03222 0 00000 0 00000 M5
 03223 0 00000 0 00000 M6
 03224 0 00000 0 00000 M7
 03225 0 00000 0 00000 M8

CURRENT VALUE OF S. SEE M6
 SIN THETA/LAMBDA
 (SIN THETA/LAMBDA)(1/DELTA)
 (U2)(D1-1)+1
 FRACTIONAL PART OF T9
 OUTPUT HEADING
 EXTRA INPUT 1
 EXTRA INPUT 2

H
 K
 L
 OBSERVED F OR F SQUARED
 1/SIGMA=SQRT OF WEIGHT
 S, SCALE FACTOR DESIGNATION
 (SIN THETA/LAMBDA)**2=Q/4
 COMPUTED FORM FACTORS

THIS SECTION SUPPLIES ORIGIN CARDS FOR THE SUBROUTINES

00000 0 00000 0 00000
 00001 0 00000 0 01542
 00000 0 00000 0 00000
 00001 0 00000 0 01752
 00000 0 00000 0 00000
 00001 0 00000 0 02275
 00000 0 00000 0 00000
 00001 0 00000 0 02326
 00000

ORG 0
 PZE
 PZE DBD1
 ORG 0
 PZE
 PZE FILE
 ORG 0
 PZE
 PZE SQRT
 ORG 0
 PZE
 PZE OUT
 END 0

8-16

000

00000000

OR-XLS2 MAIN SEGMENT

00144	RCD	EQU	100		
00145	LDGD	EQU	101		
00146	WTB	EQU	102		
00160	KH	EQU	112		
00161	KI	EQU	113		
00004	U1	EQU	4		NUMBER OF BINARY INPUT TAPE
00003	U2	EQU	3		NUMBER OF BCD OUTPUT TAPE
00005	U3	EQU	5		NUMBER OF BINARY OUTPUT TAPE
00455		ORG	301		
00455	0 02000 0	00461	START	TRA	XCA
00456	0 02000 0	03334		TRA	XTD
00457	0 02000 0	05153		TRA	DUMP
00460	0 02000 0	03164		TRA	XSB
00461	0 76200 0	00321	XCA	RCD	
00462	0 07400 4	05363		TSX	DBD1,4
00463	0 00000 0	10406		PZE	T55
00464	0 00000 0	00144		HTR	RCD
00465	0 07400 4	05030		TSX	IFF,4
00466	0 04357 0	10421		PZE	T55+11,0,IT
00467	0 02000 0	00461		TRA	XCA
00470	0 02000 0	02250	XCB	TRA	XDA
00471	0 02000 0	02712	XCC	TRA	XEB
00472	0 53400 1	10324	XRA	LXA	T61,1
00473	0 53400 2	10316		LXA	S10,2
00474	0 76200 0	00321	XRB	RCD	
00475	0 07400 4	05363		TSX	DBD1,4
00476	0 00000 0	06100		PZE	BUFFER
00477	0 00000 0	00144		HTR	RCD
00500	0 07400 4	05030		TSX	IFF,4
00501	0 04354 0	06113		PZE	BUFFER+11,0,IM
00502	0 02000 0	00474		TRA	XRB
00503	0 07400 4	05135		TSX	BLNK,4
00504	0 00010 0	06110		PZE	BUFFER+8,0,8
00505	0 02000 0	00550		TRA	XRI
00506	0 07400 4	05573	XRC	TSX	FILE,4
00507	-2 00157 1	00000		MTW	0,1,111
00510	-2 03132 1	00002		MTW	2,1,1626
00511	-2 06105 1	00004		MTW	4,1,3141
00512	-0 01455 0	10435		MZE	T63,0,813
00513	-0 04430 0	10436		MZE	T63+1,0,2328
00514	-0 07403 0	10437		MZE	T63+2,0,3843
00515	-0 01767 0	10440		MZE	T63+3,0,1015

END OF FILE

OR TXI XCD

END OF FILE

00516	-0	04742	0	10441		MZE	T63+4,0,2530
00517	-0	07715	0	10442		MZE	T63+5,0,4045
00520	0	00000	0	00144		HTR	RCD
00521	0	53400	4	04340	XRD	LXA	I3,4
00522	0	50000	0	04634	XRE	CLA	C60
00523	-0	32000	4	10440		ANA	T63+3,4
00524	0	10000	0	00532		TZE	XRE1
00525	0	40200	0	04340		SUB	I3
00526	0	56000	4	10440		LDQ	T63+3,4
00527	-0	77300	0	00031		RQL	25
00530	0	16200	0	00532		TQP	XRE1
00531	0	40200	0	04340		SUB	I3
00532	0	76700	0	00022	XRE1	ALS	18
00533	0	60100	1	00001		STO	1,1
00534	0	50000	0	04634		CLA	C60
00535	-0	32000	4	10443		ANA	T63+6,4
00536	0	10000	0	00544		TZE	XRE2
00537	0	40200	0	04340		SUB	I3
00540	0	56000	4	10443		LDQ	T63+6,4
00541	-0	77300	0	00031		RQL	25
00542	0	16200	0	00544		TQP	XRE2
00543	0	40200	0	04340		SUB	I3
00544	-0	60200	1	00001	XRE2	ORS	1,1
00545	1	77776	1	00546	XRF	TXI	XRG,1,-2
00546	2	00001	4	00522	XRG	TIX	XRE,4,1
00547	2	00001	2	00474	XRH	TIX	XRB,2,1
00550	0	76200	0	00321	XRI	RCD	
00551	0	07400	4	05363		TSX	DBD1,4
00552	0	00000	0	06100		PZE	BUFFER
00553	0	00000	0	00144		HTR	RCD
00554	0	07400	4	05030		TSX	IFF,4
00555	0	04352	0	06113		PZE	BUFFER+11,0,IC
00556	0	02000	0	00550		TRA	XRI
00557	0	07400	4	05135		TSX	BLNK,4
00560	0	00013	0	06113		PZE	BUFFER+11,0,11
00561	0	02000	0	00620		TRA	XGD
00562	0	07400	4	05573		TSX	FILE,4
00563	-2	01772	0	10462		MTW	T78,0,1018
00564	-2	03607	0	10463		MTW	T79,0,1927
00565	-2	05424	0	10464		MTW	T80,0,2836
00566	-2	07241	0	10467		MTW	T83,0,3745
00567	-2	11056	0	10466		MTW	T82,0,4654
00570	-2	12673	0	10465		MTW	T81,0,5563

ERROR RETURN FROM FILE

END OF FILE

000

000

005 005

00571	0	00000	0	00144		HTR	RCD
00572	0	56000	0	10462	XRJ	LDQ	T78
00573	0	26000	0	10463		FMP	T79
00574	0	60100	0	10473		STO	T87
00575	0	56000	0	10462		LDQ	T78
00576	0	26000	0	10464		FMP	T80
00577	0	60100	0	10474		STO	T88
00600	0	56000	0	10463		LDQ	T79
00601	0	26000	0	10464		FMP	T80
00602	0	60100	0	10475		STO	T89
00603	0	53400	1	04340		LXA	I3,1
00604	0	56000	1	10465	XRJ1	LDQ	T78+3,1
00605	0	26000	1	10465		FMP	T78+3,1
00606	0	60100	1	10473		STO	T84+3,1
00607	0	56000	1	10476		LDQ	T87+3,1
00610	0	26000	1	10470		FMP	T81+3,1
00611	0	60100	1	10476		STO	T87+3,1
00612	2	00001	1	00604		TIX	XRJ1,1,1
00613	0	53400	1	04343		LXA	I6,1
00614	0	56000	0	04752	XRJ2	LDQ	C80
00615	0	26000	1	10476		FMP	T84+6,1
00616	0	60100	1	10476		STO	T84+6,1
00617	2	00001	1	00614		TIX	XRJ2,1,1
00620	0	02000	0	03034	XCD	TRA	XFB
00621	0	77200	0	00204	XCE	REW	U1
00622	0	53400	4	04341		LXA	I4,4
00623	0	76200	0	00224	XCE1	RTB	U1
00624	0	76100	0	00000	NOP	GPY	T69
00625	0	76100	0	00000	NOP	TRA	XCE2
00626	0	76100	0	00000	NOP	HTR	RCD
00627	2	00001	4	00623	XCE2	TIX	XCE1,4,1
00630	0	50000	0	05025	XCF	CLA	C90
00631	0	40200	0	10330		SUB	T11
00632	0	77100	0	00001		ARS	1
00633	0	60100	0	10504		STO	T96
00634	0	77100	0	00001		ARS	1
00635	0	40000	0	10504		ADD	T96
00636	0	73400	1	00000		PAX	0,1
00637	0	77200	0	00205		REW	U3
00640	0	76600	0	00225		WTB	U3
00641	0	70000	0	04335	XCF1	CPY	I0
00642	2	00001	1	00641		TIX	XCF1,1,1
00643	0	53400	1	10504		LXA	T96,1

ERROR RETURN FROM FILE

END OF FILE

OR TRA XCG

00644	0	76600	0	00225	WTB U3	
00645	0	70000	0	04335	XCF2 CPY I0	
00646	2	00001	1	00645	TIX XCF2,1,1	
00647	0	53400	1	05026	LXA C91,1	
00650	0	76600	0	00225	WTB U3	
00651	0	70000	0	04335	XCF3 CPY I0	
00652	2	00001	1	00651	TIX XCF3,1,1	
00653	0	53400	1	05027	LXA C92,1	
00654	0	76600	0	00225	WTB U3	
00655	0	70000	0	04335	XCF4 CPY I0	
00656	2	00001	1	00655	TIX XCF4,1,1	
00657	0	76600	0	00333	IOD	
00660	0	53400	1	04343	XCG LXA I6,1	
00661	0	60000	1	10377	XCG1 STZ T42+6,1	
00662	2	00001	1	00661	TIX XCG1,1,1	
00663	0	60000	0	10444	STZ T65	
00664	0	60000	0	10445	STZ T66	
00665	0	60000	0	10500	STZ T92	
00666	0	60000	0	05362	XCH STZ SWTF8	OR TRA XA
00667	0	76000	0	00163	SWT 3	
00670	0	02000	0	00672	TRA XCH1	
00671	0	02000	0	00700	TRA XCH2	
00672	0	07400	4	06147	XGH1 TSX OUT,4	
00673	0	07400	4	05254	TSX ECH0,4	
00674	3	23514	0	05005	PTH C86,0,10060	
00675	3	06002	0	05021	PTH C88,0,3074	
00676	-0	00027	0	04340	FOR I3,0,23	
00677	-1	00000	0	00364	FVE 244	
00700	0	07400	4	05336	XCH2 TSX SWTF,4	
00701	0	00000	0	00707	PZE XCH3	
00702	0	07400	4	06147	TSX OUT,4	
00703	0	07400	4	05254	TSX ECH0,4	
00704	3	27451	0	10406	PTH T55,0,12073	
00705	3	02066	0	04362	PTH G3,0,1078	
00706	1	00001	0	00003	PON U2,0,1	
00707	-1	00000	0	00364	XCH3 FVE 244	
00710	0	07400	4	05336	XCH4 TSX SWTF,4	
00711	0	00000	0	00716	PZE XCH6	
00712	0	07400	4	06147	TSX OUT,4	
00713	0	07400	4	05254	TSX ECH0,4	
00714	0	00000	0	00000	XCH5 PZE	TO BE SET
00715	1	00000	0	00003	PON U2,0,0	
00716	-1	00000	0	00364	XCH6 FVE 244	

810
607

TD
TD

TD
TD

TD
TD

00717	0	07400	4	05336	XCH7	TSX	SWTF,4
00720	0	00000	0	00724		PZE	XCH8
00721	0	07400	4	06147		TSX	OUT,4
00722	0	07400	4	05254		TSX	ECHO,4
00723	1	00060	0	00003		PON	U2,0,48
00724	-1	00000	0	00000	XCH8	FVE	
00725	0	53400	4	04340	XA	LXA	I3,4
00726	0	76200	0	00224	XA1	RTB	U1
00727	-0	76000	0	00012		RTT	
00730	0	76100	0	00000		NOP	
00731	0	53400	1	04344		LXA	I7,1
00732	0	70000	1	10514	XA2	GPY	M1+7,1
00733	1	00000	0	00736		TXI	XA3
00734	1	00000	0	02065		TXI	XBI
00735	0	00000	0	00144		HTR	RCD
00736	2	00001	1	00732	XA3	TIX	XA2,1,1
00737	0	53400	1	10313		LXA	T4,1
00740	-3	00000	1	00746		TXL	XA5,1,0
00741	0	53400	2	10330		LXA	T11,2
00742	0	70000	2	00000	XA4	CPY	0,2
00743	-2	00001	1	00746		TNX	XA5,1,1
00744	1	77777	2	00742		TXI	XA4,2,-1
00745	0	00000	0	00144		HTR	RCD
00746	0	53400	1	04346	XA5	LXA	I9,1
00747	0	70000	1	10525	XA6	CPY	M8+9,1
00750	2	00001	1	00747		TIX	XA6,1,1
00751	1	00000	0	00753		TXI	XA7
00752	1	00000	0	00757		TXI	XA9
00753	0	53400	1	10327	XA7	LXA	T8,1
00754	0	70000	1	00000	XA8	CPY	0,1
00755	1	77777	1	00754		TXI	XA8,1,-1
00756	0	00000	0	00000		PZE	
00757	0	76600	0	00333	XA9	IOD	
00760	-0	76000	0	00012		RTT	
00761	1	00000	0	00763		TXI	XA10
00762	1	00000	0	00767		TXI	XB
00763	0	76400	0	00204	XA10	BST	U1
00764	2	00001	4	00726		TIX	XA1,4,1
00765	0	76200	0	00224		RTB	U1
00766	0	00000	0	00725		HTR	XA
00767	0	53400	1	10332	XB	LXA	T10,1
00770	0	53400	2	10326		LXA	T7,2
00771	0	60000	2	00000	XB1	STZ	0,2

RECORD TOO SHORT

RECORD TOO SHORT

RTT FAILS 3 TIMES. START TO SKIP RECORD

810
000

TD

00772	-2	00001	1	00774	TNX	XG,1,1
00773	1	77777	2	00771	TXI	XB1,2,-1
00774	0	53400	4	10316	XC	LXA T1,4
00775	0	53400	1	10324		LXA T61,1
00776	-0	63400	1	10434		SXD T62,1
00777	0	76100	0	00000	XD	NOP
01000	-0	63400	4	10353	XE	SXD T28,4
01001	0	60000	0	10333	XF	STZ T12
01002	0	53400	4	04343		LXA I6,4
01003	0	60000	4	10434	XF1	STZ T60+6,4
01004	2	00001	4	01003		TIX XF1,4,1
01005	0	53400	1	04340		LXA I3,1
01006	-0	53400	2	10434		LXD T62,2
01007	0	56000	1	10510	XF2	LDQ M1+3,1
01010	0	26000	2	00000		FMP 0,2
01011	0	30000	0	10333		FAD T12
01012	0	60100	0	10333		STO T12
01013	0	50000	2	00001		GLA 1,2
01014	-0	73400	4	00000		PDX 0,4
01015	-3	00000	4	01021		TXL XF3,4,0
01016	0	50000	1	10510		GLA M1+3,1
01017	0	30000	4	10434		FAD T60+6,4
01020	0	60100	4	10434		STO T60+6,4
01021	0	50000	2	00001	XF3	GLA 1,2
01022	0	73400	4	00000		PAX 0,4
01023	-3	00000	4	01027		TXL XF4,4,0
01024	0	50000	1	10510		GLA M1+3,1
01025	0	30000	4	10434		FAD T60+6,4
01026	0	60100	4	10434		STO T60+6,4
01027	1	77776	2	01030	XF4	TXI XF5,2,-2
01030	2	00001	1	01007	XF5	TIX XF2,1,1
01031	-0	63400	2	10434		SXD T62,2
01032	0	53400	1	04340		LXA I3,1
01033	0	53400	2	04335		LXA I0,2
01034	0	50200	1	10431	XF6	GLS T60+3,1
01035	0	30000	1	10434		FAD T60+6,1
01036	0	60100	2	10336		STO T15,2
01037	1	00001	2	01040		TXI XF7,2,1
01040	2	00001	1	01034	XF7	TIX XF6,1,1
01041	1	00000	0	01070	XG	TXI XH
01042	0	56000	1	10337	XG1	LDQ T13+3,1
01043	0	26000	1	10337		FMP T13+3,1
01044	0	60100	1	10342		STO T16+3,1

OR TRA XD1

OR TRA XH

OR LXA I3,1

01045	2	00001	1	01042		TIK XG1,1,1
01046	0	56000	0	10334		LDQ T13
01047	0	26000	0	10335		FMP T14
01050	0	60100	0	10342		STO T19
01051	0	56000	0	10342		LDQ T19
01052	0	26000	0	04366		FMP C7
01053	0	60100	0	10342		STO T19
01054	0	56000	0	10334		LDQ T13
01055	0	26000	0	10336		FMP T15
01056	0	60100	0	10343		STO T20
01057	0	56000	0	10343		LDQ T20
01060	0	26000	0	04366		FMP C7
01061	0	60100	0	10343		STO T20
01062	0	56000	0	10335		LDQ T14
01063	0	26000	0	10336		FMP T15
01064	0	60100	0	10344		STO T21
01065	0	56000	0	10344		LDQ T21
01066	0	26000	0	04366		FMP C7
01067	0	60100	0	10344		STO T21
01070	0	53400	4	10314	XH	LXA T2,4
01071	0	53400	2	10325		LXA T6,2
01072	0	53400	1	10326		LXA T7,1
01073	0	76100	0	00000	XI	NOP
01074	-0	63400	4	10346		SXD T23,4
01075	0	50000	0	10333		CLA T12
01076	0	60100	0	10345		STO T22
01077	0	53400	4	04340		LXA I3,4
01100	1	77777	2	01101		TXI XI1,2,-1
01101	0	56000	2	00000	XI1	LDQ 0,2
01102	0	26000	4	10337		FMP T13+3,4
01103	0	30000	0	10345		FAD T22
01104	0	60100	0	10345		STO T22
01105	1	77777	2	01106		TXI XI2,2,-1
01106	2	00001	4	01101	XI2	TIK XI1,4,1
01107	0	07400	4	06777		TSX SIN,4
01110	0	60100	0	10347		STO T24
01111	0	50000	0	10345		CLA T22
01112	0	07400	4	07000		TSX SIN+1,4
01113	0	60100	0	10350		STO T25
01114	1	77777	2	01135	XJ	TXI XK,2,-1
01115	0	60000	0	10351		STZ T26
01116	0	56000	2	00000	XJ1	LDQ 0,2
01117	0	26000	4	10345		FMP T16+6,4

INSERT TRANSFER TO HANDLE SPECIAL POSITIONS

OR LXA 16,4

345 070

TD

01120	0	30000	0	10351		FAD T26	
01121	0	60100	0	10351		STQ T26	
01122	1	77777	2	01123		TXI XJ2,2,-1	
01123	2	00001	4	01116	XJ2	TIX XJ1,4,1	
01124	0	07400	4	07027		TSX EXP,4	
01125	0	00000	0	00144		HTR RCD	NEGATIVE ANIS TEMP FACTOR
01126	0	60100	0	10352		STQ T27	
01127	0	56000	0	10352		LDQ T27	
01130	0	26000	0	10347		FMP T24	
01131	0	60100	0	10347		STQ T24	
01132	0	56000	0	10352		LDQ T27	
01133	0	26000	0	10350		FMP T25	
01134	0	60100	0	10350		STQ T25	
01135	0	50000	0	10350	XK	CLA T25	
01136	0	30000	1	00000		FAD 0,1	
01137	0	60100	1	00000		STQ 0,1	
01140	1	77777	1	01141		TXI XL,1,-1	
01141	0	53400	4	04340	XL	LXA I3,4	OR TXI XN
01142	0	56000	0	10347	XL1	LDQ T24	
01143	0	26000	4	10337		FMP T13+3,4	
01144	0	30000	1	00000		FAD 0,1	
01145	0	60100	1	00000		STQ 0,1	
01146	1	77777	1	01147		TXI XL2,1,-1	
01147	2	00001	4	01142	XL2	TIX XL1,4,1	
01150	1	77777	1	01157	XM	TXI XN,1,-1	OR LXA I6,4
01151	0	56000	0	10350	XM1	LDQ T25	
01152	0	26000	4	10345		FMP T16+6,4	
01153	0	30000	1	00000		FAD 0,1	
01154	0	60100	1	00000		STQ 0,1	
01155	1	77777	1	01156		TXI XM2,1,-1	
01156	2	00001	4	01151	XM2	TIX XM1,4,1	
01157	1	00000	0	01201	XN	TXI XQ	OR CLA T24
01160	0	30000	1	00000		FAD 0,1	
01161	0	60100	1	00000		STQ 0,1	
01162	1	77777	1	01163		TXI X0,1,-1	
01163	0	53400	4	04340	X0	LXA I3,4	OR TXI XQ
01164	0	56000	0	10350	X01	LDQ T25	
01165	0	26000	4	10337		FMP T13+3,4	
01166	0	30000	1	00000		FAD 0,1	
01167	0	60100	1	00000		STQ 0,1	
01170	1	77777	1	01171		TXI X02,1,-1	
01171	2	00001	4	01164	X02	TIX X01,4,1	
01172	1	77777	1	01201	XP	TXI XQ,1,-1	OR LXA I6,4

01173	0	56000	0	10347	XP1	LDQ T24
01174	0	26000	4	10345		FMP T16+6,4
01175	0	30000	1	00000		FAD 0,1
01176	0	60100	1	00000		STO 0,1
01177	1	77777	1	01200		TXI XP2,1,-1
01200	2	00001	4	01173	XP2	TIX XP1,4,1
01201	-0	53400	4	10346	XQ	LXD T23,4
01202	2	00001	4	01073		TIX XI,4,1
01203	-0	53400	4	10353	XR	LXD T28,4
01204	2	00001	4	00777		TIX XD,4,1
01205	0	53400	4	10314	XS	LXA T2,4
01206	0	53400	2	10325		LXA T6,2
01207	0	53400	1	10326		LXA T7,1
01210	0	50000	0	04335	XS1	CLA IO
01211	0	56000	0	04335		LDQ IO
01212	0	02000	0	01215		TRA XS3
01213	0	50000	0	10514	XS2	CLA M8
01214	0	56000	0	10515		LDQ M9
01215	0	60100	0	10516	XS3	STO M10
01216	-0	60000	0	10517		STQ M11
01217	-0	63400	4	10346	XT	SXD T23,4
01220	0	50000	2	00000	XU	CLA 0,2
01221	-0	76000	0	00003	XU1	SSM
01222	0	40000	0	10330		ADD T11
01223	0	40000	0	04336		ADD I1
01224	0	73400	4	00000		PAX 0,4
01225	0	50000	4	00000		CLA 0,4
01226	0	60100	0	10354	XU2	STO T29
01227	0	56000	0	10513	XV	LDQ M7
01230	0	26000	2	00004		FMP 4,2
01231	0	07400	4	07027		TSX EXP,4
01232	0	00000	0	00144		HTR RCD
01233	0	60100	0	10355		STO T30
01234	0	56000	0	10355		LDQ T30
01235	0	26000	0	10354		FMP T29
01236	0	60100	0	10354		STO T29
01237	1	77773	2	01242		TXI XX,2,-5
01240	0	50000	0	04360	XW	CLA G1
01241	0	60100	0	10355		STO T30
01242	0	56000	0	10354	XX	LDQ T29
01243	0	26000	1	00000		FMP 0,1
01244	0	60100	0	10356		STO T31
01245	0	30000	0	10516		FAD M10

OR TRA XS2

OR TXI XU2

OR TXI XW,2,-10

NEGATIVE SYMM TEMP FACTOR

846 072

TD

01246	0	60100	0	10516		STO M10	
01247	0	56000	0	10355	XY	LDQ T30	OR TXI XAB,1,-1
01250	0	26000	1	00000		FMP 0,1	
01251	0	60100	1	00000		STO 0,1	
01252	1	77777	1	01253		TXI XY1,1,-1	
01253	0	56000	0	10354	XY1	LDQ T29	
01254	0	26000	0	04361		FMP G2	
01255	0	60100	0	10360		STO T33	
01256	0	76000	0	00002		GHS	
01257	0	60100	0	10361		STO T34	
01260	0	53400	4	04340		LXA I3,4	
01261	0	56000	0	10361	XY2	LDQ T34	
01262	0	26000	1	00000		FMP 0,1	
01263	0	60100	1	00000		STO 0,1	
01264	1	77777	1	01265		TXI XY3,1,-1	
01265	2	00001	4	01261	XY3	TIX XY2,4,1	
01266	0	56000	0	10356	XZ	LDQ T31	OR TXI XAA
01267	0	26000	0	10513		FMP M7	
01270	0	76000	0	00002		GHS	
01271	0	60100	1	00000		STO 0,1	
01272	1	77777	1	01303		TXI XAB,1,-1	
01273	0	50200	0	10354	XAA	GLS T29	
01274	0	60100	0	10362		STO T35	
01275	0	53400	4	04343		LXA I6,4	
01276	0	56000	0	10362	XAA1	LDQ T35	
01277	0	26000	1	00000		FMP 0,1	
01300	0	60100	1	00000		STO 0,1	
01301	1	77777	1	01302		TXI XAA2,1,-1	
01302	2	00001	4	01276	XAA2	TIX XAA1,4,1	
01303	1	00000	0	01335	XAB	TXI XAF	OR LDQ T29
01304	0	26000	1	00000		FMP 0,1	
01305	0	60100	0	10357		STO T32	
01306	0	30000	0	10517		FAD M11	
01307	0	60100	0	10517		STO M11	
01310	0	56000	0	10355	XAC	LDQ T30	OR TXI XAF,1,-1
01311	0	26000	1	00000		FMP 0,1	
01312	0	60100	1	00000		STO 0,1	
01313	1	77777	1	01314		TXI XAC1,1,-1	
01314	0	53400	4	04340	XAC1	LXA I3,4	
01315	0	56000	0	10360	XAC2	LDQ T33	
01316	0	26000	1	00000		FMP 0,1	
01317	0	60100	1	00000		STO 0,1	
01320	1	77777	1	01321		TXI XAC3,1,-1	

846 078

TD

TD

01321	2	00001	4	01315	XAC3	TI	XAG2,4,1
01322	0	56000	0	10357	XAD	LDQ	T32
01323	0	26000	0	10513		FMP	M7
01324	0	76000	0	00002		CHS	
01325	0	60100	1	00000		STO	0,1
01326	1	77777	1	01335		TXI	XAF,1,-1
01327	0	53400	4	04343	XAE	LXA	I6,4
01330	0	56000	0	10362	XAE1	LDQ	T35
01331	0	26000	1	00000		FMP	0,1
01332	0	60100	1	00000		STO	0,1
01333	1	77777	1	01334		TXI	XAE2,1,-1
01334	2	00001	4	01330	XAE2	TI	XAE1,4,1
01335	-0	53400	4	10346	XAF	LXD	T23,4
01336	2	00001	4	01217		TI	XT,4,1
01337	0	56000	0	10513	XAG	LDQ	M7
01340	0	26000	0	00000	XAG1	FMP	0
01341	0	07400	4	07027		TSX	EXP,4
01342	0	00000	0	00144		HTR	RCD
01343	0	60100	0	10363		STO	T36
01344	0	50000	0	10525		CLA	T5
01345	0	40000	0	10512		ADD	M6
01346	0	62100	0	01347		STA	XAG2
01347	0	56000	0	00000	XAG2	LDQ	0
01350	-0	60000	0	10364		STQ	T37
01351	0	26000	0	10363		FMP	T36
01352	0	60100	0	10363		STO	T36
01353	1	00000	0	01354	XAH	TXI	XAI
01354	0	50000	0	10363	XAI	CLA	T36
01355	0	30000	0	10363		FAD	T36
01356	0	60100	0	10365		STO	T38
01357	0	56000	0	10365		LDQ	T38
01360	0	26000	0	10516		FMP	M10
01361	0	60100	0	10520		STO	M12
01362	1	00000	0	01463		TXI	XAM
01363	0	56000	0	10516	XAJ	LDQ	M10
01364	0	26000	0	10516		FMP	M10
01365	0	60100	0	10367		STO	T40
01366	0	56000	0	10517		LDQ	M11
01367	0	26000	0	10517		FMP	M11
01370	0	30000	0	10367		FAD	T40
01371	-0	10000	0	01376		TNZ	XAJ1
01372	0	60000	0	10520		STZ	M12
01373	0	60000	0	10365		STZ	T38

OR TXI XAE

ADDRESS TO BE SET

NEGATIVE OVERALL TEMP FACTOR

ADDRESS TO BE SET

OR TXI XAK

OR TXI XAJ

TD	01374	0	60000	0	10366		STZ T39
	01375	1	00000	0	01463		TXI XAM
	01376	0	07400	4	06116	XAJ1	TSX SQRT,4
	01377	0	00000	0	00144		HTR RCD
	01400	0	60100	0	10367		STO T40
	01401	0	56000	0	10367		LDQ T40
	01402	0	26000	0	10363		FMP T36
	01403	0	60100	0	10520		STO M12
	01404	0	50000	0	10363		GLA T36
	01405	0	24000	0	10367		FDH T40
	01406	-0	60000	0	10366		STQ T39
	01407	0	26000	0	10516		FMP M10
	01410	0	60100	0	10365		STO T38
	01411	0	56000	0	10366		LDQ T39
	01412	0	26000	0	10517		FMP M11
	01413	0	60100	0	10366		STO T39
TD	01414	1	00000	0	01463		TXI XAM
	01415	0	50000	0	10363	XAK	GLA T36
	01416	0	30000	0	10363		FAD T36
	01417	0	60100	0	10365		STO T38
	01420	0	56000	0	10365		LDQ T38
	01421	0	26000	0	10365		FMP T38
	01422	0	60100	0	10365		STO T38
	01423	0	56000	0	10365		LDQ T38
	01424	0	26000	0	10516		FMP M10
	01425	0	60100	0	10365		STO T38
	01426	0	56000	0	10365		LDQ T38
	01427	0	26000	0	10516		FMP M10
	01430	0	60100	0	10520		STO M12
	01431	0	50000	0	10365		GLA T38
	01432	0	30000	0	10365		FAD T38
	01433	0	60100	0	10365		STO T38
TD	01434	1	00000	0	01473		TXI XAN
	01435	0	56000	0	10363	XAL	LDQ T36
	01436	0	26000	0	10363		FMP T36
	01437	0	60100	0	10365		STO T38
	01440	0	30000	0	10365		FAD T38
	01441	0	60100	0	10366		STO T39
	01442	0	56000	0	10516		LDQ M10
	01443	0	26000	0	10516		FMP M10
	01444	0	60100	0	10367		STO T40
	01445	0	56000	0	10517		LDQ M11
	01446	0	26000	0	10517		FMP M11

NEGATIVE RADICAND

OR TXI XAL

	01447	0	30000	0	10367		FAD	T40	
	01450	0	60100	0	10367		STQ	T40	
	01451	0	56000	0	10367		LDQ	T40	
	01452	0	26000	0	10365		FMP	T38	
	01453	0	60100	0	10520		STO	M12	
	01454	0	56000	0	10516		LDQ	M10	
	01455	0	26000	0	10366		FMP	T39	
	01456	0	60100	0	10365		STO	T38	
	01457	0	56000	0	10517		LDQ	M11	
	01460	0	26000	0	10366		FMP	T39	
	01461	0	60100	0	10366		STO	T39	
TD	01462	1	00000	0	01473		TXI	XAN	
	01463	0	50000	0	10520	XAM	CLA	M12	OR TXI XAW
	01464	0	24000	0	10364		FDH	T37	
	01465	-0	60000	0	10523		STQ	M15	
	01466	0	56000	0	10513		LDQ	M7	
	01467	0	26000	0	10520		FMP	M12	
	01470	0	76000	0	00002		GHS		
	01471	0	60100	0	10524		STO	M16	
TD	01472	1	00000	0	01507		TXI	XAO	
	01473	0	50000	0	10520	XAN	CLA	M12	OR TXI XAW
	01474	0	24000	0	10364		FDH	T37	
	01475	-0	60000	0	10523		STQ	M15	
	01476	0	50000	0	10523		CLA	M15	
	01477	0	30000	0	10523		FAD	M15	
	01500	0	60100	0	10523		STO	M15	
	01501	0	56000	0	10513		LDQ	M7	
	01502	0	26000	0	10520		FMP	M12	
	01503	0	76000	0	00002		GHS		
	01504	0	60100	0	10524		STO	M16	
	01505	0	30000	0	10524		FAD	M16	
	01506	0	60100	0	10524		STO	M16	
	01507	0	53400	4	10314	XAO	LXA	T2,4	
	01510	0	53400	2	10326		LXA	T7,2	
	01511	0	53400	1	10327		LXA	T8,1	
	01512	-0	63400	4	10346	XAP	SXD	T23,4	
	01513	0	53400	4	10370		LXA	T41,4	
	01514	0	56000	0	10365	XAQ	LDQ	T38	
	01515	0	26000	2	00000		FMP	0,2	
	01516	0	60100	1	00000		STO	0,1	
TD	01517	1	00000	0	01523	XAR	TXI	XAS	OR LDQ T39
	01520	0	26000	2	00000	XAR1	FMP	0,2	ADDRESS TO BE SET
	01521	0	30000	1	00000		FAD	0,1	

TD

01522	0	60100	1	00000		STO	0,1
01523	1	77777	2	01524	XAS	TXI	XAS1,2,-1
01524	1	77777	1	01525	XAS1	TXI	XAT,1,-1
01525	2	00001	4	01514	XAT	TXI	XAQ,4,1
01526	-0	53400	4	10346	XAU	LXD	T23,4
01527	-2	00001	4	01533		TXN	XAW,4,1
01530	1	00000	0	01512	XAV	TXI	XAP
01531	2	00000	2	01512	XAV1	TXI	XAP,2,0
01532	0	00000	0	00144		HTR	RCD
01533	0	50000	0	10510	XAW	CLA	M4
01534	0	56000	0	10520	XAW1	LDQ	M12
01535	0	16200	0	01540		TQP	XAW2

OR NOP
 DECREMENT TO BE SET
 LOOKING FOR STORAGE THRU ZERO
 OR TXI XBK
 OR TXI XAW3

TD

01536	-0	76000	0	00003		SSM	
01537	1	00000	0	01541		TXI	XAW3
01540	0	76000	0	00003	XAW2	SSP	
01541	0	30200	0	10520	XAW3	FSB	M12
01542	0	60100	0	10521		STO	M13
01543	0	76000	0	00003		SSP	
01544	0	30000	0	10371		FAD	T42
01545	0	60100	0	10371		STO	T42
01546	0	56000	0	10511		LDQ	M5
01547	0	26000	0	10521		FMP	M13
01550	0	60100	0	10377		STO	T48
01551	0	56000	0	10377		LDQ	T48
01552	0	26000	0	10377		FMP	T48
01553	0	60100	0	10423		STO	T57
01554	0	30000	0	10373		FAD	T44
01555	0	60100	0	10373		STO	T44
01556	0	50000	0	10510		CLA	M4
01557	0	10000	0	01567		TZE	XAW4
01560	0	50000	0	10521		CLA	M13
01561	0	76000	0	00003		SSP	
01562	0	30000	0	10372		FAD	T43
01563	0	60100	0	10372		STO	T43
01564	0	50000	0	10423		CLA	T57
01565	0	30000	0	10374		FAD	T45
01566	0	60100	0	10374		STO	T45
01567	0	50000	0	10510	XAW4	CLA	M4
01570	0	76000	0	00003		SSP	
01571	0	30000	0	10375		FAD	T46
01572	0	60100	0	10375		STO	T46
01573	0	56000	0	10510		LDQ	M4
01574	0	26000	0	10511		FMP	M5

846 076

846 077

01575	0	60100	0	10400		STO T49
01576	0	56000	0	10400		LDQ T49
01577	0	26000	0	10400		FMP T49
01600	0	60100	0	10400		STO T49
01601	0	30000	0	10376		FAD T47
01602	0	60100	0	10376		STO T47
01603	0	60000	0	10522	XAX	STZ M14
01604	0	02000	0	01705		TRA XAXX
				01605		BSS 64
01705	0	50000	0	10522	XAXX	CLA M14
01706	-0	10000	0	01717		TNZ XAY
01707	0	50000	0	10511		CLA M5
01710	0	10000	0	01717		TZE XAY
01711	0	50000	0	10444		CLA T65
01712	0	30000	0	04360		FAD C1
01713	0	60100	0	10444		STO T65
01714	0	50000	0	10445		CLA T66
01715	0	30000	0	10423		FAD T57
01716	0	60100	0	10445		STO T66
01717	0	50000	0	10377	XAY	CLA T48
01720	0	76000	0	00003		SSP
01721	0	30200	0	04366		FSB C7
01722	0	12000	0	01732		TPL XBG
01723	0	50000	0	10522	XAZ	CLA M14
01724	0	10000	0	01727		TZE XBB
01725	0	50000	0	04363	XBA	CLA C4
01726	1	00000	0	01737		TXI XBF
01727	0	50000	0	04362	XBB	CLA C3
01730	0	60100	0	10401		STO T50
01731	1	00000	0	01740	XBB1	TXI XBG
01732	0	50000	0	10522	XBC	CLA M14
01733	0	10000	0	01736		TZE XBE
01734	0	50000	0	04365	XBD	CLA C6
01735	1	00000	0	01737		TXI XBF
01736	0	50000	0	04364	XBE	CLA C5
01737	0	60100	0	10401	XBF	STO T50
01740	0	07400	4	05336	XBG	TSX SWTF,4
01741	0	00000	0	01753		PZE XBG1
01742	0	07400	4	06147		TSX OUT,4
01743	0	07400	4	05254		TSX ECHO,4
01744	3	03734	0	04367		PTH C9,0,2012
01745	-3	00004	0	10505		SVN M1,0,4
01746	-3	00010	0	10506		SVN M2,0,8

OR REJECTION TEST

OR TXI XBH

OR TXI XBH

OR TRA XBG2,4, OR 6

01747	-3	00014	0	10507	SVN	M3,0,12
01750	-3	05721	0	10520	SVN	M12,0,3025
01751	-3	05736	0	10516	SVN	M10,0,3038
01752	1	00060	0	00003	PON	U2,0,48
01753	-1	00000	0	00000	XBG1	FVE
01754	0	02000	0	02035		TRA XBH
01755	0	07400	4	05336	XBG2	TSX SWTF,4
01756	0	00000	0	01771		PZE XBG3
01757	0	07400	4	06147		TSX OUT,4
01760	0	07400	4	05254		TSX ECHO,4
01761	3	03734	0	04367		PTH C9,0,2012
01762	-3	00004	0	10505	SVN	M1,0,4
01763	-3	00010	0	10506	SVN	M2,0,8
01764	-3	00014	0	10507	SVN	M3,0,12
01765	-3	05721	0	10520	SVN	M12,0,3025
01766	-3	05736	0	10516	SVN	M10,0,3038
01767	-3	05753	0	10517	SVN	M11,0,3051
01770	1	00060	0	00003	PON	U2,0,48
01771	-1	00000	0	00000	XBG3	FVE
01772	0	02000	0	02035		TRA XBH
01773	0	07400	4	05336	XBG4	TSX SWTF,4
01774	0	00000	0	02012		PZE XBG5
01775	0	07400	4	06147		TSX OUT,4
01776	0	07400	4	05254		TSX ECHO,4
01777	3	03734	0	04367		PTH C9,0,2012
02000	-3	00004	0	10505	SVN	M1,0,4
02001	-3	00010	0	10506	SVN	M2,0,8
02002	-3	00014	0	10507	SVN	M3,0,12
02003	-3	05721	0	10510	SVN	M4,0,3025
02004	-3	05736	0	10520	SVN	M12,0,3038
02005	-3	05753	0	10516	SVN	M10,0,3051
02006	-3	05770	0	10521	SVN	M13,0,3064
02007	-3	04033	0	10377	SVN	T48,0,2075
02010	3	02072	0	10401	PTH	T50,0,1082
02011	1	00060	0	00003	PON	U2,0,48
02012	-1	00000	0	00000	XBG5	FVE
02013	0	02000	0	02035		TRA XBH
02014	0	07400	4	05336	XBG6	TSX SWTF,4
02015	0	00000	0	02034		PZE XBG7
02016	0	07400	4	06147		TSX OUT,4
02017	0	07400	4	05254		TSX ECHO,4
02020	3	03734	0	04367	PTH	C9,0,2012
02021	-3	00004	0	10505	SVN	M1,0,4

846
078

02022	-3	00010	0	10506	SVN	M2,0,8	
02023	-3	00014	0	10507	SVN	M3,0,12	
02024	-3	05721	0	10510	SVN	M4,0,3025	
02025	-3	05736	0	10520	SVN	M12,0,3038	
02026	-3	05753	0	10516	SVN	M10,0,3051	
02027	-3	05770	0	10517	SVN	M11,0,3064	
02030	-3	06005	0	10521	SVN	M13,0,3077	
02031	-3	04050	0	10377	SVN	T48,0,2088	
02032	3	02107	0	10401	PTH	T50,0,1095	
02033	1	00060	0	00003	PON	U2,0,48	
02034	-1	00000	0	00000	XBG7	FVE	
02035	0	76600	0	00225	XBH	WTB U3	OR TXI XA
02036	0	53400	1	04344		LXA I7,1	
02037	0	70000	1	10514	XBH1	CPY M1+7,1	
02040	2	00001	1	02037		TIX XBH1,1,1	
02041	0	53400	1	10313		LXA T4,1	
02042	-3	00000	1	02047		TXL XBH3,1,0	
02043	0	53400	2	10330		LXA T11,2	
02044	0	70000	2	00000	XBH2	GPY 0,2	
02045	-2	00001	1	02047		TNX XBH3,1,1	
02046	1	77777	2	02044		TXI XBH2,2,-1	
02047	0	70000	0	10514	XBH3	CPY M8	
02050	0	70000	0	10515		CPY M9	
02051	0	70000	0	10516	XBH4	CPY M10	OR TXI XA
02052	0	70000	0	10517		CPY M11	
02053	0	70000	0	10520		CPY M12	
02054	0	70000	0	10521	XBH5	CPY M13	OR TXI XA
02055	0	70000	0	10522		CPY M14	
02056	0	70000	0	10523		CPY M15	
02057	0	70000	0	10524		CPY M16	
02060	0	53400	1	10331		LXA T9,1	
02061	0	53400	2	10327		LXA T8,2	
02062	0	70000	2	00000	XBH6	GPY 0,2	
02063	-2	00001	1	00725		TNX XA,1,1	
02064	1	77777	2	02062		TXI XBH6,2,-1	
02065	0	50000	0	10375	XBI	CLA T46	OR TRA XSA
02066	-0	10000	0	02072		TNZ XBI1	
02067	0	60000	0	10402		STZ T51	
02070	0	60000	0	10403		STZ T52	
02071	1	00000	0	02100		TXI XBI2	
02072	0	50000	0	10371	XBI1	CLA T42	
02073	0	24000	0	10375		FDH T46	
02074	-0	60000	0	10402		STQ T51	

079

-77-

TD

TD

020
020
020

02075 0 50000 0 10372
 02076 0 24000 0 10375
 02077 -0 60000 0 10403
 02100 0 50000 0 10373
 02101 0 07400 4 06116
 02102 0 00000 0 00144
 02103 0 60100 0 10373
 02104 0 50000 0 10374
 02105 0 07400 4 06116
 02106 0 00000 0 00144
 02107 0 60100 0 10374
 02110 0 50000 0 10376
 02111 0 07400 4 06116
 02112 0 00000 0 00144
 02113 0 60100 0 10376
 02114 -0 10000 0 02120
 02115 0 60000 0 10404
 02116 0 60000 0 10405
 02117 1 00000 0 02126
 02120 0 50000 0 10373
 02121 0 24000 0 10376
 02122 -0 60000 0 10404
 02123 0 50000 0 10374
 02124 0 24000 0 10376
 02125 -0 60000 0 10405
 02126 0 07400 4 06147
 02127 0 07400 4 05254
 02130 3 27451 0 10406
 02131 3 02066 0 04362
 02132 1 00001 0 00003
 02133 -1 00000 0 00364
 02134 0 07400 4 06147
 02135 0 07400 4 05254
 02136 3 17560 0 04766
 02137 3 11727 0 04371
 02140 1 00000 0 00003
 02141 -1 00000 0 00364
 02142 0 07400 4 06147
 02143 0 07400 4 05254
 02144 3 03734 0 04376
 02145 3 05724 0 04403
 02146 -3 05762 0 10371
 02147 -3 05777 0 10375

XBI2

XBI3

XBI4

CLA T43
 FDH T46
 STQ T52
 CLA T44
 TSX SQRT,4
 HTR RCD
 STO T44
 CLA T45
 TSX SQRT,4
 HTR RCD
 STO T45
 CLA T47
 TSX SQRT,4
 HTR RCD
 STO T47
 TNZ XBI3
 STZ T53
 STZ T54
 TXI XBI4
 CLA T44
 FDH T47
 STQ T53
 CLA T45
 FDH T47
 STQ T54
 TSX OUT,4
 TSX ECHO,4
 PTH T55,0,12073
 PTH C3,0,1078
 PON U2,0,1
 FVE 244
 TSX OUT,4
 TSX ECHO,4
 PTH C83,0,8048
 PTH G19,0,5079
 PON U2,0,0
 FVE 244
 TSX OUT,4
 TSX ECHO,4
 PTH C20,0,2012
 PTH C22,0,3028
 SVN T42,0,3058
 SVN T46,0,3071

NEGATIVE RADICAND

NEGATIVE RADICAND

NEGATIVE RADICAND

02150 -3 06011 0 10402
 02151 1 00000 0 00003
 02152 -1 00000 0 00364
 02153 0 07400 4 06147
 02154 0 07400 4 05254
 02155 3 03734 0 04376
 02156 3 05724 0 04406
 02157 -3 05762 0 10372
 02160 -3 05777 0 10375
 02161 -3 06011 0 10403
 02162 1 00000 0 00003
 02163 -1 00000 0 00364
 02164 0 07400 4 06147
 02165 0 07400 4 05254
 02166 3 05712 0 04400
 02167 3 05735 0 04403
 02170 -3 05762 0 10373
 02171 -3 05777 0 10376
 02172 -3 06011 0 10404
 02173 1 00000 0 00003
 02174 -1 00000 0 00364
 02175 0 07400 4 06147
 02176 0 07400 4 05254
 02177 3 05712 0 04400
 02200 3 05735 0 04406
 02201 -3 05762 0 10374
 02202 -3 05777 0 10376
 02203 -3 06011 0 10405
 02204 1 00000 0 00003
 02205 -1 00000 0 00364
 02206 0 50000 0 10444
 02207 0 30200 0 10446
 02210 -0 12000 0 02237
 02211 0 10000 0 02237
 02212 0 60100 0 10447
 02213 0 50000 0 10445
 02214 0 24000 0 10447
 02215 -0 60000 0 10447
 02216 0 50000 0 10445
 02217 0 07400 4 06116
 02220 0 00000 0 00144
 02221 0 60100 0 10503
 02222 0 50000 0 10447

SVN T51,0,3081
 PON U2,0,0
 FVE 244
 TSX OUT,4
 TSX ECHO,4
 PTH C20,0,2012
 PTH C23,0,3028
 SVN T43,0,3058
 SVN T46,0,3071
 SVN T52,0,3081
 PON U2,0,0
 FVE 244
 TSX OUT,4
 TSX ECHO,4
 PTH C21,0,3018
 PTH C22,0,3037
 SVN T44,0,3058
 SVN T47,0,3071
 SVN T53,0,3081
 PON U2,0,0
 FVE 244
 TSX OUT,4
 TSX ECHO,4
 PTH C21,0,3018
 PTH C23,0,3037
 SVN T45,0,3058
 SVN T47,0,3071
 SVN T54,0,3081
 PON U2,0,0
 FVE 244
 GLA T65
 FSB T67
 TMI XBI11
 TZE XBI11
 STO T68
 CLA T66
 FDH T68
 STQ T68
 CLA T66
 TSX SQRT,4
 HTR RCD
 STO T95
 CLA T68

NEGATIVE RADICAND

02223	0	07400	4	06116	TSX	SQRT,4	
02224	0	00000	0	00144	HTR	RCD	NEGATIVE RADICAND
02225	0	60100	0	10447	STO	T68	
02226	0	07400	4	06147	TSX	OUT,4	
02227	0	07400	4	05254	TSX	ECHO,4	
02230	3	31426	0	04650	PTH	C63,0,13078	
02231	-3	05762	0	10503	SVN	T95,0,3058	
02232	-3	00104	0	10444	SVN	T65,0,68	
02233	-3	00110	0	10446	SVN	T67,0,72	
02234	-3	06011	0	10447	SVN	T68,0,3081	
02235	1	00000	0	00003	PON	U2,0,0	
02236	-1	00000	0	00364	FVE	244	
02237	0	07400	4	06147	XB111 TSX	OUT,4	
02240	0	07400	4	05254	TSX	ECHO,4	
02241	-1	00000	0	00361	FVE	241	
02242	0	02000	0	03162	TRA	XSA	
02243	0	50000	0	10516	XBK CLA	M10	OR TXI XAY
02244	0	60100	0	10514	STO	M8	
02245	0	50000	0	10517	CLA	M11	
02246	0	60100	0	10515	STO	M9	
02247	1	00000	0	01717	TXI	XAY	
02250	0	76200	0	00321	XDA	RGD	
02251	0	07400	4	05363	TSX	DBD1,4	
02252	0	00000	0	06100	PZE	BUFFER	
02253	0	00000	0	00144	HTR	RCD	END OF FILE
02254	0	07400	4	05030	TSX	IFF,4	
02255	0	04356	0	06113	PZE	BUFFER+11,0,15	
02256	0	02000	0	02250	TRA	XDA	
02257	0	53400	1	04350	XDB	LXA I12,1	
02260	0	50000	0	04466	CLA	G28	
02261	0	60100	0	02265	STO	XDG1	
02262	0	50000	0	04467	CLA	G29	
02263	0	60100	0	02273	STO	XDD1	
02264	0	07400	4	05573	XDC TSX	FILE,4	
02265	0	00000	0	00000	XDC1 PZE		TO BE SET
02266	0	00000	0	00144	HTR	RCD	ERROR RETURN FROM FILE
02267	0	50000	0	10424	CLA	T58	
02270	0	40200	0	04362	SUB	G3	
02271	0	10000	0	02275	TZE	XDE	
02272	0	07400	4	05573	XDD TSX	FILE,4	
02273	0	00000	0	00000	XDD1 PZE		TO BE SET
02274	0	00000	0	00144	HTR	RCD	ERROR RETURN FROM FILE
02275	-2	00001	1	02303	XDE	TNX XDFF,1,1	

TD

002
003

TD

02276	0	50000	0	02265	XDF	CLA XDG1
02277	0	40000	0	04470		ADD G30
02300	0	62200	0	02265		STD XDG1
02301	0	62200	0	02273		STD XDD1
02302	1	00000	0	02264		TXI XDC
02303	0	07400	4	02305	XDFF	TSX XDG,4
02304	0	02000	0	00471		TRA XCC
02305	0	63400	4	10422	XDG	SXD T56,4
02306	0	53400	4	10305		LXA S1,4
02307	3	00004	4	02317		TXH XDG1,4,4
02310	0	50000	4	04314		CLA 1XEC1+1,4
02311	0	60100	0	02722		STO XEG1
02312	0	02000	4	02317		TRA XDG1,4
02313	1	00000	0	02350		TXI XDG5
02314	1	00000	0	02336		TXI XDG4
02315	1	00000	0	02331		TXI XDG3
02316	1	00000	0	02320		TXI XDG2

TD

TD

TD

TD

003
003
003

02317	0	00000	0	00144	XDG1	HTR RCD
02320	0	50000	0	04336	XDG2	CLA I1
02321	0	60100	0	10311		STO S5
02322	0	60100	0	10321		STO S12
02323	0	60100	0	10323		STO S14
02324	0	50000	0	04337		CLA I2
02325	0	60100	0	10312		STO S6
02326	0	60100	0	10322		STO S13
02327	0	50000	0	04160		CLA 1XSB
02330	0	02000	0	02361		TRA XDG6
02331	0	50000	0	04337	XDG3	CLA I2
02332	0	60100	0	10321		STO S12
02333	0	60100	0	10322		STO S13
02334	0	50000	0	04160		CLA 1XSB
02335	0	02000	0	02361		TRA XDG6
02336	0	50000	0	04336	XDG4	CLA I1
02337	0	60100	0	10311		STO S5
02340	0	60100	0	10312		STO S6
02341	0	60100	0	10322		STO S13
02342	0	50000	0	04337		CLA I2
02343	0	60100	0	10321		STO S12
02344	0	50000	0	04340		CLA I3
02345	0	60100	0	10323		STO S14
02346	0	50000	0	04157		CLA 2XSB
02347	0	02000	0	02361		TRA XDG6
02350	0	50000	0	04336	XDG5	CLA I1

MODE NOT SPECIFIED

02351	0	60100	0	10311		STO S5	
02352	0	60100	0	10312		STO S6	
02353	0	50000	0	04337		CLA I2	
02354	0	60100	0	10321		STO S12	
02355	0	60100	0	10322		STO S13	
02356	0	50000	0	04340		CLA I3	
02357	0	60100	0	10323		STO S14	
02360	0	50000	0	04157		CLA 2XSB	
02361	0	60100	0	03164	XDG6	STO XSB	
02362	0	53400	4	10306	XDH	LXA S2,4	
02363	3	00002	4	02365		TXH XDH1,4,2	
02364	3	00000	4	02366		TXH XDH2,4,0	
02365	0	00000	0	00144	XDH1	HTR RCD	S2 NOT SPECIFIED
02366	0	50000	4	04163	XDH2	CLA 1XAH+1,4	
02367	0	60100	0	01353		STO XAH	
02370	0	50000	4	04165		CLA 1XAW1+1,4	
02371	0	60100	0	01534		STO XAW1	
02372	0	50000	4	04316		CLA 1XEC2+1,4	
02373	0	60100	0	02727		STO XEC2	
02374	0	53400	4	10307		LXA S3,4	
02375	3	00003	4	02377		TXH XDH3,4,3	
02376	3	00000	4	02400		TXH XDH4,4,0	
02377	0	00000	0	00144	XDH3	HTR RCD	S3 NOT SPECIFIED
02400	0	50000	4	04153	XDH4	CLA 1XGA+1,4	
02401	0	60100	0	03116		STO XGA	
02402	0	50000	4	04144		CLA 1S3+1,4	
02403	0	60100	0	10307		STO S3	
02404	0	50000	4	04321		CLA 1XEC3+1,4	
02405	0	60100	0	02734		STO XEC3	
02406	0	53400	4	10307		LXA S3,4	
02407	0	50000	4	04167		CLA 1XFF2+1,4	
02410	0	60100	0	03104		STO XFF2	
02411	0	50000	4	04171		CLA 1XG+1,4	
02412	0	60100	0	01041		STO XG	
02413	0	50000	4	04173		CLA 1XJ+1,4	
02414	0	60100	0	01114		STO XJ	
02415	0	50000	4	04175		CLA 1XM+1,4	
02416	0	60100	0	01150		STO XM	
02417	0	50000	4	04177		CLA 1XP+1,4	
02420	0	60100	0	01172		STO XP	
02421	0	50000	4	04201		CLA 1XV+1,4	
02422	0	60100	0	01227		STO XV	
02423	0	50000	4	04203		CLA 1XZ+1,4	

02424	0	60100	0	01266		STO XZ
02425	0	50000	4	04205		CLA 1XAD+1,4
02426	0	60100	0	01322		STO XAD
02427	0	50000	4	04207		CLA 1T41+1,4
02430	0	60100	0	10370		STO T41
02431	0	62100	0	01520		STA XAR1
02432	0	76700	0	00022		ALS 18
02433	0	62200	0	01531		STD XAV1
02434	0	62200	0	04102		STD XWU
02435	0	50000	4	04150		CLA 1XWD+1,4
02436	0	60100	0	03747		STO XWD
02437	0	50000	4	04146		CLA 1XWP1+1,4
02440	0	60100	0	03773		STO XWP1
02441	0	53400	4	10310		LXA S4,4
02442	3	00003	4	02444		TXH XDH5,4,3
02443	3	00000	4	02445		TXH XDH6,4,0
02444	0	00000	0	00144	XDH5	HTR RGD
02445	0	50000	4	04212	XDH6	CLA 1XCH+1,4
02446	0	60100	0	00666		STO XCH
02447	0	50000	4	04215		CLA 1XAY+1,4
02450	0	60100	0	01717		STO XAY
02451	0	50000	4	04220		CLA 1XBB1+1,4
02452	0	60100	0	01731		STO XBB1
02453	0	50000	4	04324		CLA 1XEC4+1,4
02454	0	60100	0	02741		STO XEC4
02455	0	53400	4	10311		LXA S5,4
02456	3	00002	4	02460		TXH XDH7,4,2
02457	3	00000	4	02461		TXH XDH8,4,0
02460	0	00000	0	00144	XDH7	HTR RCD
02461	0	50000	4	04222	XDH8	CLA 1XBH+1,4
02462	0	60100	0	02035		STO XBH
02463	0	50000	4	04155		CLA 1XCF+1,4
02464	0	60100	0	00630		STO XCF
02465	0	50000	4	04157		CLA 1XSA+1,4
02466	0	60100	0	03162		STO XSA
02467	0	50000	4	04224		CLA 1XVI+1,4
02470	0	60100	0	04121		STO XVI
02471	0	53400	4	10312		LXA S6,4
02472	3	00002	4	02474		TXH XDH9,4,2
02473	3	00000	4	02475		TXH XDH10,4,0
02474	0	00000	0	00144	XDH9	HTR RCD
02475	0	50000	4	04226	XDH10	CLA 1XAW+1,4
02476	0	60100	0	01533		STO XAW

S4 NOT SPECIFIED

S5 NOT SPECIFIED

S6 NOT SPECIFIED

TD

000000

000000

02477	0	50000	4	04230		CLA	1XBI+1,4
02500	0	60100	0	02065		STO	XBI
02501	0	50000	4	04331		CLA	1XEG1+1,4
02502	0	60100	0	02763		STO	XEG1
02503	0	50000	0	10313		CLA	S7
02504	0	10000	0	02512		TZE	XDHI1
02505	0	50000	0	04235		CLA	1XUO
02506	0	60100	0	03631		STO	XUO
02507	0	50000	0	04231		CLA	1XFF1
02510	0	56000	0	04233		LDQ	1XU1
02511	1	00000	0	02516		TXI	XDHI2
02512	0	50000	0	04234	XDHI1	CLA	2XUO
02513	0	60100	0	03631		STO	XUO
02514	0	50000	0	04230		CLA	2XFF1
02515	0	56000	0	04232		LDQ	2XU1
02516	0	60100	0	03076	XDHI2	STO	XFF1
02517	-0	60000	0	01221		STQ	XU1
02520	0	53400	4	10315		LXA	S9,4
02521	3	00002	4	02523		TXH	XDHI3,4,2
02522	3	00000	4	02524		TXH	XDHI4,4,0
02523	0	00000	0	00144	XDHI3	HTR	RCD
02524	0	50000	4	04240	XDHI4	CLA	1XN+1,4
02525	0	60100	0	01157		STO	XN
02526	0	50000	4	04242		CLA	1XAB+1,4
02527	0	60100	0	01303		STO	XAB
02530	0	50000	4	04244		CLA	1XAI+1,4
02531	0	60100	0	01354		STO	XAI
02532	0	50000	4	04246		CLA	1XAK+1,4
02533	0	60100	0	01415		STO	XAK
02534	0	50000	4	04250		CLA	1XAR+1,4
02535	0	60100	0	01517		STO	XAR
02536	0	50000	4	04252		CLA	1XAV+1,4
02537	0	60100	0	01530		STO	XAV
02540	0	50000	4	04333		CLA	1XEK1+1,4
02541	0	60100	0	03010		STO	XEK1
02542	0	53400	4	10317		LXA	S15,4
02543	3	00002	4	02545		TXH	XDHI5,4,2
02544	3	00000	4	02546		TXH	XDHI6,4,0
02545	0	00000	0	00144	XDHI5	HTR	RCD
02546	0	50000	4	04137	XDHI6	CLA	1XD+1,4
02547	0	60100	0	00777		STO	XD
02550	0	50000	4	04141		CLA	1XF+1,4
02551	0	60100	0	01001		STO	XF

S9 NOT SPECIFIED

S15 NOT SPECIFIED

02552	0	50000	4	04335	CLA 1XEK2+1,4
02553	0	60100	0	03021	STO XEK2
02554	0	53400	4	10321	LXA S12,4
02555	0	50000	4	04254	CLA 1XS1+1,4
02556	0	60100	0	01210	STO XS1
02557	0	50000	4	04256	CLA 1XBK+1,4
02560	0	60100	0	02243	STO XBK
02561	0	53400	4	10322	LXA S13,4
02562	0	50000	4	04260	CLA 1XL+1,4
02563	0	60100	0	01141	STO XL
02564	0	50000	4	04262	CLA 1XO+1,4
02565	0	60100	0	01163	STO XO
02566	0	50000	4	04264	CLA 1XY+1,4
02567	0	60100	0	01247	STO XY
02570	0	50000	4	04266	CLA 1XAC+1,4
02571	0	60100	0	01310	STO XAC
02572	0	50000	4	04270	CLA 1XAM+1,4
02573	0	60100	0	01463	STO XAM
02574	0	50000	4	04272	CLA 1XAN+1,4
02575	0	60100	0	01473	STO XAN
02576	0	53400	4	10323	LXA S14,4
02577	0	50000	4	04275	CLA 1XBH4+1,4
02600	0	60100	0	02051	STO XBH4
02601	0	50000	4	04300	CLA 1XBH5+1,4
02602	0	60100	0	02054	STO XBH5
02603	0	50000	4	04327	CLA 1XEE1+1,4
02604	0	60100	0	02750	STO XEE1
02605	0	50000	0	04337	CLA I2
02606	0	40200	0	10312	SUB S6
02607	0	76700	0	00001	ALS 1
02610	0	40000	0	10315	ADD S9
02611	0	73400	4	00000	PAX 0,4
02612	0	50000	4	04304	CLA 1XCH5+1,4
02613	0	60100	0	00714	STO XCH5
02614	0	50000	4	04310	CLA 1XBG+1,4
02615	0	60100	0	01740	STO XBG
02616	0	56000	0	10314	LDQ S8
02617	0	20000	0	04342	MPY I5
02620	0	20000	0	10307	MPY S3
02621	-0	60000	0	10331	STQ T9
02622	0	53400	4	10322	LXA S13,4
02623	-3	00001	4	02625	TXL XDJ1,4,1
02624	0	56000	0	10314	LDQ S8

XDI

XDJ

T

830 018

02625	0	20000	0	10315	XDJ1	MPY S9
02626	-0	60000	0	10332		STQ T10
02627	0	50000	0	04337		CLA I2
02630	0	40200	0	10317		SUB S15
02631	0	60100	0	10443		STO T64
02632	0	56000	0	10443		LDQ T64
02633	0	20000	0	04343		MPY I6
02634	0	20000	0	10316		MPY S10
02635	-0	60000	0	10443		STQ T64
02636	-0	75400	0	00000		PXD
02637	0	76000	0	00006		GOM
02640	-0	73400	1	00000		PDX 0,1
02641	-0	75400	1	00000		PXD 0,1
02642	0	77100	0	00022		ARS 18
02643	0	60100	0	10425		STO T59
02644	0	50000	0	10525		CLA T5
02645	0	40000	0	04336		ADD I1
02646	0	40000	0	10320		ADD S11
02647	0	62100	0	01340		STA XAG1
02650	0	62100	0	03505		STA XTW
02651	0	62100	0	03535		STA XTY1
02652	0	62100	0	03547		STA XUB1
02653	0	62100	0	03550		STA XUB2
02654	0	62100	0	03742		STA XWA
02655	0	62100	0	03765		STA XWN
02656	0	60100	0	10324		STO T61
02657	0	40000	0	10443		ADD T64
02660	0	60100	0	10325		STO T6
02661	0	40000	0	10331		ADD T9
02662	0	60100	0	10330		STO T11
02663	0	40000	0	10313		ADD S7
02664	0	60100	0	10326		STO T7
02665	0	40000	0	10332		ADD T10
02666	0	60100	0	10327		STO T8
02667	0	53400	4	10305		LXA S1,4
02670	-3	00002	4	02674		TXL XDJ2,4,2
02671	0	40000	0	05024		ADD G89
02672	0	40000	0	77760		ADD K1
02673	0	40000	0	10331		ADD T9
02674	0	34000	0	10425	XDJ2	CAS T59
02675	0	00000	0	00144		HTR RCD
02676	0	76100	0	00000		NOP
02677	0	53400	4	04342		LXA I5,4

PROBLEM EXCEEDS MEMORY CAPACITY

02700	0	50000	4	10331	XDJ3	CLA T61+5,4	
02701	0	76000	0	00006		COM	
02702	0	60100	4	10331		STO T61+5,4	
02703	2	00001	4	02700		TIX XDJ3,4,1	
02704	0	50000	0	10330		CLA T11	
02705	0	76700	0	00022		ALS 18	
02706	0	62200	0	03331		STD XTG1	
02707	0	62200	0	04124		STD XVI1	
02710	-0	53400	4	10422	XDK	LXD T56,4	
02711	0	02000	4	00001		TRA 1,4	
02712	0	07400	4	06147	XEB	TSX OUT,4	
02713	0	07400	4	05254		TSX EGH0,4	
02714	3	27451	0	10406		PTH T55,0,12073	
02715	3	02066	0	04362		PTH C3,0,1078	
02716	-1	00000	0	00364		FVE 244	
02717	0	07400	4	06147	XEC	TSX OUT,4	
02720	0	07400	4	05254		TSX EGH0,4	
02721	3	01756	0	04471		PTH C31,0,1006	
02722	0	00000	0	00000	XEC1	PZE	TO BE SET
02723	-1	00000	0	00364		FVE 244	
02724	0	07400	4	06147		TSX OUT,4	
02725	0	07400	4	05254		TSX EGH0,4	
02726	3	03734	0	04521		PTH C36,0,2012	
02727	0	00000	0	00000	XEC2	PZE	TO BE SET
02730	-1	00000	0	00000		FVE	
02731	0	07400	4	06147		TSX OUT,4	
02732	0	07400	4	05254		TSX EGH0,4	
02733	3	07670	0	04526		PTH C39,0,4024	
02734	0	00000	0	00000	XEC3	PZE	TO BE SET
02735	-1	00000	0	00000		FVE	
02736	0	07400	4	06147		TSX OUT,4	
02737	0	07400	4	05254		TSX EGH0,4	
02740	3	03734	0	04536		PTH C42,0,2012	
02741	0	00000	0	00000	XEC4	PZE	TO BE SET
02742	-1	00000	0	00000		FVE	
02743	0	53400	4	10311		LXA S5,4	
02744	3	00001	4	02753		TXH XEF,4,1	
02745	0	07400	4	06147	XEE	TSX OUT,4	
02746	0	07400	4	05254		TSX EGH0,4	
02747	3	05712	0	04544		PTH C46,0,3018	
02750	0	00000	0	00000	XEE1	PZE	TO BE SET
02751	-1	00000	0	00000		FVE	
02752	1	00000	0	02760		TXI XEG	

02753	0	07400	4	06147	XEF	TSX OUT,4	
02754	0	07400	4	05254		TSX ECHO,4	
02755	3	05712	0	04544		PTH C46,0,3018	
02756	3	01775	0	04543		PTH C45,0,1021	
02757	-1	00000	0	00000		FVE	
02760	0	07400	4	06147	XEG	TSX OUT,4	
02761	0	07400	4	05254		TSX ECHO,4	
02762	3	11646	0	04563		PTH C50,0,5030	
02763	0	00000	0	00000	XEG1	PZE	TO BE SET
02764	-1	00000	0	00000		FVE	
02765	0	50000	0	10313	XEH	CLA S7	
02766	-0	10000	0	02774		TNZ XEJ	
02767	0	07400	4	06147	XEI	TSX OUT,4	
02770	0	07400	4	05254		TSX ECHO,4	
02771	3	03734	0	04574		PTH C53,0,2012	
02772	-1	00000	0	00000		FVE	
02773	1	00000	0	03001		TXI XEK	
02774	0	07400	4	06147	XEJ	TSX OUT,4	
02775	0	07400	4	05254		TSX ECHO,4	
02776	3	13624	0	04576		PTH C54,0,6036	
02777	-0	00016	0	10313		FOR S7,0,14	
03000	-1	00000	0	00000		FVE	
03001	0	07400	4	06147	XEK	TSX OUT,4	
03002	0	07400	4	05254		TSX ECHO,4	
03003	3	13624	0	04604		PTH C55,0,6036	
03004	-0	00047	0	10314		FOR S8,0,39	
03005	-1	00000	0	00000		FVE	
03006	0	07400	4	06147		TSX OUT,4	
03007	0	07400	4	05254		TSX ECHO,4	
03010	0	00000	0	00000	XEK1	PZE	TO BE SET
03011	-1	00000	0	00000		FVE	
03012	0	07400	4	06147		TSX OUT,4	
03013	0	07400	4	05254		TSX ECHO,4	
03014	3	17560	0	04617		PTH C58,0,8048	
03015	-0	00062	0	10316		FOR S10,0,50	
03016	-1	00000	0	00000		FVE	
03017	0	07400	4	06147		TSX OUT,4	
03020	0	07400	4	05254		TSX ECHO,4	
03021	0	00000	0	00000	XEK2	PZE	TO BE SET
03022	-1	00000	0	00000		FVE	
03023	0	07400	4	06147		TSX OUT,4	
03024	0	07400	4	05254		TSX ECHO,4	
03025	3	11646	0	04627		PTH C59,0,5030	

TD

846 090

88

03026	-0	00034	0	10320		FOR S11,0,28	
03027	-1	00000	0	00000		FVE	
03030	0	07400	4	06147		TSX OUT,4	
03031	0	07400	4	05254		TSX ECHO,4	
03032	-1	00000	0	00361		FVE 241	
03033	0	02000	0	00472	XEL	TRA XRA	
03034	0	50000	0	10320	XFB	CLA T3	
03035	0	40000	0	04336		ADD I1	
03036	0	73400	1	00000		PAX 0,1	
03037	0	50000	0	10525		CLA T5	
03040	0	76000	0	00006		GOM	
03041	0	73400	2	00000		PAX 0,2	
03042	0	76200	0	00321	XFC	RGD	
03043	0	07400	4	05363		TSX DBD1,4	
03044	0	00000	0	06100		PZE BUFFER	
03045	0	00000	0	00144		HTR RGD	END OF FILE
03046	0	07400	4	05030		TSX IFF,4	
03047	0	04355	0	06113		PZE BUFFER+11,0,IP	
03050	0	02000	0	03042		TRA XFC	
03051	0	07400	4	05135		TSX BLNK,4	
03052	0	00002	0	06102		PZE BUFFER+2,0,2	
03053	0	02000	0	03116		TRA XGA	
03054	0	07400	4	05573		TSX FILE,4	
03055	-2	00155	2	00000		MTW 0,2,109	
03056	0	00000	0	00144		HTR RGD	ERROR RETURN FROM FILE
03057	1	77777	2	03060		TXI XFD,2,-1	
03060	2	00001	1	03042	XFD	TIX XFC,1,1	
03061	0	53400	1	10314	XFE	LXA T2,1	
03062	0	53400	2	10325		LXA T6,2	
03063	0	76200	0	00321	XFF	RGD	
03064	0	07400	4	05363		TSX DBD1,4	
03065	0	00000	0	06100		PZE BUFFER	
03066	0	00000	0	00144		HTR RGD	END OF FILE
03067	0	07400	4	05030		TSX IFF,4	
03070	0	04355	0	06113		PZE BUFFER+11,0,IP	
03071	0	02000	0	03063		TRA XFF	
03072	0	07400	4	05135		TSX BLNK,4	
03073	0	00013	0	06113		PZE BUFFER+11,0,11	
03074	0	02000	0	03116		TRA XGA	
03075	0	07400	4	05573		TSX FILE,4	
03076	-1	00153	2	00000	XFF1	MON 0,2,107	OR MTW 0,2,107
03077	-2	01456	2	00001		MTW 1,2,814	
03100	-2	02761	2	00002		MTW 2,2,1521	

03101	-2	04264	2	00003		MTW	3,2,2228
03102	-2	05567	2	00004		MTW	4,2,2935
03103	0	00000	0	00144		HTR	RCD
03104	1	77773	2	03115	XFF2	TXI	XFG,2,-5
03105	0	07400	4	05573	XFF3	TSX	FILE,4
03106	-2	07072	2	00000		MTW	0,2,3642
03107	-2	10375	2	00001		MTW	1,2,4349
03110	-2	11700	2	00002		MTW	2,2,5056
03111	-2	13203	2	00003		MTW	3,2,5763
03112	-2	14506	2	00004		MTW	4,2,6470
03113	0	00000	0	00144		HTR	RCD
03114	1	77773	2	03115		TXI	XFG,2,-5
03115	2	00001	1	03063	XFG	TIX	XFF,1,1
03116	0	02000	0	00621	XGA	TRA	XCE
03117	0	60100	0	10307		STQ	S3
03120	0	07400	4	02305	XGB	TSX	XDG,4
03121	0	56000	0	04342	XGC	LDQ	I5
03122	0	20000	0	10314		MPY	S8
03123	-0	60000	0	10476		STQ	T90
03124	0	50000	0	10325		CLA	T6
03125	0	40200	0	10476		SUB	T90
03126	0	40000	0	04336		ADD	I1
03127	0	73400	1	00000		PAX	0,1
03130	0	40200	0	10476		SUB	T90
03131	0	40000	0	04342		ADD	I5
03132	0	73400	2	00000		PAX	0,2
03133	0	53400	4	10314	XGD	LXA	S8,4
03134	0	50000	1	00000	XGE	CLA	0,1
03135	0	60100	0	10477		STQ	T91
03136	-0	63400	1	10346		SXD	T23,1
03137	0	53400	1	04343	XGF	LXA	I6,1
03140	0	56000	0	10477	XGG	LDQ	T91
03141	0	26000	1	10476		FMP	T84+6,1
03142	0	60100	2	00000		STQ	0,2
03143	-2	00001	1	03145	XGH	TNX	XGJ,1,1
03144	1	77777	2	03140	XGI	TXI	XGG,2,-1
03145	-2	00001	4	00621	XGJ	TNX	XCE,4,1
03146	1	00017	2	03147	XGK	TXI	XGL,2,15
03147	-0	53400	1	10346	XGL	LXD	T23,1
03150	1	00005	1	03151		TXI	XGM,1,5
03151	0	50000	1	00001	XGM	CLA	1,1
03152	0	60100	2	00006		STQ	6,2
03153	0	50000	1	00002		CLA	2,1

ERROR RETURN FROM FILE
OR TXI XFF3,2,-5

ERROR RETURN FROM FILE

OR CLA I2

03154	0	60100	2	00007	STO 7,2	
03155	0	50000	1	00003	CLA 3,1	
03156	0	60100	2	00010	STO 8,2	
03157	0	50000	1	00004	CLA 4,1	
03160	0	60100	2	00011	STO 9,2	
03161	0	02000	0	03134	TRA XGE	
03162	0	77000	0	00205	WEF U3	OR TRA XSB
03163	0	77000	0	00205	WEF U3	
03164	0	76200	0	00321	RCD	OR TRA XVH
03165	0	07400	4	05363	TSX DBD1,4	
03166	0	00000	0	06100	PZE BUFFER	
03167	0	00000	0	03164	HTR XSB	END OF FILE
03170	0	07400	4	05030	TSX IFF,4	
03171	0	04353	0	06113	PZE BUFFER+11,0,1K	
03172	0	02000	0	03164	TRA XSB	
03173	0	07400	4	05135	TSX BLNK,4	
03174	0	00002	0	06102	PZE BUFFER+2,0,2	
03175	0	02000	0	03217	TRA XSK	
03176	0	07400	4	05573	TSX FILE,4	
03177	-1	00152	0	77761	MON K2,0,106	
03200	-1	01310	0	77760	MON K1,0,712	
03201	-2	00152	0	10446	MTW T67,0,106	
03202	0	00000	0	00144	HTR RCD	ERROR RETURN FROM FILE
03203	0	50000	0	77760	CLA K1	
03204	0	76700	0	00001	ALS 1	
03205	0	60100	0	77760	STO K1	
03206	0	53400	1	77760	LXA K1,1	
03207	0	76200	0	00321	RCD	
03210	0	53400	2	04346	LXA I9,2	
03211	0	70000	1	77760	CPY K1,1	
03212	0	02000	0	03214	TRA XSH1	
03213	0	00000	0	03207	HTR XSG	END OF FILE
03214	0	70000	1	77761	CPY K1+1,1	
03215	2	00001	2	03211	TSX XSH,2,1	
03216	2	00002	1	03207	TSX XSG,1,2	
03217	0	53400	1	77761	LXA K2,1	
03220	3	00000	1	03223	TXH XSM,1,0	
03221	0	60000	0	77760	STZ K1	
03222	0	02000	0	03361	TRA XTO	
03223	0	50000	0	10313	CLA S7	
03224	0	60100	0	77763	STO K4	
03225	0	50000	0	10305	CLA S1	
03226	0	60100	0	77774	STO K13	

03154
03155
03156
03157
03160
03161
03162
03163
03164
03165
03166
03167
03170
03171
03172
03173
03174
03175
03176
03177
03200
03201
03202
03203
03204
03205
03206
03207
03210
03211
03212
03213
03214
03215
03216
03217
03220
03221
03222
03223
03224
03225
03226

03227	0	50000	0	77761	XSN	CLA K2
03230	0	40000	0	04336		ADD I1
03231	0	76500	0	00043		LRS 35
03232	0	20000	0	77761		MPY K2
03233	0	76500	0	00001		LRS 1
03234	-0	60000	0	77775		STQ K14
03235	0	50000	0	04665		CLA C64
03236	0	40200	0	77760		SUB K1
03237	0	60100	0	77776		STO K15
03240	0	40200	0	77761		SUB K2
03241	0	60100	0	77773		STO K12
03242	0	40200	0	77775		SUB K14
03243	0	60100	0	77775		STO K14
03244	0	40200	0	77761		SUB K2
03245	0	40200	0	04336		SUB I1
03246	0	76000	0	00006		COM
03247	0	60100	0	77771		STO K10
03250	0	50000	0	77775		CLA K14
03251	0	40200	0	04336		SUB I1
03252	0	76000	0	00006		COM
03253	0	62100	0	77777		STA K16
03254	0	50000	0	77773		CLA K12
03255	0	40200	0	04336		SUB I1
03256	0	76000	0	00006		COM
03257	0	76700	0	00022		ALS 18
03260	0	62200	0	77777		STD K16
03261	0	50000	0	77775		CLA K14
03262	0	40000	0	77761		ADD K2
03263	0	60100	0	77772		STO K11
03264	0	53400	4	77771	XSO	LXA K10,4
03265	0	60000	0	77762		STZ K3
03266	0	53400	2	10320	XSP	LXA S11,2
03267	0	53400	1	77760	XSQ	LXA K1,1
03270	-0	50000	1	77760	XSR	GAL K1,1
03271	-0	63400	1	77766		SXD K7,1
03272	0	53400	1	04351		LXA I36,1
03273	-0	76000	0	00001	XSS	PBT
03274	0	02000	0	03303		TRA XSU
03275	0	60200	0	77767	XST	SLW K8
03276	0	50000	0	77762		CLA K3
03277	0	40000	0	04336		ADD I1
03300	0	60100	0	77762		STO K3
03301	-0	50000	0	77767		CAL K8

845
094

03302	1	77777	4	03303		TXI XSU,4,-1
03303	0	76700	0	00001	XSU	ALS 1
03304	-2	00001	1	03307	XSV	TNX XSX,1,1
03305	2	00001	2	03273	XSW	TIX XSS,2,1
03306	0	02000	0	03315		TRA XTA
03307	-0	53400	1	77766	XSX	LXD K7,1
03310	-2	00001	1	03322		TNX XTB,1,1
03311	2	00001	2	03270	XSX	TIX XSR,2,1
03312	-0	50000	1	77760	XSZ	CAL K1,1
03313	-0	63400	1	77766		SXD K7,1
03314	0	53400	1	04351		LXA I36,1
03315	0	60200	0	77767	XTA	SLW K8
03316	-0	63400	1	77765		SXD K6,1
03317	-0	63400	4	77764		SXD K5,4
03320	0	50000	0	04336		CLA I1
03321	0	02000	0	03323		TRA XTB1
03322	0	50000	0	04337	XTB	CLA I2
03323	0	60100	0	77770	XTB1	STO K9
03324	0	76400	0	00205	XTC	BST U3
03325	0	76400	0	00205		BST U3
03326	0	76200	0	00225		RTB U3
03327	0	07400	4	00146		TSX WTB,4
03330	0	00000	0	00005		PZE U3
03331	0	00000	0	77323	XTC1	PZE -START,0,0
03332	0	77200	0	00205		REW U3
03333	0	02000	0	00144		TRA RGD
03334	0	53400	1	04342	XTD	LXA I5,1
03335	0	76200	0	00225	XTD1	RTB U3
03336	2	00001	1	03335		TIX XTD1,1,1
03337	0	53400	4	04340	XTE	LXA I3,4
03340	0	76200	0	00225	XTF	RTB U3
03341	-0	76000	0	00012		RTT
03342	0	76100	0	00000		NOP
03343	0	53400	1	10326	XTG	LXA T7,1
03344	0	70000	0	10502		GPY T94
03345	0	70000	1	00000	XTH	GPY 0,1
03346	1	77777	1	03345	XTI	TXI XTH,1,-1
03347	0	00000	0	00144		HTR RGD
03350	0	76600	0	00333	XTJ	IOD
03351	-0	76000	0	00012		RTT
03352	0	02000	0	03356		TRA XTL
03353	0	77200	0	00205	XTK	REW U3
03354	0	77200	0	00204		REW U1

DECREMENT TO BE SET

 ENTER OR-XLS3
 RETURN FROM OR XLS5

END OF FILE

03355	0	02000	0	03361	TRA	XTO
03356	0	76400	0	00205	XTL	BST U3
03357	2	00001	4	03340	XTM	TIX XTF,4,1
03360	0	00000	0	03337	XTN	HTR XTE
03361	0	07400	4	06147	XTO	TSX OUT,4
03362	0	07400	4	05254		TSX EGH0,4
03363	3	27451	0	10406		PTH T55,0,12073
03364	3	02066	0	04362		PTH G3,0,1078
03365	1	00001	0	00003		PON U2,0,1
03366	-1	00000	0	00364		FVE 244
03367	0	50000	0	10445	XTOO	GLA T66
03370	0	30200	0	10502		FSB T94
03371	0	60100	0	10445		STO T66
03372	0	50000	0	10444		GLA T65
03373	0	30200	0	10446		FSB T67
03374	0	60100	0	10447		STO T68
03375	0	10000	0	03401		TZE XT001
03376	0	50000	0	10445		GLA T66
03377	0	24000	0	10447		FDH T68
03400	-0	60000	0	10447		STQ T68
03401	0	50000	0	10445	XT001	GLA T66
03402	0	07400	4	06116		TSX SQRT,4
03403	-0	76000	0	00003		SSM
03404	0	60100	0	10503		STO T95
03405	0	50000	0	10447		GLA T68
03406	0	07400	4	06116		TSX SQRT,4
03407	-0	76000	0	00003		SSM
03410	0	60100	0	10447		STO T68
03411	0	07400	4	06147	XT002	TSX OUT,4
03412	0	07400	4	05254		TSX EGH0,4
03413	3	03734	0	04776		PTH G84,0,2012
03414	3	11727	0	04371		PTH G19,0,5079
03415	1	00000	0	00003		PON U2,0,0
03416	-1	00000	0	00364		FVE 244
03417	0	07400	4	06147	XT003	TSX OUT,4
03420	0	07400	4	05254		TSX EGH0,4
03421	3	31426	0	04650		PTH G63,0,13078
03422	-3	05762	0	10503		SVN T95,0,3058
03423	-3	00104	0	10444		SVN T65,0,68
03424	-3	00110	0	10446		SVN T67,0,72
03425	-3	06011	0	10447		SVN T68,0,3081
03426	1	00000	0	00003		PON U2,0,0
03427	-1	00000	0	00364		FVE 244

RTT FAILS 3 TIMES. START TO TRY AGAIN

03430	0	07400	4	06147	XT004	TSX OUT,4
03431	0	07400	4	05254		TSX EGH0,4
03432	3	11646	0	05000		PTH G85,0,5030
03433	1	00000	0	00003		PON U2,0,0
03434	-1	00000	0	00364		FVE 244
03435	0	50000	0	05334	XTPP	GLA SWTP7
03436	0	60100	0	05335		STO SWTP8
03437	0	76000	0	00164	XTPP1	SWT 4
03440	0	02000	0	03442		TRA XTPP2
03441	0	02000	0	03450		TRA XTPP3
03442	0	07400	4	06147	XTPP2	TSX OUT,4
03443	0	07400	4	05254		TSX EGH0,4
03444	3	23514	0	05005		PTH G86,0,10060
03445	3	04024	0	05017		PTH G87,0,2068
03446	-0	00027	0	04341		FOR I4,0,23
03447	-1	00000	0	00364		FVE 244
03450	0	07400	4	05311	XTPP3	TSX SWTP,4
03451	0	00000	0	03456		PZE XTPP4
03452	0	07400	4	06147		TSX OUT,4
03453	0	07400	4	05254		TSX EGH0,4
03454	3	23514	0	04666		PTH G65,0,10060
03455	1	00000	0	00003		PON U2,0,0
03456	-1	00000	0	00364	XTPP4	FVE 244
03457	0	50000	0	04700	XTP	GLA G66
03460	0	60100	0	10451		STO T70
03461	0	50000	0	04701		GLA G66+1
03462	0	60100	0	10452		STO T70+1
03463	0	50000	0	04336		GLA I1
03464	0	60100	0	10453		STO T71
03465	0	53400	2	10326	XTQ	LXA T7,2
03466	0	53400	1	10320		LXA S11,1
03467	0	53400	4	77760		LXA K1,4
03470	3	00000	4	03473		TXH XTS,4,0
03471	0	60000	0	77767	XTR	STZ K8
03472	0	02000	0	03475		TRA XTT
03473	-0	50000	4	77760	XTS	QAL K1,4
03474	0	60200	0	77767		SLW K8
03475	-0	63400	4	77766	XTT	SXD K7,4
03476	0	53400	4	04351		LXA I36,4
03477	-0	63400	4	77765	XTU	SXD K6,4
03500	-0	50000	0	77767		CAL K8
03501	-0	76000	0	00001		PBT
03502	0	02000	0	03537		TRA XUA

816 037

03503 0 76700 0 00001 XTV ALS 1
03504 0 60200 0 77767 SLW K8
03505 0 50000 1 00000 XTW CLA 0,1
03506 0 60100 0 10454 STO T72
03507 0 30000 2 00000 FAD 0,2
03510 0 60100 0 10455 STO T73
03511 0 50000 2 00001 CLA 1,2
03512 0 07400 4 06116 TSX SQRT,4
03513 0 00000 0 00144 HTR RCD
03514 0 60100 0 10456 STO T74
03515 0 56000 0 10456 LDQ T74
03516 0 26000 0 10447 FMP T68
03517 0 60100 0 10456 STO T74
03520 0 07400 4 05311 XTX TSX SWTP,4
03521 0 00000 0 03533 PZE XTX1
03522 0 07400 4 06147 TSX OUT,4
03523 0 07400 4 05254 TSX ECHO,4
03524 3 03735 0 10451 PTH T70,0,2013
03525 -0 00020 0 10453 FOR T71,0,16
03526 -3 07671 0 10454 SVN T72,0,4025
03527 -3 07704 2 00000 SVN 0,2,4036
03530 -3 07717 0 10455 SVN T73,0,4047
03531 -3 07732 0 10456 SVN T74,0,4058
03532 1 00000 0 00003 PON U2,0,0
03533 -1 00000 0 00364 XTX1 FVE 244
03534 0 50000 0 10455 XTY CLA T73
03535 0 60100 1 00000 XTY1 STO 0,1
03536 1 77776 2 03553 XTZ TXI XUG,2,-2
03537 0 76700 0 00001 XUA ALS 1
03540 0 60200 0 77767 SLW K8
03541 0 07400 4 05311 XUB TSX SWTP,4
03542 0 00000 0 03552 PZE XUB3
03543 0 07400 4 06147 TSX OUT,4
03544 0 07400 4 05254 TSX ECHO,4
03545 3 03735 0 10451 PTH T70,0,2013
03546 -0 00020 0 10453 FOR T71,0,16
03547 -3 07671 1 00000 XUB1 SVN 0,1,4025
03550 -3 07717 1 00000 XUB2 SVN 0,1,4047
03551 1 00000 0 00003 PON U2,0,0
03552 -1 00000 0 00364 XUB3 FVE 244
03553 -2 00001 1 03564 XUC TNX XUH,1,1
03554 0 50000 0 10453 XUD CLA T71
03555 0 40000 0 04336 ADD I1

ADDRESS TO BE SET

INVERSE DIAGONAL IS NEGATIVE

ADDRESS TO BE SET

ADDRESS TO BE SET
ADDRESS TO BE SET

03556	0	60100	0	10453		STO T71
03557	-0	53400	4	77765	XUE	LXD K6,4
03560	2	00001	4	03477		TIX XTU,4,1
03561	-0	53400	4	77766	XUF	LXD K7,4
03562	2	00001	4	03473		TIX XTS,4,1
03563	0	02000	0	03471		TRA XTR
03564	-3	00000	1	03574	XUH	TXL XUJ,1,0
03565	0	53400	1	04335	XUI	LXA I0,1
03566	0	60000	0	10453		STZ T71
03567	0	50000	0	04702		CLA C67
03570	0	60100	0	10451		STO T70
03571	0	50000	0	04703		CLA C67+1
03572	0	60100	0	10452		STO T70+1
03573	0	02000	0	03557		TRA XUE
03574	0	53400	4	10314	XUJ	LXA S8,4
03575	0	50000	0	04336	XUK	CLA I1
03576	0	60100	0	10453		STO T71
03577	0	53400	1	10325	XUL	LXA T6,1
03600	-0	63400	1	10457		SXD T75,1
03601	-0	63400	4	10460	XUM	SXD T76,4
03602	0	07400	4	05311	XUM1	TSX SWTP,4
03603	0	00000	0	03611		PZE XUM2
03604	0	07400	4	06147		TSX OUT,4
03605	0	07400	4	05254		TSX EGHO,4
03606	3	01756	0	04704		PTH G68,0,1006
03607	-0	00010	0	10453		FOR T71,0,8
03610	1	00000	0	00003		PON U2,0,0
03611	-1	00000	0	00364	XUM2	FVE 244
03612	0	50000	0	10370	XUN	CLA T41
03613	0	76700	0	00001		ALS 1
03614	0	73400	1	00000		PAX 0,1
03615	0	40000	0	04740		ADD C78
03616	0	62100	0	03652		STA XUV1
03617	0	40000	0	04336		ADD I1
03620	0	62100	0	03654		STA XUV2
03621	-3	00012	1	03625		TXL XUN1,1,10
03622	0	50000	0	04733		CLA C72
03623	0	56000	0	04734		LDQ C72+1
03624	0	02000	0	03627		TRA XUN2
03625	0	50000	0	04731	XUN1	CLA C71
03626	0	56000	0	04732		LDQ C71+1
03627	0	60100	0	04715	XUN2	STO C70
03630	-0	60000	0	04716		STQ C70+1

03631	-0	50000	0	04735	XUO	CAL C75
03632	0	02000	0	03634		TRA XUP1
03633	-0	50000	0	04736	XUP	CAL C76
03634	0	60200	0	03724	XUP1	SLW XVD1
03635	0	40000	0	04737		ADD C77
03636	0	60200	0	03725		SLW XVD2
03637	-0	53400	4	77765	XUQ	LXD K6,4
03640	2	00001	4	03651		TIX XUV,4,1
03641	-0	53400	4	77766	XUR	LXD K7,4
03642	2	00001	4	03645		TIX XUT,4,1
03643	0	60000	0	77767	XUS	STZ K8
03644	0	02000	0	03647		TRA XUU
03645	-0	50000	4	77760	XUT	CAL K1,4
03646	0	60200	0	77767		SLW K8
03647	-0	63400	4	77766	XUU	SXD K7,4
03650	0	53400	4	04351		LXA I36,4
03651	-0	63400	4	77765	XUV	SXD K6,4
03652	0	50000	1	00000	XUV1	GLA 0,1
03653	0	60100	0	10451		STO T70
03654	0	50000	1	00000	XUV2	GLA 0,1
03655	0	60100	0	10452		STO T70+1
03656	-0	63400	1	10461		SXD T77,1
03657	-0	53400	1	10457		LXD T75,1
03660	-0	50000	0	77767	XUW	CAL K8
03661	-0	76000	0	00001		PBT
03662	0	02000	0	03715		TRA XVG
03663	0	76700	0	00001	XUX	ALS 1
03664	0	60200	0	77767		SLW K8
03665	0	50000	1	00000	XUY	GLA 0,1
03666	0	30000	2	00000		FAD 0,2
03667	0	60100	0	10455		STO T73
03670	0	50000	2	00001		GLA 1,2
03671	0	07400	4	06116		TSX SQRT,4
03672	0	00000	0	00144		HTR RCD
03673	0	60100	0	10456		STO T74
03674	0	56000	0	10456		LDQ T74
03675	0	26000	0	10447		FMP T68
03676	0	60100	0	10456		STO T74
03677	0	07400	4	05311	XUZ	TSX SWTP,4
03700	0	00000	0	03711		PZE XUZ1
03701	0	07400	4	06147		TSX OUT,4
03702	0	07400	4	05254		TSX ECHO,4
03703	3	03734	0	10451		PTH T70,0,2012

OR TRA XUP

ADDRESS TO BE SET

ADDRESS TO BE SET

INVERSE DIAGONAL IS NEGATIVE

03704	-3	15561	1	00000		SVN	0,1,7025	
03705	-3	15574	2	00000		SVN	0,2,7036	
03706	-3	15607	0	10455		SVN	T73,0,7047	
03707	-3	15622	0	10456		SVN	T74,0,7058	
03710	1	00000	0	00003		PON	U2,0,0	
03711	-1	00000	0	00364	XUZ1	FVE	244	
03712	0	50000	0	10455	XVA	CLA	T73	
03713	0	60100	1	00000		STO	0,1	
03714	1	77776	2	03730	XVB	TXI	XVE,2,-2	
03715	0	76700	0	00001	XVC	ALS	1	
03716	0	60200	0	77767		SLW	K8	
03717	0	07400	4	05311	XVD	TSX	SWTP,4	
03720	0	00000	0	03727		PZE	XVD3	
03721	0	07400	4	06147		TSX	OUT,4	
03722	0	07400	4	05254		TSX	ECHO,4	
03723	3	03734	0	10451		PTH	T70,0,2012	
03724	-3	15561	1	00000	XVD1	SVN	0,1,7025	OR FOR 0,1,21
03725	-3	15607	1	00000	XVD2	SVN	0,1,7047	OR FOR 0,1,43
03726	1	00000	0	00003		PON	U2,0,0	
03727	-1	00000	0	00364	XVD3	FVE	244	
03730	1	77777	1	03731	XVE	TXI	XVE1,1,-1	
03731	-0	63400	1	10457	XVE1	SXD	T75,1	
03732	-0	53400	1	10461		LXD	T77,1	
03733	2	00002	1	03633		TIX	XUP,1,2	
03734	-0	53400	4	10460	XVF	LXD	T76,4	
03735	-2	00001	4	03742		TNX	XWA,4,1	
03736	0	50000	0	10453	XVG	CLA	T71	
03737	0	40000	0	04336		ADD	I1	
03740	0	60100	0	10453		STO	T71	
03741	0	02000	0	03601		TRA	XUM	
03742	0	50000	0	00000	XWA	CLA	0	ADDRESS TO BE SET
03743	0	10000	0	03766		TZE	XW0	
03744	0	60100	0	10477	XWB	STO	T91	
03745	0	53400	1	10314	XWC	LXA	S8,1	
03746	0	53400	2	10325		LXA	T6,2	
03747	0	50000	0	10477	XWD	CLA	T91	OR TRA XWH
03750	0	30000	2	00004		FAD	4,2	
03751	0	60100	2	00004		STO	4,2	
03752	-2	00001	1	03765	XWE	TNX	XWN,1,1	
03753	1	77773	2	03747	XWF	TXI	XWD,2,-5	
03754	1	77774	2	03755	XWH	TXI	XWI,2,-4	
03755	0	53400	4	04343	XWI	LXA	I6,4	
03756	0	56000	0	10477	XWJ	LDQ	T91	

03757	0	26000	4	10476		FMP	T84+6,4
03760	0	30000	2	00000		FAD	0,2
03761	0	60100	2	00000		STO	0,2
03762	1	77777	2	03763	XWK	TXI	XWL,2,-1
03763	2	00001	4	03756	XWL	TIX	XWJ,4,1
03764	2	00001	1	03754	XWM	TIX	XWH,1,1
03765	0	60000	0	00000	XWN	STZ	0
03766	0	53400	1	10314	XWO	LXA	S8,1
03767	0	53400	2	10325		LXA	T6,2
03770	0	50000	0	04336		CLA	I1
03771	0	60100	0	10453		STO	T71
03772	0	76100	0	00000	XWP	NOP	
03773	0	50000	2	00004	XWP1	CLA	4,2
03774	-0	12000	0	04071		TMI	XWS
03775	0	02000	0	04101		TRA	XWT
03776	0	76100	0	00000	XWQ	NOP	
03777	0	50000	2	00004	XWR	CLA	4,2
04000	-0	12000	0	04071		TMI	XWS
04001	0	50000	2	00005		CLA	5,2
04002	-0	12000	0	04071		TMI	XWS
04003	0	50000	2	00006		CLA	6,2
04004	-0	12000	0	04071		TMI	XWS
04005	0	56000	2	00011		LDQ	9,2
04006	0	26000	2	00011		FMP	9,2
04007	0	60100	0	10501		STO	T93
04010	0	56000	2	00005		LDQ	5,2
04011	0	26000	2	00006		FMP	6,2
04012	0	30200	0	10501		FSB	T93
04013	-0	12000	0	04071		TMI	XWS
04014	0	56000	2	00010		LDQ	8,2
04015	0	26000	2	00010		FMP	8,2
04016	0	60100	0	10501		STO	T93
04017	0	56000	2	00004		LDQ	4,2
04020	0	26000	2	00006		FMP	6,2
04021	0	30200	0	10501		FSB	T93
04022	-0	12000	0	04071		TMI	XWS
04023	0	56000	2	00007		LDQ	7,2
04024	0	26000	2	00007		FMP	7,2
04025	0	60100	0	10501		STO	T93
04026	0	56000	2	00004		LDQ	4,2
04027	0	26000	2	00005		FMP	5,2
04030	0	30200	0	10501		FSB	T93
04031	-0	12000	0	04071		TMI	XWS

ADDRESS TO BE SET

TRANSFER TO RESET RELATIONS BETWEEN X,Y,Z
OR TRA XWQ

TRANSFER TO RESET RELATIONS BETWEEN BETAS

04032	0	56000	2	00004		LDQ	4,2
04033	0	26000	2	00011		FMP	9,2
04034	0	76500	0	00043		LRS	35
04035	0	26000	2	00011		FMP	9,2
04036	0	60100	0	10501		STO	T93
04037	0	56000	2	00007		LDQ	7,2
04040	0	26000	2	00007		FMP	7,2
04041	0	76500	0	00043		LRS	35
04042	0	26000	2	00006		FMP	6,2
04043	0	30000	0	10501		FAD	T93
04044	0	60100	0	10501		STO	T93
04045	0	56000	2	00010		LDQ	8,2
04046	0	26000	2	00010		FMP	8,2
04047	0	76500	0	00043		LRS	35
04050	0	26000	2	00005		FMP	5,2
04051	0	30000	0	10501		FAD	T93
04052	0	60100	0	10501		STO	T93
04053	0	56000	2	00004		LDQ	4,2
04054	0	26000	2	00005		FMP	5,2
04055	0	76500	0	00043		LRS	35
04056	0	26000	2	00006		FMP	6,2
04057	0	30200	0	10501		FSB	T93
04060	0	60100	0	10501		STO	T93
04061	0	56000	2	00007		LDQ	7,2
04062	0	26000	2	00010		FMP	8,2
04063	0	76500	0	00043		LRS	35
04064	0	26000	2	00011		FMP	9,2
04065	0	76500	0	00043		LRS	35
04066	0	26000	0	04753		FMP	G81
04067	0	30000	0	10501		FAD	T93
04070	0	12000	0	04101		TPL	XWT
04071	0	07400	4	06147	XWS	TSX	OUT,4
04072	0	07400	4	05254		TSX	EGH0,4
04073	3	23514	0	04754		PTH	G82,0,10060
04074	-0	00036	0	10453		FOR	T71,0,30
04075	1	00000	0	00003		PON	U2,0,0
04076	-1	00000	0	00364		FVE	244
04077	0	50000	0	04336		CLA	I1
04100	0	60100	0	10500		STO	T92
04101	-2	00001	1	04110	XWT	TNX	XVGG,1,1
04102	2	00000	2	04104	XWU	TIX	XWV,2,0
04103	0	00000	0	00144		HTR	RCD
04104	0	50000	0	10453	XWV	CLA	T71

DECREMENT TO BE SET

04105	0	40000	0	04336	ADD	I1	
04106	0	60100	0	10453	STO	T71	
04107	0	02000	0	03772	TRA	XWP	
04110	0	50000	0	10500	XVGG	CLA	T92
04111	-0	10000	0	04115		TNZ	XVGG1
04112	0	76000	0	00164		SWT	4
04113	0	02000	0	04115		TRA	XVGG1
04114	0	02000	0	04120		TRA	XVH
04115	0	07400	4	06147	XVGG1	TSX	OUT,4
04116	0	07400	4	05254		TSX	EGH0,4
04117	-1	00000	0	00361		FVE	241
04120	0	77200	0	00204	XVH	REW	U1
04121	0	77200	0	00205	XVI	REW	U3
04122	0	07400	4	00146		TSX	WTB,4
04123	0	00000	0	00005		PZE	U3
04124	0	00000	0	77323	XVI1	PZE	-START,0,0
04125	0	76200	0	00225		RTB	U3
04126	0	07400	4	00146		TSX	WTB,4
04127	0	00000	0	00005		PZE	U3
04130	0	00000	0	00400		PZE	-32512,0,0
04131	0	77200	0	00205		REW	U3
04132	0	50000	0	10500	XVJ	CLA	T92
04133	0	10000	0	00160		TZE	KH
04134	0	02000	0	00161		TRA	KI
						SENSE-SETTING WORDS	
04135	0	02000	0	10526		TRA	XD1
04136	0	76100	0	00000	1XD	NOP	
04137	0	02000	0	01070		TRA	XH
04140	0	60000	0	10333	1XF	STZ	T12
04141	0	00000	0	00001		PZE	1
04142	0	00000	0	00002		PZE	2
04143	0	00000	0	00001	1S3	PZE	1
04144	0	02000	0	03776		TRA	XWQ
04145	0	50000	2	00004	1XWP1	CLA	4,2
04146	0	02000	0	03754		TRA	XWH
04147	0	50000	0	10477	1XWD	CLA	T91
04150	0	50000	0	04337		CLA	I2
04151	0	02000	0	00621		TRA	XCE
04152	0	02000	0	00621	1XGA	TRA	XCE
04153	0	02000	0	00660		TRA	XCG
04154	0	50000	0	05025	1XCF	CLA	C90
04155	0	02000	0	03164		TRA	XSB
04156	0	77000	0	00205	1XSA	WEF	U3

OR TRA XVJ

DECREMENT TO BE SET

845
105
254

	04157	0	76200	0	00321	2XSB	RCD
	04160	0	02000	0	04120	1XSB	TRA XVH
TD	04161	1	00000	0	01415		TXI XAK
TD	04162	1	00000	0	01354	1XAH	TXI XAI
TD	04163	1	00000	0	01541		TXI XAW3
	04164	0	56000	0	10520	1XAW1	LDQ M12
	04165	1	77773	2	03105		TXI XFF3,2,-5
	04166	1	77773	2	03115	1XFF2	TXI XFG,2,-5
	04167	0	53400	1	04340		LXA I3,1
TD	04170	1	00000	0	01070	1XG	TXI XH
	04171	0	53400	4	04343		LXA I6,4
	04172	1	77777	2	01135	1XJ	TXI XK,2,-1
	04173	0	53400	4	04343		LXA I6,4
	04174	1	77777	1	01157	1XM	TXI XN,1,-1
	04175	0	53400	4	04343		LXA I6,4
	04176	1	77777	1	01201	1XP	TXI XQ,1,-1
	04177	1	77766	2	01240		TXI XW,2,-10
	04200	0	56000	0	10513	1XV	LDQ M7
TD	04201	1	00000	0	01273		TXI XAA
	04202	0	56000	0	10356	1XZ	LDQ T31
TD	04203	1	00000	0	01327		TXI XAE
	04204	0	56000	0	10357	1XAD	LDQ T32
	04205	0	00000	0	00012		PZE 10
	04206	0	00000	0	00005	1T41	PZE 5
	04207	0	02000	0	00725		TRA XA
	04210	0	60000	0	05362		STZ SWTF8
	04211	0	60000	0	05362	1XCH	STZ SWTF8
TD	04212	1	00000	0	02035		TXI XBH
	04213	0	50000	0	10377		CLA T48
	04214	0	50000	0	10377	1XAY	CLA T48
TD	04215	1	00000	0	02035		TXI XBH
TD	04216	1	00000	0	02035		TXI XBH
TD	04217	1	00000	0	01740	1XBB1	TXI XBG
TD	04220	1	00000	0	00725		TXI XA
	04221	0	76600	0	00225	1XBH	WTB U3
	04222	0	02000	0	04132		TRA XVJ
	04223	0	77200	0	00205	1XVI	REW U3
TD	04224	1	00000	0	02243		TXI XBK
	04225	0	50000	0	10510	1XAW	CLA M4
	04226	0	02000	0	03162		TRA XSA
	04227	0	50000	0	10375	1XBI	CLA T46
	04230	-2	00153	2	00000	2XFF1	MTW 0,2,107
	04231	-1	00153	2	00000	1XFF1	MON 0,2,107

TD	04232	1	00000	0	01226	2XU1	TXI XU2
	04233	-0	76000	0	00003	1XU1	SSM
	04234	0	02000	0	03633	2XUO	TRA XUP
	04235	-0	50000	0	04735	1XUO	CAL C75
	04236	0	50000	0	10347		CLA T24
TD	04237	1	00000	0	01201	1XN	TXI XQ
	04240	0	56000	0	10354		LDQ T29
TD	04241	1	00000	0	01335	1XAB	TXI XAF
TD	04242	1	00000	0	01363		TXI XAJ
	04243	0	50000	0	10363	1XAI	CLA T36
TD	04244	1	00000	0	01435		TXI XAL
	04245	0	50000	0	10363	1XAK	CLA T36
	04246	0	56000	0	10366		LDQ T39
TD	04247	1	00000	0	01523	1XAR	TXI XAS
	04250	0	76100	0	00000		NOP
TD	04251	1	00000	0	01512	1XAV	TXI XAP
	04252	0	02000	0	01213		TRA XS2
	04253	0	50000	0	04335	1XS1	CLA I0
TD	04254	1	00000	0	01717		TXI XAY
	04255	0	50000	0	10516	1XBK	CLA M10
TD	04256	1	00000	0	01157		TXI XN
	04257	0	53400	4	04340	1XL	LXA I3,4
TD	04260	1	00000	0	01201		TXI XQ
	04261	0	53400	4	04340	1XO	LXA I3,4
	04262	1	77777	1	01303		TXI XAB,1,-1
	04263	0	56000	0	10355	1XY	LDQ T30
	04264	1	77777	1	01335		TXI XAF,1,-1
	04265	0	56000	0	10355	1XAC	LDQ T30
TD	04266	1	00000	0	01533		TXI XAW
	04267	0	50000	0	10520	1XAM	CLA M12
TD	04270	1	00000	0	01533		TXI XAW
	04271	0	50000	0	10520	1XAN	CLA M12
	04272	0	70000	0	10516		GPY M10
	04273	0	70000	0	10516		GPY M10
TD	04274	1	00000	0	00725	1XBH4	TXI XA
	04275	0	70000	0	10521		CPY M13
TD	04276	1	00000	0	00725		TXI XA
TD	04277	1	00000	0	00725	1XBH5	TXI XA
	04300	3	37340	0	04446		PTH C27,0,16096
	04301	3	33404	0	04430		PTH C26,0,14084
	04302	3	21536	0	04417		PTH C25,0,9054
	04303	3	13624	0	04411	1XCH5	PTH C24,0,6036
	04304	0	02000	0	02014		TRA XBG6

846 106

04305	0	02000	0	01773		TRA	XBG4
04306	0	02000	0	01755		TRA	XBG2
04307	0	07400	4	05336	1XBG	TSX	SWTF,4
04310	3	13632	0	04513		PTH	C35,0,6042
04311	3	15610	0	04504		PTH	C34,0,7048
04312	3	07676	0	04500		PTH	C33,0,4030
04313	3	13632	0	04472	1XEC1	PTH	C32,0,6042
04314	3	03745	0	04524		PTH	C38,0,2021
04315	3	01767	0	04523	1XEC2	PTH	C37,0,1015
04316	3	21563	0	04741		PTH	C79,0,9075
04317	3	03761	0	04534		PTH	C41,0,2033
04320	3	03761	0	04532	1XEC3	PTH	C40,0,2033
04321	3	01772	0	04543		PTH	C45,0,1018
04322	3	03750	0	04541		PTH	C44,0,2024
04323	3	01772	0	04540	1XEC4	PTH	C43,0,1018
04324	3	05731	0	04560		PTH	C49,0,3033
04325	3	07707	0	04554		PTH	C48,0,4039
04326	3	11665	0	04547	1XEE1	PTH	C47,0,5045
04327	3	03772	0	04572		PTH	C52,0,2042
04330	3	03772	0	04570	1XEG1	PTH	C51,0,2042
04331	3	03734	0	04615		PTH	C57,0,2012
04332	3	05712	0	04612	1XEK1	PTH	C56,0,3018
04333	3	13624	0	04642		PTH	C62,0,6036
04334	3	11646	0	04635	1XEK2	PTH	C61,0,5030

INTEGERS

04335	0	00000	0	00000	I0	PZE	0
04336	0	00000	0	00001	I1	PZE	1
04337	0	00000	0	00002	I2	PZE	2
04340	0	00000	0	00003	I3	PZE	3
04341	0	00000	0	00004	I4	PZE	4
04342	0	00000	0	00005	I5	PZE	5
04343	0	00000	0	00006	I6	PZE	6
04344	0	00000	0	00007	I7	PZE	7
04345	0	00000	0	00010	I8	PZE	8
04346	0	00000	0	00011	I9	PZE	9
04347	0	00000	0	00013	I11	PZE	11
04350	0	00000	0	00014	I12	PZE	12
04351	0	00000	0	00044	I36	PZE	36
04352	0000000000023				IC	BCD	100000C
04353	0000000000042				IK	BCD	100000K
04354	0000000000044				IM	BCD	100000M
04355	0000000000047				IP	BCD	100000P
04356	0000000000062				IS	BCD	100000S

04357 000000000063
 04360 +201400000000
 04361 +203622077324
 04362 606060606060
 04363 546060606060
 04364 545460606060
 04365 547354546060
 04366 +202400000000
 04367 606060006060
 04370 600060606000
 04371 456444255121
 04372 634651606060
 04373 242545464431
 04374 452163465160
 04375 606060606051
 04376 605160262123
 04377 634651606060
 04400 606625312730
 04401 632524605160
 04402 262123634651
 04403 314523436424
 04404 314527607125
 04405 514662606060
 04406 464431636331
 04407 452760712551
 04410 466260606060
 04411 606060306060
 04412 604260606043
 04413 606060232143
 04414 236443216325
 04415 246060606060
 04416 606060602160
 04417 606060306060
 04420 604260606043
 04421 606060232143
 04422 236443216325
 04423 246060606060
 04424 606060602160
 04425 606060606060
 04426 606060606022
 04427 606060606060
 04430 606060306060

IT BCD 100000T
 CONSTANTS
 C1 OCT 201400000000 FLOATING ONE
 C2 DEC 6.2831853 2PI
 C3 BCD 1 INDICATORS FOR OUTPUT
 C4 BCD 1* X
 C5 BCD 1** X
 C6 BCD 1*,** X
 C7 DEC 2. LIMIT ON DELTA/SIGMA
 C9 BCD 2 0 0 0
 C19 BCD 5NUMERATOR DENOMINATOR R
 C20 BCD 2 R FACTOR
 C21 BCD 3 WEIGHTED R FACTOR
 C22 BCD 3INCLUDING ZEROS
 C23 BCD 3OMITTING ZEROS
 C24 BCD 6 H K L CALCULATED A
 C25 BCD 9 H K L CALCULATED A B
 C26 BCD H K L OBSERVED CALCULATED A OBS

04431 604260606043
 04432 606060606046
 04433 226225516525
 04434 246060602321
 04435 432364432163
 04436 252460606060
 04437 606060606021
 04440 606060606060
 04441 606060462262
 04442 402321436060
 04443 744622624023
 04444 214334616231
 04445 274421606060
 04446 606060306060
 04447 604260606043
 04450 606060606046
 04451 226225516525
 04452 246060602321
 04453 432364432163
 04454 252460606060
 04455 606060606021
 04456 606060606060
 04457 606060606060
 04460 226060606060
 04461 606060604622
 04462 624023214360
 04463 607446226240
 04464 232143346162
 04465 312744216060
 04466 -0 00147 0 10424
 04467 -1 00147 1 10321
 04470 -0 00457 0 00000
 04471 604446242540
 04472 602346444764
 04473 632560263167
 04474 252460216346
 04475 446023464563
 04476 513122646331
 04477 464562606060
 04500 602346444764
 04501 632560266046
 04502 516026606250
 04503 642151252460

BCD 4-CAL (OBS-CAL)/SIGMA

C27 BCD H K L OBSERVED CALCULATED A

BCD 6B OBS-CAL (OBS-CAL)/SIGMA

C28 MZE T58,0,103
 C29 MON S1+12,1,103
 C30 MZE 0,0,303
 C31 BCD 1 MODE-
 C32 BCD 6 COMPUTE FIXED ATOM CONTRIBUTIONS

C33 BCD 4 COMPUTE F OR F SQUARED

04504 602346444764
 04505 632560242551
 04506 316521633165
 04507 256260264651
 04510 604325216263
 04511 606250642151
 04512 256260606060
 04513 604325216263
 04514 606250642151
 04515 256260646231
 04516 452760464324
 04517 602425513165
 04520 216331652562
 04521 602221622524
 04522 604645606060
 04523 602660606060
 04524 602660625064
 04525 215125246060
 04526 606325444725
 04527 512163645125
 04530 602621236346
 04531 516240606060
 04532 606270444425
 04533 635131236060
 04534 602145316246
 04535 635146473123
 04536 602223246046
 04537 646347646340
 04540 602664434360
 04541 604721516331
 04542 214360606060
 04543 604546452560
 04544 602231452151
 04545 706046646347
 04546 646340606060
 04547 606330516460
 04550 263167252460
 04551 216346446023
 04552 464563513122
 04553 646331464562
 04554 606330516460
 04555 266046516026
 04556 606250642151

C34 BCD 7 COMPUTE DERIVATIVES FOR LEAST SQUARES

 C35 BCD 6 LEAST SQUARES USING OLD DERIVATIVES

 C36 BCD 2 BASED ON
 C37 BCD 1 F
 C38 BCD 2 F SQUARED
 C39 BCD 4 TEMPERATURE FACTORS-

 C40 BCD 2 SYMMETRIC
 C41 BCD 2 ANISOTROPIC
 C42 BCD 2 BCD OUTPUT-
 C43 BCD 1 FULL
 C44 BCD 2 PARTIAL

 C45 BCD 1 NONE
 C46 BCD 3 BINARY OUTPUT-

 C47 BCD 5 THRU FIXED ATOM CONTRIBUTIONS

 C48 BCD 4 THRU F OR F SQUARED

04557 252460606060
04560 606330516460
04561 242551316521
04562 633165256260
04563 604622622551
04564 652524602660
04565 465160266062
04566 506421512524
04567 606346602225
04570 602346456231
04571 242551252460
04572 603127454651
04573 252460606060
04574 604525646351
04575 464560606060
04576 606740512170
04577 606631633060
04600 606060423145
04601 246260462660
04602 264651446026
04603 212363465162
04604 604564442225
04605 516046266021
04606 634644626031
04607 456021627044
04610 442563513123
04611 606445316340
04612 602325456351
04613 466270444425
04614 635131236060
04615 602123254563
04616 513123606060
04617 604564442225
04620 516046266062
04621 704444256351
04622 706023215124
04623 626046516062
04624 704444256351
04625 706051466463
04626 314525624060
04627 604564442225
04630 516046266062
04631 232143256026

C49 BCD 3 THRU DERIVATIVES

C50 BCD 5 OBSERVED F OR F SQUARED TO BE

C51 BCD 2 CONSIDERED

C52 BCD 2 IGNORED

C53 BCD 2 NEUTRON

C54 BCD 6 X-RAY WITH KINDS OF FORM FACTORS

C55 BCD 6 NUMBER OF ATOMS IN ASYMMETRIC UNIT-

C56 BCD 3 CENTROSYMMETRIC

C57 BCD 2 ACENTRIC

C58 BCD 8 NUMBER OF SYMMETRY CARDS OR SYMMETRY ROUTINES-

C59 BCD 5 NUMBER OF SCALE FACTORS-

04632	212363465162				
04633	406060606060				
04634	0 00000 0 00017	C60	PZE 15	MASK USED TO DECODE SYMMETRY CARDS	
04635	606462256027	C61	BCD 5	USE GENERAL SYMMETRY ROUTINE	
04636	254525512143				
04637	606270444425				
04640	635170605146				
04641	646331452560				
04642	606270444425	C62	BCD 6	SYMMETRY ROUTINES SUPPLIED BY USER	
04643	635170605146				
04644	646331452562				
04645	606264474743				
04646	312524602270				
04647	606462255160				
04650	606250642151	C63	BCD	SQUARE ROOT (SUM W(OBS-CALC)**2/(M-N))	
04651	256051464663				S
04652	607462644460				
04653	667446226240				
04654	232143233454				
04655	540261744440				
04656	453434606060				
04657	606060606060				
04660	606060606060				
04661	606060606062				
04662	505163746060		BCD 3QRT(	0- 0)	
04663	600040606000				
04664	346060606060				
04665	0 00000 0 77760	C64	PZE K1	ADDRESS OF FIRST INTERSEGMENT TEMPORARY	
04666	604721512144	C65	BCD	PARAMETER	OLD CHANGE NEW ERROR
04667	256325516060				
04670	606060606060				
04671	606046432460				
04672	606060606023				
04673	302145272560				
04674	606060606060				
04675	452566606060				
04676	606060602551				
04677	514651606060				
04700	622321432560	C66	BCD 2SCALE	FACTOR	
04701	262123634651				
04702	466525512143	C67	BCD 2OVERALL	B	
04703	436022606060				
04704	602163464460	C68	BCD 1	ATOM	

8-15
112

0470
113

04705	602646514460	C69	BCD 2 FORM FACTOR	
04706	262123634651			
04707	606760606060		BCD 2 X	
04710	606060606060			
04711	607060606060		BCD 2 Y	
04712	606060606060			
04713	607160606060		BCD 2 Z	
04714	606060606060			
	04715	C70	BSS 2	TO BE SET
04717	602225632174		BCD 2 BETA(2,2)	
04720	027302346060			
04721	602225632174		BCD 2 BETA(3,3)	
04722	037303346060			
04723	602225632174		BCD 2 BETA(1,2)	
04724	017302346060			
04725	602225632174		BCD 2 BETA(1,3)	
04726	017303346060			
04727	602225632174		BCD 2 BETA(2,3)	
04730	027303346060			
04731	602163464431	C71	BCD 2 ATOMIC B	
04732	236022606060			
04733	602225632174	C72	BCD 2 BETA(1,1)	
04734	017301346060			
04735	-0 00025 1 00000	C75	FOR 0,1,21	X-RAY FORM FACTOR OUTPUT
04736	-3 15561 1 00000	C76	SVN 0,1,7025	NEUTRON FORM FACTOR OUTPUT
04737	0 00026 0 00000	C77	PZE 0,0,22	
04740	0 00000 0 04705	C78	PZE C69	ADDRESS OF FIRST TITLE
04741	606270444425	C79	BCD 9 SYMMETRIC CONVERTED TO ANISOTROPIC BEFORE REFINING	
04742	635131236023			
04743	464565255163			
04744	252460634660			
04745	214531624663			
04746	514647312360			
04747	222526465125			
04750	605125263145			
04751	314527606060			
04752	+177400000000	C80	DEC .25	
04753	+202400000000	C81	DEC 2.	
04754	606325444725	C82	BCD TEMPERATURE FACTOR OF ATOM	IS NOT POSITIVE-DEFINITE.
04755	512163645125			
04756	602621236346			
04757	516046266021			
04760	634644606060			

04761 603162604546
 04762 636047466231
 04763 633165254024
 04764 252631453163
 04765 253360606060
 04766 602431622351
 04767 254721452370
 04770 602621236346
 04771 516260222162
 04772 252460464560
 04773 314547646360
 04774 472151214425
 04775 632551623360
 04776 602562633144
 04777 216325604626
 05000 602221622524
 05001 604645604664
 05002 634764636047
 05003 215121442563
 05004 255162336060
 05005 606364514560
 05006 464560622545
 05007 622560626631
 05010 632330606060
 05011 634660626447
 05012 475125626260
 05013 464540433145
 05014 256047513145
 05015 633145276046
 05016 266060606060
 05017 472151214425
 05020 632551623360
 05021 266046516026
 05022 606250642151
 05023 252433606060
 05024 0 00000 0 00020
 05025 3 77777 7 77323
 05026 0 00000 0 00300
 05027 0 00000 0 00200
 05030 0 76000 0 00166
 05031 0 02000 0 05033
 05032 0 02000 4 00003

C83 BCD 8 DISCREPANCY FACTORS BASED ON INPUT PARAMETERS.

C84 BCD 2 ESTIMATE OF

C85 BCD 5 BASED ON OUTPUT PARAMETERS.

C86 BCD TURN ON SENSE SWITCH TO SUPPRESS ON-LINE PRINTING OF

C87 BCD 2 PARAMETERS.

C88 BCD 3F OR F SQUARED.

C89	PZE 16	NO. OF INTERSEGMENT STORAGE LOCATIONS
C90	PTH -START,7,32767	USED TO COMPUTE LENGTH OF DUMMY RECORD
C91	PZE 192	LENGTH OF DUMMY RECORD 3
C92	PZE 128	LENGTH OF DUMMY RECORD 4
	SUBROUTINE TO CHECK IDENTIFICATION LETTER	
IFF	SWT 6	
	TRA IFF1	
	TRA 3,4	

845
114

05033 0 50000 4 00001 IFF1 CLA 1,4
05034 0 62100 0 05040 STA IFF2
05035 0 77100 0 00022 ARS 18
05036 0 62100 0 05043 STA IFF3
05037 0 62100 0 05056 STA IFF6
05040 0 50000 0 00000 IFF2 CLA 0 ADDRESS TO BE SET
05041 -0 32000 0 05133 ANA IFF11
05042 0 60100 0 05134 STO IFF12
05043 0 34000 0 00000 IFF3 CAS 0 ADDRESS TO BE SET
05044 -1 00000 0 05046 IFF4 TXI IFF5,0,0
05045 0 02000 4 00003 TRA 3,4
05046 -0 63400 4 05044 IFF5 SXD IFF4,4
05047 0 07400 4 06147 TSX OUT,4
05050 0 07400 4 05254 TSX ECHO,4
05051 3 02015 0 05134 PTH IFF12,0,1037
05052 3 13624 0 05076 PTH IFF7,0,6036
05053 -1 00000 0 00364 FVE 244
05054 0 07400 4 06147 TSX OUT,4
05055 0 07400 4 05254 TSX ECHO,4
05056 3 02015 0 00000 IFF6 PTH 0,0,1037 ADDRESS TO BE SET
05057 3 13624 0 05104 PTH IFF8,0,6036
05060 -1 00000 0 00364 FVE 244
05061 0 07400 4 06147 TSX OUT,4
05062 0 07400 4 05254 TSX ECHO,4
05063 3 15602 0 05112 PTH IFF9,0,7042
05064 -1 00000 0 00364 FVE 244
05065 0 07400 4 06147 TSX OUT,4
05066 0 07400 4 05254 TSX ECHO,4
05067 3 23514 0 05121 PTH IFF10,0,10060
05070 -1 00000 0 00364 FVE 244
05071 0 07400 4 06147 TSX OUT,4
05072 0 07400 4 05254 TSX ECHO,4
05073 -1 00000 0 00361 FVE 241
05074 -0 53400 4 05044 LXD IFF4,4
05075 0 00000 4 00002 HTR 2,4
05076 602421632160 IFF7 BCD 6 DATA CARD IDENTIFICATION LETTER IS
05077 232151246031
05100 242545633126
05101 312321633146
05102 456043256363
05103 255160316260
05104 604751462751 IFF8 BCD 6 PROGRAM CALLS FOR CARD WITH LETTER
05105 214460232143

010
115

05106 436260264651
 05107 602321512460
 05110 663163306043
 05111 256363255160
 05112 604764636023
 05113 465151252363
 05114 602321512460
 05115 314560512521
 05116 242551602145
 05117 246047514623
 05120 252524336060
 05121 606346602270
 05122 472162626021
 05123 434360312425
 05124 456331263123
 05125 216331464560
 05126 632562636260
 05127 636451456046
 05130 456062254562
 05131 256062663163
 05132 233060063360

IFF9 BCD 7 PUT CORRECT CARD IN READER AND PROCEED.

IFF10 BCD TO BYPASS ALL IDENTIFICATION TESTS TURN ON SENSE SWITCH 6.

05133 0 00000 0 00077
 05134 0 00000 0 00000

IFF11 PZE 63
 IFF12

MASK
 LETTER FROM GARD

SUBROUTINE TO TEST FOR BLANK FIELD

05135 -0 63400 1 05143
 05136 0 50000 4 00001
 05137 0 62100 0 05141
 05140 -0 73400 1 00000
 05141 0 50000 1 00000
 05142 0 34000 0 05152
 05143 1 00000 0 05145
 05144 0 02000 0 05147
 05145 -0 53400 1 05143
 05146 0 02000 4 00003
 05147 2 00001 1 05141
 05150 -0 53400 1 05143
 05151 0 02000 4 00002
 05152 606060606060

BLNK SXD BLNK2,1
 CLA 1,4
 STA BLNK1
 PDX 0,1
 BLNK1 CLA 0,1
 GAS BLNK5
 BLNK2 TXI BLNK3,0,0
 TRA BLNK4
 BLNK3 LXD BLNK2,1
 TRA 3,4
 BLNK4 TIX BLNK1,1,1
 LXD BLNK2,1
 TRA 2,4
 BLNK5 BCD 1

ADDRESS TO BE SET

OCTAL AND FLOATING DECIMAL DUMP FOR TEST PURPOSES

05153 0 07400 4 06147
 05154 0 07400 4 05254
 05155 3 27451 0 10406
 05156 3 02066 0 04362

DUMP TSX OUT,4
 TSX ECHO,4
 PTH T55,0,12073
 PTH C3,0,1078

010
 116

114
 1221

05157	1	00001	0	00003		PON	U2,0,1
05160	0	53400	1	05252		LXA	DUMP7,1
05161	0	07400	4	06147	DUMP1	TSX	OUT,4
05162	0	07400	4	05254		TSX	ECHO,4
05163	-2	17531	1	00000		SIX	0,1,8025
05164	-2	17562	1	00001		SIX	1,1,8050
05165	-2	17613	1	00002		SIX	2,1,8075
05166	-2	17644	1	00003		SIX	3,1,8100
05167	1	00000	0	00003		PON	U2,0,0
05170	-0	75400	1	00000		PXD	0,1
05171	0	77100	0	00022		ARS	18
05172	0	76000	0	00006		COM	
05173	0	40000	0	04336		ADD	11
05174	0	73400	2	00000		PAX	0,2
05175	-0	75400	2	00000		PXD	0,2
05176	0	76500	0	00043		ERS	35
05177	0	53400	4	04343		LXA	16,4
05200	0	76700	0	00003	DUMP8	ALS	3
05201	-0	76300	0	00003		LGL	3
05202	2	00001	4	05200		TIX	DUMP8,4,1
05203	-0	50100	0	05253		ORA	DUMP9
05204	0	60200	0	05251		SLW	DUMP6+8
05205	0	53400	2	04345		LXA	18,2
05206	0	56000	1	00000	DUMP2	LDQ	0,1
05207	0	53400	4	04343		LXA	16,4
05210	0	76700	0	00003	DUMP3	ALS	3
05211	-0	76300	0	00003		LGL	3
05212	2	00001	4	05210		TIX	DUMP3,4,1
05213	0	60200	2	05251		SLW	DUMP6+8,2
05214	0	53400	4	04343		LXA	16,4
05215	0	76700	0	00003	DUMP4	ALS	3
05216	-0	76300	0	00003		LGL	3
05217	2	00001	4	05215		TIX	DUMP4,4,1
05220	0	60200	2	05252		SLW	DUMP6+9,2
05221	1	77777	1	05222		TXI	DUMP5,1,-1
05222	2	00002	2	05206	DUMP5	TIX	DUMP2,2,2
05223	0	07400	4	06147		TSX	OUT,4
05224	0	07400	4	05254		TSX	ECHO,4
05225	3	01756	0	05251		PTH	DUMP6+8,0,1006
05226	3	01772	0	05241		PTH	DUMP6,0,1018
05227	3	02001	0	05242		PTH	DUMP6+1,0,1025
05230	3	02023	0	05243		PTH	DUMP6+2,0,1043
05231	3	02032	0	05244		PTH	DUMP6+3,0,1050

05232	3	02054	0	05245	PTH	DUMP6+4,0,1068	
05233	3	02063	0	05246	PTH	DUMP6+5,0,1075	
05234	3	02105	0	05247	PTH	DUMP6+6,0,1093	
05235	3	02114	0	05250	PTH	DUMP6+7,0,1100	
05236	1	00060	0	00003	PON	U2,0,48	
05237	3	66653	1	05161	TXH	DUMP1,1,-T5-256	DECREMENT IS -(FINAL ADDRESS+1)
05240	0	02000	0	00144	TRA	RCD	
				05241	DUMP6	BSS 9	
05252	0	00000	0	67473	DUMP7	PZE -S1	-(INITIAL ADDRESS)
05253	6009900000000				DUMP9	BCD 1 00000	
							SUBROUTINE TO TEST NATURE OF ERROR RETURN FROM NY OUT3
05254	0	12000	0	05272	ECHO	TPL EGH04	
05255	-0	10000	0	05272	TNZ	EGH04	
05256	-0	63400	4	05310	SXD	EGH07,4	
05257	0	07400	4	06147	TSX	OUT,4	
05260	0	02000	0	05263	TRA	EGH02	
05261	3	15602	0	05301	PTH	EGH06,0,7042	
05262	-1	00000	0	00000	ECHO1	FVE	
05263	-0	53400	4	05310	ECHO2	LXD EGH07,4	
05264	-0	50000	4	00001	ECHO3	CAL 1,4	
05265	-0	77100	0	00041	ARS	33	
05266	0	34000	0	05300	CAS	EGH05	
05267	1	77777	4	05264	TXI	EGH03,4,-1	
05270	0	02000	4	00002	TRA	2,4	TO NORMAL RETURN OF NY OUT3
05271	1	77777	4	05264	TXI	EGH03,4,-1	
05272	-0	75400	4	00000	ECHO4	PXD 0,4	
05273	0	76000	0	00006	COM		
05274	-0	73400	4	00000	PDX	0,4	
05275	-0	75400	4	00000	PXD	0,4	
05276	0	77100	0	00022	ARS	18	
05277	0	00000	0	00144	HTR	RCD	CALLING SEQUENCE ERROR. ADDRESS IN ACC.
05300	-0	00000	0	00005	ECHO5	PZE 5	
05301	605454546047				ECHO6	BCD 7 *** PRINTER ERROR IN PREVIOUS LINE ***	
05302	513145632551						
05303	602551514651						
05304	603145604751						
05305	256531466462						
05306	604331452560						
05307	545454606060						
05310	0 00000	0	00000		ECHO7	PZE	INDEX SAVED IN DECREMENT
							SUBROUTINE TO SUPPRESS ON-LINE PRINTING OF PARAMETERS
05311	0	50000	4	00001	SWTP	CLA 1,4	
05312	0	62100	0	05331	STA	SWTP5	

05313	0	76000	0	00164	SWT	4	
05314	0	02000	0	05327	TRA	SWTP4	
05315	0	50000	0	05335	CLA	SWTP8	
05316	0	10000	0	05325	TZE	SWTP2	
05317	0	60000	0	05335	STZ	SWTP8	
05320	-0	63400	4	05326	SXD	SWTP3,4	
05321	0	07400	4	06147	SWTP1	TSX OUT,4	
05322	0	07400	4	05254		TSX ECHO,4	
05323	-1	00000	0	00361		FVE 241	
05324	-0	53400	4	05326		LXD SWTP3,4	
05325	0	56000	0	05333	SWTP2	LDQ SWTP6	
05326	1	00000	0	05331	SWTP3	TXI SWTP5,0,0	INDEX SAVED IN DECREMENT
05327	0	56000	0	05334	SWTP4	LDQ SWTP7	
05330	-0	60000	0	05335		STQ SWTP8	
05331	-0	62000	0	00000	SWTP5	SLQ 0	ADDRESS TO BE SET
05332	0	02000	4	00002		TRA 2,4	
05333	0	76100	0	00000	SWTP6	NOP	CONSTANT
05334	-1	00000	0	00000	SWTP7	FVE	CONSTANT
05335	0	00000	0	00000	SWTP8	PZE	INDICATOR
SUBROUTINE TO SUPPRESS ON-LINE PRINTING OF F OR F**2							
05336	0	50000	4	00001	SWTF	CLA 1,4	
05337	0	62100	0	05356		STA SWTF5	
05340	0	76000	0	00163		SWT 3	
05341	0	02000	0	05354		TRA SWTF4	
05342	0	50000	0	05362		CLA SWTF8	
05343	0	10000	0	05352		TZE SWTF2	
05344	0	60000	0	05362		STZ SWTF8	
05345	-0	63400	4	05353		SXD SWTF3,4	
05346	0	07400	4	06147	SWTF1	TSX OUT,4	
05347	0	07400	4	05254		TSX ECHO,4	
05350	-1	00000	0	00361		FVE 241	
05351	-0	53400	4	05353		LXD SWTF3,4	
05352	0	56000	0	05360	SWTF2	LDQ SWTF6	
05353	1	00000	0	05356	SWTF3	TXI SWTF5,0,0	INDEX SAVED IN DECREMENT
05354	0	56000	0	05361	SWTF4	LDQ SWTF7	
05355	-0	60000	0	05362		STQ SWTF8	
05356	-0	62000	0	00000	SWTF5	SLQ 0	ADDRESS TO BE SET
05357	0	02000	4	00002		TRA 2,4	
05360	0	76100	0	00000	SWTF6	NOP	CONSTANT
05361	-1	00000	0	00000	SWTF7	FVE	CONSTANT
05362	0	00000	0	00000	SWTF8	PZE	INDICATOR
THE FOLLOWING SUBROUTINES ARE ON RELOCATABLE CARDS							
05363		DBD1	BSS	136			

05573 FILE BSS 197
 06100 BUFFER BSS 14
 06116 SQRT BSS 25
 06147 OUT BSS 408
 06777 SIN BSS 24
 07027 EXP BSS 35
 07072 TABLES BSS 651

SENSE INDICATORS

10305 0 00000 0 00000 S1
 10306 0 00000 0 00001 S2 PZE 1
 10307 0 00000 0 00001 S3 PZE 1
 10310 0 00000 0 00001 S4 PZE 1
 10311 0 00000 0 00002 S5 PZE 2
 10312 0 00000 0 00001 S6 PZE 1
 10313 0 00000 0 00000 S7
 10314 0 00000 0 00000 S8
 10315 0 00000 0 00000 S9
 10316 0 00000 0 00000 S10
 10317 0 00000 0 00001 S15 PZE 1
 10320 0 00000 0 00001 S11 PZE 1
 10321 0 00000 0 00000 S12
 10322 0 00000 0 00000 S13
 10323 0 00000 0 00000 S14

MODE INDICATOR
 F OR F SQUARED INDICATOR
 SYMM OR ANIS INDICATOR
 BCD OUTPUT INDICATOR
 BINARY OUTPUT YES OR NO
 OBSERVED TO BE CONSIDERED
 NUMBER OF FORM FACTOR TABLES
 NUMBER OF ATOMS IN ASYMMETRIC UNIT
 CENTRO OR ACENTRIC
 NO. OF SYMM CARDS OR SYMM ROUTINES
 GENERAL OR USERS SYMMETRY ROUTINE
 NO. OF SCALE FACTORS
 FIXED ATOM CONTRIBUTION INDICATOR
 ARE DERIVATIVES COMPUTED
 EXTENT OF BINARY OUTPUT

TEMPORARY STORAGE

10316 I1 SYN S10
 10314 T2 SYN S8
 10320 T3 SYN S11
 10313 T4 SYN S7

10324 0 00000 0 00000 T61
 10325 0 00000 0 00000 T6
 10326 0 00000 0 00000 T7
 10327 0 00000 0 00000 T8
 10330 0 00000 0 00000 T11
 10331 0 00000 0 00000 T9
 10332 0 00000 0 00000 T10
 10333 0 00000 0 00000 T12
 10334 0 00000 0 00000 I13
 10335 0 00000 0 00000 I14
 10336 0 00000 0 00000 T15
 10337 0 00000 0 00000 I16
 10340 0 00000 0 00000 T17
 10341 0 00000 0 00000 T18
 10342 0 00000 0 00000 T19

COMP LOC FIRST SYMMETRY CODE WORD
 COMP LOC FIRST ATOM PARAMETER
 COMP LOC SUMMATION STORAGE
 COMP LOC DERIVATIVE STORAGE
 COMP LOC FORM FACTOR STORAGE
 NO. OF ATOMIC PARAMETERS
 NO. OF INTERMEDIATE SUMS
 T(J)
 H(J)
 K(J)
 L(J)
 H**2(J)
 K**2(J)
 L**2(J)
 ZHK(J)

10343	0	00000	0	00000	T20
10344	0	00000	0	00000	T21
10345	0	00000	0	00000	T22
10346	0	00000	0	00000	T23
10347	0	00000	0	00000	T24
10350	0	00000	0	00000	T25
10351	0	00000	0	00000	T26
10352	0	00000	0	00000	T27
10353	0	00000	0	00000	T28
10354	0	00000	0	00000	T29
10355	0	00000	0	00000	T30
10356	0	00000	0	00000	T31
10357	0	00000	0	00000	T32
10360	0	00000	0	00000	T33
10361	0	00000	0	00000	T34
10362	0	00000	0	00000	T35
10363	0	00000	0	00000	T36
10364	0	00000	0	00000	T37
10365	0	00000	0	00000	T38
10366	0	00000	0	00000	T39
10367	0	00000	0	00000	T40
10370	0	00000	0	00000	T41
10371	0	00000	0	00000	T42
10372	0	00000	0	00000	T43
10373	0	00000	0	00000	T44
10374	0	00000	0	00000	T45
10375	0	00000	0	00000	T46
10376	0	00000	0	00000	T47
10377	0	00000	0	00000	T48
10400	0	00000	0	00000	T49
10401	0	00000	0	00000	T50
10402	0	00000	0	00000	T51
10403	0	00000	0	00000	T52
10404	0	00000	0	00000	T53
10405	0	00000	0	00000	T54
			10406	T55	BSS 12
10422	0	00000	0	00000	T56
10423	0	00000	0	00000	T57
10424	0	00000	0	00000	T58
10425	0	00000	0	00000	T59
			10426	T60	BSS 6
10434	0	00000	0	00000	T62
			10435	T63	BSS 6

```

2HL(J)
2KL(J)
TRIG ARGUMENT (I,J)
INDEX I IN DECREMENT
SIN(I,J), EXP(I,J)SIN(I,J)
COS(I,J), EXP(I,J)COS(I,J)
EXP ARGUMENT (I,J)
EXP(I,J)
INDEX J IN DECREMENT
F(I), SYM T.F.(I)F(I)
SYM T.F.(I)
F(I)SYM T.F.(I)SUM(I)EXP(I,J)COS(I,J)
F(I)SYM T.F.(I)SUM(I)EXP(I,J)SIN(I,J)
2PI-F(I)SYM T.F.(I)
MINUS 2PI F(I)SYM T.F.(I)
MINUS F(I)SYM T.F.(I)
OVERALL T.F., SCALE*OV.T.F
SCALE FACTOR
COEFFICIENT OF D A/D PARAMETER
COEFFICIENT OF D B/D PARAMETER
A**2, (A**2+B**2)**(1/2), A**2+B**2
5 FOR SYM OR 10 FOR ANIS T.F.
R FACTOR NUMERATOR
SAME OMITTING UNOBSERVEDS
WEIGHTED R FACTOR NUMERATOR
SAME OMITTING UNOBSERVEDS
R FACTOR DENOMINATOR
WEIGHTED R FACTOR DENOMINATOR
(OBS-CALC)/SIGMA
W*OBS**2
HOLLERITH DISAGREEMENT INDICATOR
R FACTOR
SAME OMITTING UNOBSERVEDS
WEIGHTED R FACTOR
SAME OMITTING UNOBSERVEDS
IDENTIFICATION OF PROBLEM
INDEX 4 IN DECREMENT
W(OBS-CALC)**2
SENSE INPUT TO TEST FOR BLANK
MACHINE CAPACITY LESS ONE
COMPONENTS OF TRANSFORMED INDICES
COMP CURRENT LOC SYMM CODE WORD
HOLLERITH INPUT FROM SYMMETRY CARDS

```

10443	0	00000	0	00000	T64
10444	0	00000	0	00000	T65
10445	0	00000	0	00000	T66
10446	0	00000	0	00000	T67
10447	0	00000	0	00000	T68
10450	0	00000	0	00000	T69
				10451	T70
10453	0	00000	0	00000	T71
10454	0	00000	0	00000	T72
10455	0	00000	0	00000	T73
10456	0	00000	0	00000	T74
10457	0	00000	0	00000	T75
10460	0	00000	0	00000	T76
10461	0	00000	0	00000	T77
10462	0	00000	0	00000	T78
10463	0	00000	0	00000	T79
10464	0	00000	0	00000	T80
10465	0	00000	0	00000	T81
10466	0	00000	0	00000	T82
10467	0	00000	0	00000	T83
10470	0	00000	0	00000	T84
10471	0	00000	0	00000	T85
10472	0	00000	0	00000	T86
10473	0	00000	0	00000	T87
10474	0	00000	0	00000	T88
10475	0	00000	0	00000	T89
10476	0	00000	0	00000	T90
10477	0	00000	0	00000	T91
10500	0	00000	0	00000	T92
10501	0	00000	0	00000	T93
10502	0	00000	0	00000	T94
10503	0	00000	0	00000	T95
10504	0	00000	0	00000	T96
10505	0	00000	0	00000	M1
10506	0	00000	0	00000	M2
10507	0	00000	0	00000	M3
10510	0	00000	0	00000	M4
10511	0	00000	0	00000	M5
10512	0	00000	0	00000	M6
10513	0	00000	0	00000	M7
10514	0	00000	0	00000	M8
10515	0	00000	0	00000	M9

BSS 2

DATA AND OUTPUT TEMPORARIES .

NUMBER OF SYMMETRY CODE WORDS
 M, NUMBER OF REFLECTIONS USED
 SUM W(OBS-CALC)**2 FOR REFLECTIONS USED
 N, NUMBER OF PARAMETERS VARIED
 SQRT (SUM W(OBS-CALC)**2/(M-N))
 DISCARDS COPIED HERE
 PARAMETER TITLE FOR OUTPUT
 SCALE FACTOR OR ATOM NUMBER
 OLD PARAMETER
 NEW PARAMETER
 STANDARD ERROR OF PARAMETER
 INDEX P IN DECREMENT
 INDEX I IN DECREMENT
 INDEX Q IN DECREMENT
 A*
 B*
 G*
 COS GAMMA*
 COS BETA*
 COS ALPHA*
 (.25)(A*)(A*)
 (.25)(B*)(B*)
 (.25)(C*)(C*)
 (.25)(A*)(B*)(COS GAMMA*)
 (.25)(A*)(G*)(COS BETA*)
 (.25)(B*)(C*)(COS ALPHA*)
 5(NO. OF ATOMS)
 B(I), OVERALL B
 INDICATOR FOR POS-DEF TEMP. FACTOR
 USED FOR TESTS ON TEMP. FACTORS
 CORRECTION TO SUM W(OBS-CALC)**2
 SQRT (SUM W(OBS-CALC)**2)
 HALF LENGTH OF CODE DUMP
 H
 K
 L
 OBS
 SQRT W=1/SIGMA
 SCALE FACTOR IDENTIFICATION
 (SIN THETA/LAMBDA)**2
 FIXED ATOM A
 FIXED ATOM B

10516	0	00000	0	00000	M10
10517	0	00000	0	00000	M11
10520	0	00000	0	00000	M12
10521	0	00000	0	00000	M13
10522	0	00000	0	00000	M14
10523	0	00000	0	00000	M15
10524	0	00000	0	00000	M16

A
B
GALC
OBS-CALC
REJECTION INDICATOR
D CALC/D SCALE
D CALC/D OVERALL T.F.

10525	0	00000	0	10526	T5
10526	0	00000	0	00000	XD1

THE FOLLOWING MAY BE CHANGED BY THE USER
PZE XD1 ADDRESS OF LAST LOC USED
SYMMETRY ROUTINES IF WRITTEN BY USER

IMMEDIATELY FOLLOWING THE ADDRESS SPECIFIED IN T5 THE
PROGRAM ASSIGNS THE FOLLOWING STORAGE-

SCALE FACTORS.
OVERALL TEMPERATURE FACTOR.
SIX SYMMETRY CODE WORDS FOR EACH SYMMETRY CARD.
FIVE OR TEN PARAMETERS PER ATOM.
FORM FACTORS UNLESS PROBLEM IS NEUTRON ONE.
FIVE, TEN, OR TWENTY LOCATIONS PER ATOM USED
FOR DERIVATIVES OF A AND B.

THIS AREA LATER USED FOR PARAMETER CHANGES AND
DIAGONAL ELEMENTS OF INVERSE MATRIX.
FIVE OR TEN LOCATIONS PER ATOM USED FOR
DERIVATIVES OF F OR F SQUARED.

THE PROGRAM ASSIGNS THE FOLLOWING STORAGE
IMMEDIATELY PRECEEDING INTERSEGMENT STORAGE-
PARAMETER SELECTION WORDS.

INTERSEGMENT TEMPORARY STORAGE

ORG 32752

				77760	
77760	0	00000	0	00000	K1
77761	0	00000	0	00000	K2
77762	0	00000	0	00000	K3
77763	0	00000	0	00000	K4
77764	0	00000	0	00000	K5
77765	0	00000	0	00000	K6
77766	0	00000	0	00000	K7
77767	0	00000	0	00000	K8
77770	0	00000	0	00000	K9
77771	0	00000	0	00000	K10
77772	0	00000	0	00000	K11
77773	0	00000	0	00000	K12
77774	0	00000	0	00000	K13
77775	0	00000	0	00000	K14
77776	0	00000	0	00000	K15

NUMBER OF PARAMETER SELECTION WORDS
NUMBER OF PARAMETERS TO BE VARIED
NUMBER OF SCALE FACTORS TO BE VARIED
NUMBER OF KINDS OF FORM FACTORS
COMP. DERIV. ADDRESS IN DECREMENT
BIT COUNTER IN DECREMENT
SELECTION WORD COUNTER IN DECREMENT
PARTLY SHIFTED SELECTION WORD
BY-PASS INDICATOR
COMP. INITIAL DERIVATIVE ADDRESS
INITIAL MATRIX ADDRESS +N
INITIAL VECTOR ADDRESS
MODE NUMBER
INITIAL MATRIX ADDRESS
INITIAL SELECTION WORD ADDRESS

77777 0 00000 0 00000 K16

-MATRIX ADDRESS,0,-VECTOR ADDRESS

THIS SECTION SUPPLIES ORIGIN CARDS FOR THE SUBROUTINES

00000 0 00000 0 00000
 00001 0 00000 0 05363
 00000 0 00000 0 00000
 00001 0 00000 0 05573
 00000 0 00000 0 00000
 00001 0 00000 0 06116
 00000 0 00000 0 00000
 00001 0 00000 0 06147
 00000 0 00000 0 00000
 00001 0 00000 0 06777
 00000 0 00000 0 00000

ORG 0
 PZE
 PZE DBD1
 ORG 0
 PZE
 PZE FILE
 ORG 0
 PZE
 PZE SQRT
 ORG 0
 PZE
 PZE OUT
 ORG 0
 PZE
 PZE SIN
 ORG 0

00000 0 53400 4 00000
 00001 0 70000 4 00002
 00002 1 77777 4 00001
 00003 0 00000 0 07072
 00004 0 76200 0 00321
 00005 0 70000 0 00000
 00006 0 76300 0 00021
 00007 0 32000 0 00027
 00010 0 70000 0 00001
 00011 0 10000 0 00000
 00012 0 73400 4 00000
 00013 0 40000 0 00000
 00014 0 40000 0 00003
 00015 0 62100 0 00020
 00016 0 62100 0 00021
 00017 0 50000 0 00000
 00020 0 70000 4 00000
 00021 0 36100 4 00000
 00022 2 00001 4 00020
 00023 0 60200 0 00002
 00024 0 50000 0 00002
 00025 0 40200 0 00001
 00026 0 10000 0 00004
 00027 0 00000 0 00037

SBL2

MU SBL 2 0026 CARDS SHIFTING BINARY LOADER-ONE CARD
 LXA 0,4 CLEAR IR4
 CPY 2,4 COPYLOADER INTO 2,3, ETC.
 TXI 1,4,32767 REPEAT UNTIL LOADER IN
 HTR TABLES SHIFTING INCREMENT
 RCD SELECT CARD READER
 CPY 0 9L IN 0 AND MQ
 LLS 17 WORD COUNT (=WC) IN AC ADDRESS
 ANA 23 EXTRACT WORD COUNT
 CPY 1 9R IN 1 (CHECK SUM)
 TZE 0 IF WC=0, HAVE TRANSFER CARD, GO TO IT
 PAX 0,4 SET IR4=WC
 ADD 0 (WC+LA) IN AC (LA=LOAD ADDRESS)
 ADD 3 (WC+LA+INC) IN AC
 STA 16 PLANT (WC+LA+INC) AS CPY ADDRESS
 STA 17 AND AS ACL ADDRESS
 CAL 0 PREPARE FOR CARD SUM
 CPY 0,4 COPY WORD FROM BINARY CARD
 ACL 0,4 AND ADD IT TO CARD SUM
 TIX 16,4,1 REPEATING UNTIL DONE
 SLW 2 FORM (CARD SUM)-(CHECK SUM)
 CLA 2 X
 SUB 1 X
 TZE 4 IF 0, PROCEED TO NEXT CARD
 HTR 31 MASK FOR WORD COUNT (HALT FOR ERROR)

845 124

00000

END 0

846 125

MATRIX STORING SEGMENT

NUMBER OF BINARY OUTPUT TAPE

```
00005    U3      EQU 5
00144    RCD     EQU 100
00146    WTB     EQU 102
00455             ORG 301
```

00455	0	02000	0	00461	START	TRA	XJA
00456	0	00000	0	00144		HTR	RCD
00457	0	02000	0	00144		TRA	RCD
00460	0	00000	0	00144		HTR	RCD
00461	0	53400	4	77774	XJA	LXA	K13,4
00462	3	00004	4	00464		TXH	XJA1,4,4
00463	3	00002	4	00465		TXH	XJA2,4,2
00464	0	00000	0	00144	XJA1	HTR	RCD
00465	0	50000	4	00717	XJA2	CLA	3XKL+3,4
00466	0	60100	0	00645		STO	XKL
00467	0	53400	4	77770		LXA	K9,4
00470	0	50000	4	00717		CLA	1XJK+1,4
00471	0	60100	0	00546		STO	XJK
00472	0	50000	0	77775		CLA	K14
00473	0	62100	0	00642		STA	XKK2
00474	0	62100	0	00643		STA	XKK3
00475	0	62100	0	00653		STA	XKO
00476	0	62100	0	00654		STA	XK01
00477	0	62100	0	00674		STA	XKT1
00500	0	50000	0	77776		CLA	K15
00501	0	62100	0	00675		STA	XKT2
00502	0	62100	0	00676		STA	XKT3
00503	0	62100	0	00515		STA	XJA3
00504	0	50000	0	77777		CLA	K16
00505	0	76700	0	00022		ALS	18
00506	0	62200	0	00561		STD	XJN1
00507	0	50000	0	77761		CLA	K2
00510	0	40000	0	00720		ADD	I3
00511	0	76500	0	00043		LRS	35
00512	0	20000	0	77761		MPY	K2
00513	0	76300	0	00042		LLS	3,4
00514	0	73400	1	00000		PAX	0,1
00515	0	60000	1	00000	XJA3	STZ	0,1
00516	2	00001	1	00515		TIX	XJA3,1,1
00517	0	53400	4	00721	XJB	LXA	I4,4
00520	0	76200	0	00225	XJB1	RTB	U3
00521	2	00001	4	00520		TIX	XJB1,4,1
00522	0	53400	4	00720	XJC	LXA	I3,4

NO ENTRY HERE

NO ENTRY HERE

INCORRECT MODE SPECIFIED

ADDRESS TO BE SET

100-443887-100

124

00523	-0	63400	4	00724	XJD	SXD T301,4
00524	0	76200	0	00225		RTB U3
00525	-0	76000	0	00012		RTT
00526	0	76100	0	00000		NOP
00527	0	70000	0	00725	XJE	CPY T302
00530	0	02000	0	00533		TRA XJF
00531	0	02000	0	00701		TRA XLE
00532	0	00000	0	00144		HTR RCD
00533	0	53400	4	00721	XJF	LXA I4,4
00534	0	70000	0	00725	XJF1	CPY T302
00535	2	00001	4	00534		TIX XJF1,4,1
00536	0	70000	0	00726	XJG	CPY T303
00537	0	50000	0	77763	XJH	GLA K4
00540	0	40000	0	00722		ADD I7
00541	0	73400	4	00000		PAX 0,4
00542	0	70000	0	00727	XJH1	CPY T304
00543	2	00001	4	00542		TIX XJH1,4,1
00544	0	70000	0	00730	XJI	CPY T305
00545	0	70000	0	00731	XJJ	CPY T306
00546	-0	53400	4	77764	XJK	LXD K5,4
00547	-0	53400	1	77765		LXD K6,1
00550	-0	53400	2	77766		LXD K7,2
00551	-0	50000	0	77767		GAL K8
00552	0	70000	4	00000	XJL	CPY 0,4
00553	0	02000	0	00556		TRA XJM
00554	0	00000	0	00000		PZE
00555	0	02000	0	00573		TRA XJT
00556	-0	76000	0	00001	XJM	PBT
00557	0	02000	0	00562		TRA XJO
00560	1	77777	4	00561	XJN	TXI XJN1,4,-1
00561	-3	00000	4	00570	XJN1	TXL XJS,4,0
00562	0	76700	0	00001	XJO	ALS 1
00563	2	00001	1	00552	XJP	TIX XJL,1,1
00564	-2	00001	2	00570	XJQ	TNX XJS,2,1
00565	0	53400	1	00723	XJR	LXA I36,1
00566	-0	50000	2	77760		GAL K1,2
00567	0	02000	0	00552		TRA XJL
00570	0	70000	0	00732	XJS	CPY T307
00571	0	02000	0	00570		TRA XJS
00572	0	00000	0	00000		PZE
00573	0	76600	0	00333	XJT	IOD
00574	-0	76000	0	00012		RTT
00575	0	02000	0	00577		TRA XJU

NO WORDS IN RECORD

OR TRA XJS

DECREMENT TO BE SET

846 128

00576	0	02000	0	00604		TRA	XJX
00577	-0	53400	4	00724	XJU	LXD	T301,4
00600	-2	00001	4	00603		TNX	XJW,4,1
00601	0	76400	0	00205	XJV	BST	U3
00602	0	02000	0	00523		TRA	XJD
00603	0	00000	0	00522	XJW	HTR	XJC
00604	0	50000	0	00730	XJX	CLA	T305
00605	-0	10000	0	00522		TNZ	XJC
00606	0	50000	0	00725	XJY	CLA	T302
00607	0	10000	0	00522		TZE	XJC
00610	0	53400	1	77762	XJZ	LXA	K3,1
00611	-3	00000	1	00640		TXL	XKK,1,0
00612	0	53400	2	77771		LXA	K10,2
00613	0	60000	2	00000	XJZ1	STZ	0,2
00614	1	77777	2	00615		TXI	XJZ2,2,-1
00615	2	00001	1	00613	XJZ2	TIK	XJZ1,1,1
00616	0	53400	2	77771	XKA	LXA	K10,2
00617	0	53400	4	00726		LXA	T303,4
00620	0	53400	1	77760		LXA	K1,1
00621	-0	50000	1	77760	XKB	CAL	K1,1
00622	-0	63400	1	00724		SXD	T301,1
00623	0	53400	1	00723		LXA	I36,1
00624	-0	76000	0	00001	XKC	PBT	
00625	0	02000	0	00633		TRA	XKG
00626	2	00001	4	00632	XKD	TIK	XKF,4,1
00627	0	56000	0	00731	XKE	LDQ	T306
00630	-0	60000	2	00000		STQ	0,2
00631	0	02000	0	00640		TRA	XKK
00632	1	77777	2	00634	XKF	TXI	XKH,2,-1
00633	-2	00001	4	00640	XKG	TNX	XKK,4,1
00634	0	76700	0	00001	XKH	ALS	1
00635	2	00001	1	00624	XKI	TIK	XKC,1,1
00636	-0	53400	1	00724	XKJ	LXD	T301,1
00637	2	00001	1	00621		TIK	XKB,1,1
00640	0	53400	1	77761	XKK	LXA	K2,1
00641	0	56000	0	00725	XKK1	LDQ	T302
00642	0	26000	1	00000	XKK2	FMP	0,1
00643	0	60100	1	00000	XKK3	STO	0,1
00644	2	00001	1	00641		TIK	XKK1,1,1
00645	0	50000	0	77772	XKL	CLA	K1,1
00646	0	62100	0	00655		STA	XK02
00647	0	62100	0	00656		STA	XK03
00650	0	53400	1	77761	XKM	LXA	K2,1

RTT FAILS 3 TIMES. START TO SKIP RECORD

ADDRESS TO BE SET
ADDRESS TO BE SET

OR TRA XKS

1001
-126-

00651	-0	75400	1	00000	XKN	PXD 0,1	
00652	-0	73400	2	00000		PDX 0,2	
00653	0	56000	1	00000	XKO	LDQ 0,1	ADDRESS TO BE SET
00654	0	26000	2	00000	XK01	FMP 0,2	ADDRESS TO BE SET
00655	0	30000	2	00000	XK02	FAD 0,2	ADDRESS TO BE SET
00656	0	60100	2	00000	XK03	STO 0,2	ADDRESS TO BE SET
00657	2	00001	2	00653	XKP	TIX XK0,2,1	
00660	-2	00001	1	00667	XKQ	TNX XKS,1,1	
00661	-0	75400	1	00000	XKR	PXD 0,1	
00662	0	77100	0	00022		ARS 18	
00663	0	40000	0	00655		ADD XK02	
00664	0	62100	0	00655		STA XK02	
00665	0	62100	0	00656		STA XK03	
00666	0	02000	0	00651		TRA XKN	
00667	0	53400	1	77761	XKS	LXA K2,1	
00670	0	56000	0	00725		LDQ I302	
00671	0	26000	0	00727		FMP I304	
00672	0	60100	0	00727		STO T304	
00673	0	56000	0	00727	XKT	LDQ T304	
00674	0	26000	1	00000	XKT1	FMP 0,1	ADDRESS TO BE SET
00675	0	30000	1	00000	XKT2	FAD 0,1	ADDRESS TO BE SET
00676	0	60100	1	00000	XKT3	STO 0,1	ADDRESS TO BE SET
00677	2	00001	1	00673	XKU	TIX XKT,1,1	
00700	0	02000	0	00522		TRA XJC	
00701	0	76200	0	00225	XLE	RTB U3	
00702	0	07400	4	00146	XLF	TSX WTB,4	
00703	0	00000	0	00005		PZE U3	
00704	0	77054	0	77323		PZE -START,0,-I36-1	
00705	0	50000	0	77777	XLG	CLA K16	
00706	0	60100	0	00711		STO XLG1	
00707	0	07400	4	00146		TSX WTB,4	
00710	0	00000	0	00005		PZE U3	
00711	0	00000	0	00000	XLG1	PZE	TO BE SET
00712	0	02000	0	00144		TRA RCD	ENTER OR-XLS4
						SENSE-SETTING WORDS	
00713	0	02000	0	00667		TRA XKS	
00714	0	50000	0	77772	3XKL	CLA K11	
00715	0	02000	0	00570		TRA XJS	
00716	-0	53400	4	77764	1XJK	LXD K5,4	
00717	0	00000	0	00001	I1	PZE 1	
00720	0	00000	0	00003	I3	PZE 3	
00721	0	00000	0	00004	I4	PZE 4	
00722	0	00000	0	00007	I7	PZE 7	

00723 0 00000 0 00044 I36 PZE 36
 00724 0 00000 0 00000 T301
 00725 0 00000 0 00000 T302
 00726 0 00000 0 00000 T303
 00727 0 00000 0 00000 T304
 00730 0 00000 0 00000 T305
 00731 0 00000 0 00000 T306
 00732 0 00000 0 00000 T307

INDEX STORED IN DECREMENT
 SQRT W
 SCALE FACTOR IDENTIFICATION
 OBS-CALC
 REJECTION INDICATOR
 D CALC/D SCALE
 DISCARDS ARE COPIED HERE

THE PROGRAM ASSIGNS THE FOLLOWING STORAGE
 IMMEDIATELY PRECEEDING INTERSEGMENT STORAGE-
 N LOCATIONS FOR THOSE DERIVATIVES USED.
 N(N+1)/2 LOCATIONS FOR THE MATRIX.
 N LOCATIONS FOR THE VECTOR.
 PARAMETER SELECTION WORDS.

INTERSEGMENT TEMPORARY STORAGE

77760	K1	EQU 32752	NUMBER OF PARAMETER SELECTION WORDS
77761	K2	EQU K1+1	NUMBER OF PARAMETERS TO BE VARIED
77762	K3	EQU K2+1	NUMBER OF SCALE FACTORS TO BE VARIED
77763	K4	EQU K3+1	NUMBER OF KINDS OF FORM FACTORS
77764	K5	EQU K4+1	COMP. DERIV. ADDRESS IN DECREMENT
77765	K6	EQU K5+1	BIT COUNTER IN DECREMENT
77766	K7	EQU K6+1	SELECTION WORD COUNTER IN DECREMENT
77767	K8	EQU K7+1	PARTLY SHIFTED SELECTION WORD
77770	K9	EQU K8+1	BY-PASS INDICATOR
77771	K10	EQU K9+1	COMP. INITIAL DERIVATIVE ADDRESS
77772	K11	EQU K10+1	INITIAL MATRIX ADDRESS +N
77773	K12	EQU K11+1	INITIAL VECTOR ADDRESS
77774	K13	EQU K12+1	MODE NUMBER
77775	K14	EQU K13+1	INITIAL MATRIX ADDRESS
77776	K15	EQU K14+1	INITIAL SELECTION WORD ADDRESS
77777	K16	EQU K15+1	-MATRIX ADDRESS,0,-VECTOR ADDRESS
00000		END 0	

				OR-XLS4	MATRIX INVERSION SEGMENT	
		00004	U1	EQU 4		NUMBER OF BINARY INPUT TAPE
		00005	U3	EQU 5		NUMBER OF BINARY OUTPUT TAPE
		00144	RCD	EQU 100		
		00146	WIB	EQU 102		
		00147	RTB	EQU 103		
		00455		ORG 301		
00455	0	02000	0	00461	START TRA XMA	
00456	0	00000	0	00144	HTR RCD	NO ENTRY HERE
00457	0	02000	0	00144	TRA RCD	
00460	0	00000	0	00144	HTR RCD	NO ENTRY HERE
00461	0	53400	4	77774	XMA LXA K13,4	
00462	3	00003	4	00504	TXH XMF,4,3	
00463	0	50000	0	77761	XMB CLA K2	
00464	0	76700	0	00022	ALS 18	
00465	0	62200	0	00471	STD XMC1	
00466	0	50000	0	77777	CLA K16	
00467	0	62100	0	00471	STA XMC1	
00470	0	07400	4	00514	XMC TSX SMI,4	
00471	0	00000	0	00000	XMC1 PZE	TO BE SET
00472	0	00000	0	00144	HTR RCD	MATRIX IS SINGULAR
00473	0	07400	4	00146	XMD TSX WTB,4	
00474	0	00000	0	00005	PZE U3	
00475	0	76720	0	77323	PZE -START,0,-SMI-228	
00476	0	50000	0	77777	XME CLA K16	
00477	0	60100	0	00502	STO XME1	
00500	0	07400	4	00146	TSX WTB,4	
00501	0	00000	0	00005	PZE U3	
00502	0	00000	0	00000	XME1 PZE	TO BE SET
00503	0	02000	0	00144	TRA RCD	ENTER OR-XLS5
00504	0	50000	0	77777	XMF CLA K16	
00505	0	62100	0	00510	STA XMF1	
00506	0	07400	4	00147	TSX RTB,4	
00507	0	00000	0	00004	PZE U1	
00510	0	00000	0	00000	XMF1 PZE	ADDRESS TO BE SET
00511	0	00000	0	00144	HTR RCD	END OF FILE
00512	0	76400	0	00204	BST U1	
00513	0	02000	0	00473	TRA XMD	
		00514	SMI	BSS 228		

THE PROGRAM ASSIGNS THE FOLLOWING STORAGE
 IMMEDIATELY PRECEEDING INTERSEGMENT STORAGE-
 N LOCATIONS USED BY OR SMI
 N(N+1)/2 LOCATIONS FOR THE MATRIX.

N LOCATIONS FOR THE VECTOR.

PARAMETER SELECTION WORDS.

INTERSEGMENT TEMPORARY STORAGE

77760	K1	EQU 32752	NUMBER OF PARAMETER SELECTION WORDS
77761	K2	EQU K1+1	NUMBER OF PARAMETERS TO BE VARIED
77762	K3	EQU K2+1	NUMBER OF SCALE FACTORS TO BE VARIED
77763	K4	EQU K3+1	NUMBER OF KINDS OF FORM FACTORS
77764	K5	EQU K4+1	COMP. DERIV. ADDRESS IN DECREMENT
77765	K6	EQU K5+1	BIT COUNTER IN DECREMENT
77766	K7	EQU K6+1	SELECTION WORD COUNTER IN DECREMENT
77767	K8	EQU K7+1	PARTLY SHIFTED SELECTION WORD
77770	K9	EQU K8+1	BY-PASS INDICATOR
77771	K10	EQU K9+1	COMP. INITIAL DERIVATIVE ADDRESS
77772	K11	EQU K10+1	INITIAL MATRIX ADDRESS +N
77773	K12	EQU K11+1	INITIAL VECTOR ADDRESS
77774	K13	EQU K12+1	MODE NUMBER
77775	K14	EQU K13+1	INITIAL MATRIX ADDRESS
77776	K15	EQU K14+1	INITIAL SELECTION WORD ADDRESS
77777	K16	EQU K15+1	-MATRIX ADDRESS, 0, -VECTOR ADDRESS

THIS SECTION PRODUCES AN ORIGIN CARD FOR THE SUBROUTINE

00000	0	00000	0	00000	ORG 0
00001	0	00000	0	00514	PZE
00000					PZE SMI
					END 0

846
132

				OR-XLS5	MATRIX-VECTOR MULTIPLICATION SEGMENT	
					NUMBER OF BINARY OUTPUT TAPE	
			00005	U3	EQU 5	
			00144	RCD	EQU 100	
			00146	WTB	EQU 102	
			00155	KE	EQU 109	
			00455		ORG 301	
00455	0	02000	0	00461	START TRA XNA	
00456	0	00000	0	00144	HTR RCD	NO ENTRY HERE
00457	0	02000	0	00144	TRA RCD	
00460	0	00000	0	00144	HTR RCD	NO ENTRY HERE
00461	0	50000	0	77776	XNA GLA K15	
00462	0	62100	0	00475	STA XND1	
00463	0	62100	0	00517	STA XNHH2	
00464	0	50000	0	77775	GLA K14	
00465	0	62100	0	00507	STA XNG	
00466	0	62100	0	00534	STA XNL	
00467	0	53400	4	77777	XNB LXA K16,4	
00470	0	53400	1	77761	LXA K2,1	
00471	0	60000	0	00566	XNC STZ T501	
00472	-0	63400	4	00571	SXD T504,4	
00473	0	53400	2	77761	LXA K2,2	
00474	0	56000	4	00000	XND LDQ 0,4	
00475	0	26000	2	00000	XND1 FMP 0,2	ADDRESS TO BE SET
00476	0	30000	0	00566	FAD T501	
00477	0	60100	0	00566	STO T501	
00500	-2	00001	2	00507	XNE TNX XNG,2,1	
00501	-0	63400	2	00502	XNEE SXD XNEE1,2	
00502	3	00000	1	00506	XNEE1 TXH XNFF,1,0	DECREMENT TO BE SET
00503	-0	63400	2	00504	XNF SXD XNF1,2	
00504	2	00000	4	00474	XNF1 TIX XND,4,0	DECREMENT TO BE SET
00505	0	00000	0	00144	HTR RCD	
00506	1	77777	4	00474	XNFF TXI XND,4,-1	
00507	0	60100	1	00000	XNG STO 0,1	ADDRESS TO BE SET
00510	-2	00001	1	00513	XNH TNX XNHH,1,1	
00511	-0	53400	4	00571	XNCC LXD T504,4	
00512	1	77777	4	00471	TXI XNC,4,-1	
00513	0	60000	0	00570	XNHH STZ T503	
00514	0	53400	1	77771	LXA K10,1	
00515	0	53400	2	77761	LXA K2,2	
00516	0	56000	1	00000	XNHH1 LDQ 0,1	
00517	0	26000	2	00000	XNHH2 FMP 0,2	ADDRESS TO BE SET
00520	0	30000	0	00570	FAD T503	
00521	0	60100	0	00570	STO T503	

00522	1	77777	1	00523		TXI	XNHH3,1,-1
00523	2	00001	2	00516	XNHH3	TIX	XNHH1,2,1
00524	0	07400	4	00146	XNI	TSX	WTB,4
00525	0	00000	0	00005		PZE	U3
00526	0	77212	0	77323		PZE	-START,0,-18-1
00527	0	53400	4	00564	XNJ	LXA	I3,4
00530	0	76600	0	00225	XNK	WTB	U3
00531	0	53400	1	77761		LXA	K2,1
00532	0	53400	2	77777		LXA	K16,2
00533	0	70000	0	00570		CPY	T503
00534	0	70000	1	00000	XNL	CPY	0,1
00535	0	70000	2	00000		CPY	0,2
00536	-0	63400	1	00537	XNM	SXD	XNM1,1
00537	2	00000	2	00541	XNM1	TIX	XNN,2,0
00540	0	00000	0	00144		HTR	RCD
00541	2	00001	1	00534	XNN	TIX	XNL,1,1
00542	0	76400	0	00205	XNO	BST	U3
00543	0	76200	0	00225		RTB	U3
00544	-0	76000	0	00012		RTT	
00545	0	76100	0	00000		NOP	
00546	0	70000	0	00567	XNP	CPY	T502
00547	0	02000	0	00546		TRA	XNP
00550	0	00000	0	00000		PZE	
00551	0	76600	0	00333	XNQ	IOD	
00552	-0	76000	0	00012		RTT	
00553	0	02000	0	00561		TRA	XNT
00554	0	77000	0	00205	XNR	WEF	U3
00555	0	53400	4	00565	XNS	LXA	I8,4
00556	0	76400	0	00205	XNS1	BST	U3
00557	2	00001	4	00556		TIX	XNS1,4,1
00560	0	02000	0	00155		TRA	KE
00561	0	76400	0	00205	XNT	BST	U3
00562	2	00001	4	00530	XNU	TIX	XNK,4,1
00563	0	00000	0	00527	XNV	HTR	XNJ
00564	0	00000	0	00003	I3	PZE	3
00565	0	00000	0	00010	I8	PZE	8
00566	0	00000	0	00000	T501		
00567	0	00000	0	00000	T502		
00570	0	00000	0	00000	T503		
00571	0	00000	0	00000	T504		

ADDRESS TO BE SET

DECREMENT TO BE SET

RTT FAILS 3 TIMES. START TO TRY AGAIN

COMPUTED PARAMETER CHANGE, X(I)
 DISCARDS COPIED HERE
 CORRECTION TO SUM W(OBS-CALC)**2
 INITIAL ADDRESS SAVED HERE

THE PROGRAM ASSIGNS THE FOLLOWING STORAGE
 IMMEDIATELY PRECEEDING INTERSEGMENT STORAGE-
 N LOCATIONS FOR THE COMPUTED PARAMETER CHANGES

N(N+1)/2 LOCATIONS FOR THE MATRIX.

N LOCATIONS FOR THE VECTOR.

PARAMETER SELECTION WORDS.

INTERSEGMENT TEMPORARY STORAGE

77760	K1	EQU 32752	NUMBER OF PARAMETER SELECTION WORDS
77761	K2	EQU K1+1	NUMBER OF PARAMETERS TO BE VARIED
77762	K3	EQU K2+1	NUMBER OF SCALE FACTORS TO BE VARIED
77763	K4	EQU K3+1	NUMBER OF KINDS OF FORM FACTORS
77764	K5	EQU K4+1	COMP. DERIV. ADDRESS IN DECREMENT
77765	K6	EQU K5+1	BIT COUNTER IN DECREMENT
77766	K7	EQU K6+1	SELECTION WORD COUNTER IN DECREMENT
77767	K8	EQU K7+1	PARTLY SHIFTED SELECTION WORD
77770	K9	EQU K8+1	BY-PASS INDICATOR
77771	K10	EQU K9+1	COMP. INITIAL SOLUTION ADDRESS
77772	K11	EQU K10+1	INITIAL MATRIX ADDRESS +N
77773	K12	EQU K11+1	INITIAL VECTOR ADDRESS
77774	K13	EQU K12+1	MODE NUMBER
77775	K14	EQU K13+1	INITIAL MATRIX ADDRESS
77776	K15	EQU K14+1	INITIAL SELECTION WORD ADDRESS
77777	K16	EQU K15+1	-MATRIX ADDRESS,0,-VECTOR ADDRESS
00000		END 0	

840 135

				OR XLS6	OUTPUT OF MATRIX OR INVERSE
		00455	START EQU 301		REFERS TO OR XLS2
		10406	T55 EQU 4358		REFERS TO OR XLS2
		77761	K2 EQU 32753		REFERS TO OR XLS2
		00125	ORG 85		
00125	0	77200	0 00205 MA	REW 5	
00126	0	76200	0 00225 MB	RTB 5	
00127	-0	76200	0 00225	RTB 5	
00130	0	50000	0 01314 MC	CLA N	
00131	-0	10000	0 00142	TNZ ME	
00132	0	07400	4 00343	TSX RTB,4	
00133	0	00000	0 00005	PZE 5	
00134	0	00000	0 76463	PZE =A	
00135	0	00000	0 00000	HTR 0	END OF FILE
00136	0	50000	0 01676	CLA A=32512+K2	
00137	0	60100	0 01314	STO N	
00140	-0	10000	0 00142 MD	TNZ ME	
00141	0	00000	0 00000	HTR 0	N IS ZERO
00142	0	76200	0 00225 ME	RTB 5	
00143	0	76200	0 00225	RTB 5	
00144	0	76200	0 00225 ME3	RTB 5	
00145	0	70000	0 01315	CPY A	
00146	0	02000	0 00144	TRA ME3	
00147	0	07400	4 00343 ME1	TSX RTB,4	
00150	0	00000	0 00005	PZE 5	
00151	0	00000	0 76463	PZE =A	
00152	0	00000	0 00000	HTR 0	END OF FILE. TAPE IS INCOMPLETE.
00153	0	53400	4 00426	LXA I12,4	
00154	0	50000	4 11262 ME2	CLA A=START+T55+12,4	
00155	0	60100	4 00445	STO TITLE+12,4	
00156	2	00001	4 00154	TIX ME2,4,1	
00157	0	76200	0 00225	RTB 5	
00160	0	76000	0 00165 MF	SWT 5	
00161	0	02000	0 00166	TRA MH	
00162	0	76200	0 00225 MG	RTB 5	
00163	0	76200	0 00225	RTB 5	
00164	0	50000	0 00417	CLA C5	
00165	0	60100	0 00245	STO MP2	
00166	0	07400	4 00343 MH	TSX RTB,4	
00167	0	00000	0 00005	PZE 5	

00330	0	50000	0	01314	MV	BSS 16
00331	0	40200	0	01313		CLA N
00332	0	76700	0	00022		SUB I
00333	0	62200	0	00334		ALS 18
00334	2	00000	2	00335	MV1	STD MV1
00335	1	00001	1	00336	MW	TXI MW,2,0
00336	-3	00000	1	00271	MW1	TXI MW1,1,1
00337	0	53400	1	00445	MX	TXL MR,1,0
00340	1	00016	1	00341		LXA J1,1
00341	-3	00000	1	00176	MX1	TXI MX1,1,14
00342	0	00000	0	00000		TXL MJ,1,0
						HTR 0
						END OF PROGRAM
						SUBROUTINE TO READ RECORD FROM TAPE
00343	0	50000	4	00001	RTB	CLA 1,4
00344	0	40000	0	00371		ADD RTB7
00345	0	60100	0	00354		STO RTB3
00346	0	50000	4	00001		CLA 1,4
00347	0	40000	0	00372		ADD RTB8
00350	0	60100	0	00366		STO RTB6
00351	-0	53400	1	00364	RTB1	LXD RTB5,1
00352	0	50000	4	00002	RTB2	CLA 2,4
00353	0	73400	2	00000		PAX 0,2
00354	0	76200	0	00220	RTB3	RTB 0
00355	-0	76000	0	00012		RTT
00356	0	76100	0	00000		NOP
00357	0	70000	2	00000	RTB4	CPY 0,2
00360	1	77777	2	00357		TXI RTB4,2,-1
00361	0	02000	4	00003		TRA 3,4
00362	0	76600	0	00333		IOD
00363	-0	76000	0	00012		RTT
00364	1	00003	0	00366	RTB5	TXI RTB6,0,3
00365	0	02000	4	00004		TRA 4,4
00366	0	76400	0	00200	RTB6	BST 0
00367	2	00001	1	00352		TXI RTB2,1,1
00370	0	00000	0	00351		HTR RTB1
00371	0	76200	0	00220	RTB7	RTB 0
00372	0	76400	0	00200	RTB8	BST 0
00373	0	02000	0	00330	C1	TRA MV
00374	-0	00006	0	01313	C2	FOR 1,0,6
00375	-2	05710	2	01314		SIX A-1,2,3016

DECREMENT SET AT N-1

DECREMENT SET AT J2

DECREMENT SET AT N
END OF PROGRAM

SUBROUTINE TO READ RECORD FROM TAPE

TO BE SET

TO BE SET

RTT FAILS 3 TIMES. START TO TRY AGAIN.
CONSTANT
CONSTANT

00376	-2	05720	2	01315		SIX	A,2,3024
00377	-2	05730	2	01316		SIX	A+1,2,3032
00400	-2	05740	2	01317		SIX	A+2,2,3040
00401	-2	05750	2	01320		SIX	A+3,2,3048
00402	-2	05760	2	01321		SIX	A+4,2,3056
00403	-2	05770	2	01322		SIX	A+5,2,3064
00404	-2	06000	2	01323		SIX	A+6,2,3072
00405	-2	06010	2	01324		SIX	A+7,2,3080
00406	-2	06020	2	01325		SIX	A+8,2,3088
00407	-2	06030	2	01326		SIX	A+9,2,3096
00410	-2	06040	2	01327		SIX	A+10,2,3104
00411	-2	06050	2	01330		SIX	A+11,2,3112
00412	-2	06060	2	01331		SIX	A+12,2,3120
00413	1	00060	0	00003		PON	3,0,48
00414	442163513167				C3	BCD	1MATRIX
00415	314565255162				C4	BCD	2INVERSE
00416	256060606060						
00417	3	03735	0	00415	C5	PTH	C4,0,2013
00420	606060606060				C6	BCD	1
00421	3	01757	0	00420	C7	PTH	C6,0,1007
00422	0	00000	0	01313	C8	PZE	I
00423	0	02000	0	00265	C9	TRA	MP1
00424	2	00000	0	00000	C10	PTW	
00425	0	00000	0	00001	I1	PZE	1
00426	0	00000	0	00014	I12	PZE	12
00427	0	00000	0	00015	I13	PZE	13
00430	0	00000	0	00020	I16	PZE	16
				00431	TITLE	BSS	12
				00445	J1	BSS	13
00462	0	00000	0	00000	J2		
				00463	OUT	BSS	408
01313	0	00000	0	00000	I		
01314	0	00000	0	00000	N		
01315	0	00000	0	00000	A		
				00000			
00000	0	00000	0	00000			
00001	0	00000	0	00463			
				00125			

LARGE POSITIVE INTEGER

FIRST COLUMN IN SECTION
LAST COLUMN IN SECTION

CURRENT ROW NUMBER
ORDER OF MATRIX
START OF STORAGE AREA

ORIGIN CARD FOR OUT

ORG 0
PZE
PZE OUT
END MA

00170	0	00000	0	76463		PZE -A
00171	0	00000	0	00000		HTR 0
00172	0	77200	0	00205		REW 5
00173	0	53400	1	01314	MI	LXA N,1
00174	-0	63400	1	00341		SXD MX1,1
00175	0	53400	1	00425		LXA I1,1
00176	-0	63400	1	00274	MJ	SXD MS,1
00177	-0	75400	1	00000		PXD 0,1
00200	0	77100	0	00022		ARS 18
00201	0	60100	0	00445		STO J1
00202	0	50000	0	00424		CLA C10
00203	0	40200	0	00445		SUB J1
00204	0	73400	2	00000		PAX 0,2
00205	0	53400	4	00430	MK	LXA I16,4
00206	0	50000	4	00414	MK1	CLA C2+16,4
00207	0	60100	4	00330		STO MU+18,4
00210	2	00001	4	00206		TIX MK1,4,1
00211	0	53400	4	00427	ML	LXA I13,4
00212	0	50000	0	00445		CLA J1
00213	0	40000	0	00425	ML1	ADD I1
00214	0	60100	4	00463		STO J1+14,4
00215	2	00001	4	00213		TIX ML1,4,1
00216	0	50000	0	00462	MM	CLA J2
00217	0	40200	0	01314		SUB N
00220	-0	12000	0	00234		TMI MO
00221	0	10000	0	00234		TZE MO
00222	0	73400	4	00000	MN	PAX 0,4
00223	0	50000	0	00373		CLA C1
00224	0	60100	4	00330		STO MV,4
00225	0	50000	0	00423		CLA C9
00226	0	60100	4	00265		STO MP1,4
00227	0	50000	0	00413		CLA C2+15
00230	0	60100	4	00327		STO MV-1,4
00231	0	60100	4	00264		STO MP1-1,4
00232	0	53400	4	01314		LXA N,4
00233	0	02000	0	00235		TRA MO1
00234	0	53400	4	00462	MO	LXA J2,4
00235	-0	63400	4	00336	MO1	SXD MW1,4
00236	0	07400	4	00463	MO2	TSX OUT,4
00237	0	00000	0	00236		HTR MO2

END OF FILE

00240	3	27451	0	00431		PTH	TITLE,0,12073	
00241	3	02066	0	00420		PTH	C6,0,1078	
00242	1	00001	0	00003		PON	3,0,1	
00243	0	07400	4	00463	MP	TSX	OUT,4	
00244	0	00000	0	00243		HTR	MP	
00245	3	01757	0	00414	MP2	PTH	C3,0,1007	
00246	-0	00016	0	00445		FOR	J1,0,14	
00247	-0	00026	0	00446		FOR	J1+1,0,22	
00250	-0	00036	0	00447		FOR	J1+2,0,30	
00251	-0	00046	0	00450		FOR	J1+3,0,38	
00252	-0	00056	0	00451		FOR	J1+4,0,46	
00253	-0	00066	0	00452		FOR	J1+5,0,54	
00254	-0	00076	0	00453		FOR	J1+6,0,62	
00255	-0	00106	0	00454		FOR	J1+7,0,70	
00256	-0	00116	0	00455		FOR	J1+8,0,78	
00257	-0	00126	0	00456		FOR	J1+9,0,86	
00260	-0	00136	0	00457		FOR	J1+10,0,94	
00261	-0	00146	0	00460		FOR	J1+11,0,102	
00262	-0	00156	0	00461		FOR	J1+12,0,110	
00263	-0	00166	0	00462		FOR	J1+13,0,118	
00264	1	00060	0	00003		PON	3,0,48	
00265	0	07400	4	00463	MP1	TSX	OUT,4	
00266	0	00000	0	00245		HTR	MP2	
00267	1	00060	0	00003		PON	3,0,48	
00270	0	53400	1	00425	MQ	LXA	I1,1	
00271	-0	75400	1	00000	MR	PXD	0,1	
00272	0	77100	0	00022		ARS	18	
00273	0	60100	0	01313		STO	I	
00274	-3	00000	1	00306	MS	TXL	MU,1,0	J1 SET IN DECREMENT
00275	0	50000	0	00462	MT	CLA	J2	
00276	0	40200	0	01313		SUB	I	
00277	0	73400	4	00000		PAX	0,4	
00300	0	50000	4	00262		CLA	MP+15,4	
00301	0	60100	4	00325		STO	MU+15,4	
00302	0	50000	0	00422		CLA	C8	
00303	0	62100	4	00325		STA	MU+15,4	
00304	0	50000	0	00421		CLA	C7	
00305	0	60100	4	00324		STO	MU+14,4	
00306	0	07400	4	00463	MU	TSX	OUT,4	
00307	0	00000	0	00306		HTR	MU	

DISTRIBUTION

1-5.	W. R. Busing
6-10.	H. A. Levy
11.	M. J. Skinner
12-13.	Central Research Library
14.	Document Reference Library
15.	ORNL-RC
16-30.	TISE
31-100.	Laboratory Records

DO NOT PHOTOSTAT