
J. H. Reibenspies
Supplementary Materials


Joseph H. Reibenspies, Department of Chemistry, Texas A & M University, College Station, Texas 77843. E-mail: reibenspies@chemvx.tamu.edu

Abstract
Statistical short cut procedures involving the median, midrange and the mean are presented as methods for location of peak/anomaly positions in area detector data. These methods test for normal distribution in uniform background intensities in which peak/anomaly magnitudes are considered as outlying data. Typically the tests are applied to large data arrays where the background distributions are near normal with the statistic Mean ≈ Median ≈ \( \frac{1}{2}(x_{1:n} + x_{n:n}) \). For data arrays with large intensity outliers the statistic \( (x_{1:n} + x_{n:n} - 2*\text{Median}) \) and \( (\text{Mean} - \text{Median}) \) will be both greater than zero. If the outliers are censored than ideally the above statistics will be equal to zero. Peak/anomaly pixel positions are identified as those pixels with magnitudes greater than the magnitude of smallest censored point.

1) FORTRAN program SPOTMD. Midrange Method for location of peak positions
2) FORTRAN program SPOTMN. Mean Method for location of peak positions
3) FORTRAN program SPOTSK. Skew Method for location of peak positions
4) Results file from SPOTMD for 124 x 124 data array.
5) Results file from SPOTMN for 124 x 124 data array
6) Results file from SPOTSK for 124 x 124 data array

083508
PROGRAM 1. FORTRAN PROGRAM SPOTMD (MIDRANGE METHOD)

C+-----------------------------------------------------------------------+
C SPOTMD (1.0.0)                                                          +
C+-----------------------------------------------------------------------+
C
COPYRIGHT CMSL 1996 (ALL RIGHT RESERVED)                                 
C
C+-----------------------------------------------------------------------+
C REV 1.0.0 (1996)                                                        +
C J. REIBENSPIES                                                         
C CRYSTAL AND MOLECULAR LABORATORY                                      
C COLLEGE STATION TEXAS 77845                                          
C+-----------------------------------------------------------------------+
C ORDERED STATISTICS : This program employs ordered statistics to        
C determine the positions of peak/anomaly positions                    
C in two-dimensional data histograms.                                  
C
C DAVID F.N. & JOHNSON N.L. ANN. EUGEN. LONDON (1954) 18, 351-353       
C midrange = (x(n)+x(2)) * .5                                           
C 0 = x(n)+x(2) - 2*median                                                
C 1) (HEAP) SORT BINS IN ASCENDING ORDER                                 
C 2) CALCULATE MEDIAN AND MEAN FOR N BINS                               
C 3) CALCULATE D = X(N)+X(2)-2*MEDIAN                                   
C 4) IF D .GT. 0 THEN N=N-1 REPEAT 1,2,3                                 
C 5) X(N)=PEAK THRESHOLD                                                 
C
C HEAP SORT : NUMERICAL RECIPES 2ND ED P 327.                            
C
C+-----------------------------------------------------------------------+

C PROGRAM SPOTMD                                                          
C
CHARACTER ICH(63)*1,IP(124,124)*1,LIN*1                                     
REAL TX(2)                                                                
INTEGER IPK(124,124),IA(15376),IB(124,124)                                 

C
C
C DATA ICH /'0','1','2','3','4','5','6','7','8','9','A','B','C',       
1'D','E','F','G','H','T','J','K','L','M','N','O','P','Q','R','S',     
2'T','U','V','W','X','Y','Z','a','b','c','e','f','g','h','i','j',   
3'k','l','m','n','o','p','q','r','s','t','u','v','w','x','y','z',  
4'!',','/
C
OPEN (1,FILE='PLATE.DAT',STATUS='OLD')                                   
OPEN (2,FILE='SPOTMD.OUT',STATUS='OLD',ERR=10)
CLOSE (2, STATUS='DELETE')
10 OPEN (2, FILE='SPOTMD.OUT', STATUS='NEW')

C
WRITE (2, '(A)') ' SPOTMD (1.0.0) CMSL (1996) '
WRITE (2, '(A)') ' PROGRAM FOR LOCATION OF ANOMALY BASES '
WRITE (2, '(A)') ' INPUT = PLATE.DAT : OUTPUT = SPOTMD.OUT '

ID1 = 124
ID2 = 124
IMX = 0
IMN = 999999
I = 0
20 I = I + 1
   IF (I.GT.ID1) GO TO 40
   READ (1,'(A,2515)') LIN, (IPK(I,J),J=1,25)
   READ (1,'(A,2515)') LIN, (IPK(I,J),J=26,50)
   READ (1,'(A,2515)') LIN, (IPK(I,J),J=51,75)
   READ (1,'(A,2515)') LIN, (IPK(I,J),J=76,100)
   READ (1,'(A,2415)') LIN, (IPK(I,J),J=101,124)
   DO 30 J = 1,ID2
      IMX = MAX(IPK(I,J),IMX)
      IMN = MIN(IPK(I,J),IMN)
   30 CONTINUE
   GO TO 20
C
C RAW DATA MAP
C
40 INP = ID1*ID2
   CLOSE (1)
   XS = FLOAT(IMX) - FLOAT(IMN)
   DO 60 I = 1,ID1
      DO 50 J = 1,ID2
         X = FLOAT(IPK(I,J)) - FLOAT(IMN)
         II = INT((X/XS)*35) + 1
         IP(I,J) = ICH(II)
      50 CONTINUE
   60 CONTINUE

   WRITE (2, '(A)') ' +++++++++++++'
   WRITE (2, '(A)') ' +++++++++++++ RAW DATA +++++++++++++'
   WRITE (2, '(A)') ' +++++++++++++'
   WRITE (2, '(A)')
   WRITE (2, '(1X,3A)')
   1 ' ++++++++++++++++++++++++++++ ++++++',
   2 ' ++++++++LEGEND ++++++++ ++++++',
   3 ' ++++++++++++++++++++++++++++ ++++++'
C
C
   X = FLOAT(IMN)
XI = XS/36.
X = X - XI
DO 61 I = 1,36,12
   DO 61 J=1,12
      II=I+J-1
      WRITE(2,'(10X,2A,F12.0)') ICH(II),' = ',XI*II+X
61  CONTINUE

DO 70 I = 1,ID1
   WRITE (2,'(1X,I3,1X,124A1)') I, (IP(I,J),J=1,ID1)
70  CONTINUE

C
C
INP=0
C
T=DTIME(TX)

DO 80 I=1,124
   DO 80 J=1,124
      INP=INP+1
      IA(INP)=IPK(I,J)
80  CONTINUE

C SORT IN ASCENDING ORDER

CALL HEAPSORT (INP,IA)

INA=INP+1
INB=0

C START MAIN LOOP
100  INA=INA-1
     IM=INA/2
     IF(IA(INA)+IA(2)-2*IA(IM).LE.0) GOTO 110
     INB=INB+1
     GO TO 100
110  DO 130 I=1,124
      DO 130 J=1,124
         IB(I,J)=0
         IF (IPK(i,j),GE,IA(INA)) IB(I,J)=1
130  CONTINUE

T=DTIME(TX)
WRITE (2,8005) ' BASE MAP ' 
DO 135 I=1,ID1
   DO 135 J=1,ID2
      IP(I,J)='.'
      IF( IB(I,J) .EQ. 1 ) IP(I,J)='D'
135  CONTINUE
DO 136 I = 1,ID1
   WRITE (2,'(1X,I3,1X,124A1)') I, (IP(I,J),J=1,ID1)
136  CONTINUE

DO 140 I=1,124
   WRITE (2,'(124H1)') (IB(I,J),J=1,124)
140  CONTINUE
   IMR = INT((IA(INA)+(A(2))*5.0)
   IED = INT((IA(INA)-IA(2))/3.0)
   IMN = INA/2
   IMN = I(A(IMN))
   WRITE (2,'(/A)') 'STATISTICS'
   WRITE (2,'(A,I12)') 'NUMBER OF PIXELS SCANNED : ',INA
   WRITE (2,'(A,I12)') 'NUMBER OF PIXELS FLAGGED : ',INB
   WRITE (2,'(A,I12)') 'PEAK THRESHOLD : ',IA(INA)
   WRITE (2,'(A,I12)') 'BKGD. AVERAGE (MIDRANGE) : ',IMR.
   WRITE (2,'(A,I12)') 'BKGD. E.S.D. (FROM RANGE): ',IED
   WRITE (2,'(A,I12)') 'BKGE. MEDIAN : ',IMN
   WRITE (2,'(A,F12.3)') 'C.P.U. TIME : ',TX(1)
END

SUBROUTINE HEAPSORT (N,IA)
   INTEGER N,IA(N)
   IF(N.LT.2) RETURN
   L=N/2+1
   IR=N
10  CONTINUE
   IF(L.GT.1) THEN
      L=L-1
      ITP=IA(L)
   ELSE
      ITP=IA(IR)
      IA(IR)=IA(1)
      IR=IR-1
      IF(IR.EQ.1) THEN
         IA(1)=ITP
         RETURN
      END IF
   END IF
   I=L
20  IF(J.LE.IR) THEN
      IF(J.LT.IR) THEN
         IF(IA(J).LT.IA(J+1)) J=J+1
      END IF
      IF(ITP.LT.IA(J)) THEN
         IA(I)=IA(J)
         I=J
         J=J+I
      ELSE
         J=IR+1
      END IF
      GOTO 20
END IF
IA(I)=ITP
GOTO 10
END
PROGRAM 2. FORTRAN PROGRAM SPOTMN (MEAN METHOD)

C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C SPOTMN (1.0.0) +
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C
COPYRIGHT CMSL 1996 (ALL RIGHT RESERVED)
C
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C REV 1.0.0 (1996)
C J. REIBENSPIES
C CRYSTAL AND MOLECULAR LABORATORY
C COLLEGE STATION TEXAS 77845
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C
C ORDER STATISTICS. This program uses Order Statistics to determine
C peak/anomaly positions.
C
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C
C 1) Use HeapSort to sort the data array in ascending order
C 2) Find the median and mean
C 3) calculate D = mean - median
C 4) if D > 0 then N=N-1 repeat steps 2 and 3
C 5) peak threshold = X(N-1)
C
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C
C
C
C
C

PROGRAM SPOTMN
C
CHARACTER ICH(63)*1,IP(124,124)*1,LIN*1
REAL TX(2)
C
INTEGER IPK(124,124),IA(15376),IB(124,124)
C
C
C
C
DATA ICH /'0','1','2','3','4','5','6','7','8','9','A','B','C','
D','E','F','G','H','I','J','K','L','M','N','O','P','Q','R','S','
T','U','V','W','X','Y','Z','a','b','c','d','e','f','g','h','i','j','
k','l','m','n','o','p','q','r','s','t','u','v','w','x','y','z','
4!*"!
C
OPEN (1,FILE='PLATE.DAT',STATUS='OLD')
OPEN (2,FILE='SPOTMN.OUT',STATUS='OLD',ERR=10)
CLOSE (2,STATUS='DELETE')
OPEN (2, FILE='SPOTMN.OUT', STATUS='NEW')

C
WRITE (2, '(A)') ' SPOTMN (1.0.0) CMSL (1996)' WRITE (2, '(A)') ' PROGRAM FOR LOCATION OF ANOMALLY BASES' WRITE (2, '(A)') ' INPUT = PLATE.DAT : OUTPUT = SPOTMN.OUT'

ID1 = 124
ID2 = 124
IMX = 0
IMN = 999999
I = 0
20 I = I + 1
IF (I .GT. ID1) GO TO 40
READ (1, '(A,255S)') LIN, (IPK(I,J),J=1,25)
READ (1, '(A,255S)') LIN, (IPK(I,J),J=26,50)
READ (1, '(A,255S)') LIN, (IPK(I,J),J=51,75)
READ (1, '(A,255S)') LIN, (IPK(I,J),J=76,100)
READ (1, '(A,245S)') LIN, (IPK(I,J),J=101,124)
DO 30 J = 1, ID2
IMX = MAX(IPK(I,J), IMX)
IMN = MIN(IPK(I,J), IMN)
30 CONTINUE
GO TO 20

C
C RAW DATA MAP
C

40 INP = ID1*ID2
CLOSE (1)
XS = FLOAT(IMX) - FLOAT(IMN)
DO 60 I = 1, ID1
DO 50 J = 1, ID2
X = FLOAT(IPK(I,J)) - FLOAT(IMN)
II = INT((X/XS)*35) + 1
IP(I,J) = ICH(II)
50 CONTINUE
60 CONTINUE

WRITE (2, '(A)') ' ++++++++'
WRITE (2, '(A)') ' ++++++++ RAW DATA ++++++++'
WRITE (2, '(A)') ' ++++++++'
WRITE (2, '(3A)')
C
WRITE (2, '(1X,3A)')
1 ' ++++++++++++++++++++++++++++++++++++++++++++++++++++++++',
2 ' ++++++++LEGEND++++++++++++++++++++++++++++++++++++++',
3 ' +++++++++++++++++++++++++++++++++++++++++++++++++++++++'
C
C output OD map
C
C
X = FLOAT(IMN)
XI = XS/36.
X = X - XI

DO 61 I=1,36,12
   DO 61 J=1,12
      II=I+J-1
      WRITE (2, '(10X,2A,F12.0)') ICH(II), '= ', XI*II+X
61    CONTINUE

DO 70 I = 1,ID1
   WRITE (2, '(1X,I3,1X,124A1)') I, (IP(I,J), J=1,ID1)
70 CONTINUE

C
C
INP=0
C
C LOAD MAIN ARRAY
T=DTIME(TX)
DO 80 I=1,124
   DO 80 J=1,124
      INP=INP+1
      IA(INP)=IPK(I,J)
80 CONTINUE

C SORT IN ASCENDING ORDER
CALL HEAPSORT(INP,IA)

INA=INP+1
INB=0

100 INA=INA-1
   IM=INT(FLOAT(INA)/2.)
   XD=FLOAT(IA(IM))
   XM=0
   DO 101 I=1,INA
101 XM=XM+FLOAT(IA(I))
   XM=XM/FLOAT(INA)

IF(XM.LE.XD) GOTO 110

INB=INB+1
GO TO 100

110 DO 130 I=1,124
   DO 130 J=1,124
      IB(I,J)=0
      IF (IPK(I,J).GT.IA(INA)) IB(I,J)=1
   CONTINUE
T=DTIME(TX)
WRITE (2, '(/A)') ' BASE MAP '
DO 135 I=1,ID1
   DO 135 J=1,ID2
IP(I,J)=.'
IF( IB(I,J) .EQ. 1 ) IP(I,J)=`N'
135 CONTINUE
DO 136 I=1,ID1
WRITE (2,'(1X,I3,1X,124A1)') I, (IP(I,J),J=1,ID1)
136 CONTINUE

DO 140 I=1,124
WRITE (2,'(124A1)') (IB(I,J),J=1,124)
140 CONTINUE

IMX = IMX/2
IMX = IA(IMX)
IMR = INT( (IA(INA)+IA(2))*5 )
IES = INT( (IA(INA)-IA(2))*33333 )
WRITE (2,'(A)') ' STATISTICS'
WRITE (2,'(A,112)') ' NUMBER OF PIXELS SCANNED :',INP
WRITE (2,'(A,112)') ' NUMBER OF PIXELS CENSORED :',INB
WRITE (2,'(A,112)') ' BKGD. THRESHOLD :',IA(INA)
WRITE (2,'(A,112)') ' BKGD. AVERAGED (MIDRANGE) :',IMR
WRITE (2,'(A,112)') ' BKGD. E.S.D. (FROM RANGE) :',IES
WRITE (2,'(A,F12.3)') ' C.P.U. TIME :',TX(1)
END

SUBROUTINE HEAPSORT(N,IA)
INTEGER N,IA(N)
IF(N.LT.2) RETURN
L=N/2+1
IR=N
10 CONTINUE
IF(L.GT.1) THEN
  L=L-1
  ITP=IA(L)
ELSE
  ITP=IA(IR)
  IA(IR)=IA(1)
  IR=IR-1
  IF(IR.EQ.1) THEN
    IA(1)=ITP
    RETURN
  END IF
END IF
END IF
I=L
J=L+L
20 IF(J.LE.IR) THEN
  IF(J.LT.IR) THEN
    IF(IA(J).LT.IA(J+1)) J=J+1
  END IF
  IF(ITP.LT.IA(J)) THEN
    IA(I)=IA(J)
    I=J
  END IF
  J=J+J
ELSE
J=IR+1
END IF
GOTO 20
END IF
IA(I)=ITP
GOTO 10
END
PROGRAM 3. FORTRAN PROGRAM SPOTSK (SKEW METHOD)

C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C          SPOTSK (1.0.0)           +
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++C
COPYRIGHT CMSL 1996 (ALL RIGHT RESERVED)
C
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++C
C REV 1.0.0 (1996)
C J. REIBENSPIES
C CRYSTAL AND MOLECULAR LABORATORY
C COLLEGE STATION TEXAS 77845
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++C
C
C SKEW METHOD
C
C      SKEW = [ (X-<X>/ SIG ])**3 * 1/N
C      SIG = [ (X-<X>)**2 / N-1 ]**.5
C 1) HeapSort Array in ascending order
C 2) determine <X>, SIG, SKEW
C 3) if SKEW GT 0 then N=N-1 repeat 1,2
C 4) peak threshold = X(N)
C
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++C

PROGRAM SPOTSK
C
CHARACTER ICH(63)*1,IP(124,124)*1,LIN*1
C
REAL TX(2)
INTEGER IPK(124,124),IA(15376),IB(124,124)
C
C
C
DATA ICH/*0,'I',2',3',4',5',6',7',8',9',A',B',C',
2'T',U',V',W',X',Y',Z',a',b',c',e',e',r',g',h',i',j',
3'k',l',m',n',o',p',q',r',s',t',u',u',v',w',x',y',z',
4''','''
C
OPEN (1, FILE= 'PLATE.DAT', STATUS= 'OLD')
OPEN (2, FILE= 'SPOTSK.OUT', STATUS= 'OLD', ERR= 10)
CLOSE (2, STATUS= 'DELETE')
10 OPEN (2, FILE= 'SPOTSK.OUT', STATUS= 'NEW')
C
WRITE (2, '(A)') ' SPOTSK (1.0.0) CMSL (1996) ' 
WRITE (2, '(A)') ' PROGRAM FOR LOCATION OF ANOMALLY BASES ' 
WRITE (2, '(A)') ' INPUT = PLATE.DAT : OUTPUT = SPOTSK.OUT ' 


ID1 = 124
ID2 = 124
IMX = 0
IMN = 999999
I = 0
20 I = I + 1
   IF (.GT. ID1) GO TO 40
   READ (1, '(A,2515)') LIN, (IPK(I,J), J=1,25)
   READ (1, '(A,2515)') LIN, (IPK(I,J), J=26,50)
   READ (1, '(A,2515)') LIN, (IPK(I,J), J=51,75)
   READ (1, '(A,2515)') LIN, (IPK(I,J), J=76,100)
   READ (1, '(A,2415)') LIN, (IPK(I,J), J=101,124)
   DO 30 J = 1, ID2
      IMX = MAX(IPK(I,J), IMX)
      IMN = MIN(IPK(I,J), IMN)
   30 CONTINUE
   GO TO 20

C
C RAW DATA MAP
C

40 INP = ID1*ID2
   CLOSE (1)
   XS = FLOAT(IMX) - FLOAT(IMN)
   DO 60 I = 1, ID1
      DO 50 J = 1, ID2
         X = FLOAT(IPK(I,J)) - FLOAT(IMN)
         IJ = INT((X/XS)*35) + 1
         IP(I,J) = IC(IJ)
      50 CONTINUE
   60 CONTINUE

   WRITE (2, '(A)') ' ++++++++''
   WRITE (2, '(A)') ' ++++++++ RAW DATA ++++++++'
   WRITE (2, '(A)') ' ++++++++''
   WRITE (2, '(A)')

   WRITE (2, '(/1X,3A)')
      1 ' ++++++++ ++++++++++++++++++++++++++++++++''',
      2 ' ++++++++++++++++++LEGEND +++++++++++++++++++''',
      3 ' ++++++++++++++++++++++++++++++++'''

C
C output OD map
C
X = FLOAT(IMN)
XI = XS/36.
X = X - XI

   DO 61 I = 1, 36, 12
   DO 61 J = 1, 12
      IJ = I + J - 1
WRITE (2, '(10X, 2A, F12.0), ') ICH(ID), ' = ', XI*I+X

CONTINUE

DO 70 I = 1, ID1
   WRITE (2, '(1X, I3, 1X, 124A1)') I, (IP(I,J), J=1,ID1)
CONTINUE
C
C
INP=0
C
LOAD MAIN ARRAY
T=DTIME(TX)
DO 80 I = 1, 124
   DO 80 J = 1, 124
      INP=INP+1
      IA(INP)=IPK(I,J)
CONTINUE
C
SORT IN ASCENDING ORDER
CALL HEAPSORT (INP, IA)

INA=INP
INB=0

XM=0
X2=0
DO 101 I = 1, INA
   XM=XM+FLOAT(IA(I))
   X2=X2+FLOAT(IA(I))*2
CONTINUE
XS=SQRT((INA*X2 - XM**2) / (INA*(INA-1)))
XM=XM/FLOAT(INA)
X3=0
DO 103 I = 1, INA
   X3=X3+((FLOAT(IA(I))-XM)/XS)**3
   X3=X3/FLOAT(INA)
   IF (X3.LT.0) GOTO 110
   INB=INB+1
   INA=INA-1
   GO TO 100
110 DO 130 I = 1, 124
   DO 130 J = 1, 124
      IB(I,J)=0
      IF (IPK(I,J), GT JA(INA)) IB(I,J)=1
CONTINUE
T=DTIME(TX)
WRITE (2, '(/A)') ' BASE MAP '
DO 135 I = 1, ID1
   DO 135 J = 1, ID2
      IP(I,J)=
CONTINUE
IF (IB(I,J) .EQ. 1) IP(I,J)='S'
CONTINUE
DO 136 I = 1,ID1
   WRITE (2,*(1X,13,1X,124A1)) I, (IP(I,J),J=1,ID1)
136 CONTINUE
DO 140 I=1,124
   WRITE (2,*(12411)) (IB(I,J),J=1,124)
140 CONTINUE
WRITE (2,*(A) ) 'STATISTICS '
IMN=INT((IA(INA)+IA(2)) *.5 )
IES=INT((IA(INA)-IA(2)) *.33333)
IMX=INA/2
IMX=IA(IMX)
WRITE (2,*(A121) ) 'NUMBER OF PIXELS SCANNED ' ,INP
WRITE (2,*(A121) ) 'NUMBER OF PIXELS CENSORED ' ,INB
WRITE (2,*(A121) ) 'PEAK THRESHOLD ' ,IA(INA)
WRITE (2,*(A121) ) 'BKGD. AVERAGE (MIDRANGE) ' ,IMN
WRITE (2,*(A121) ) 'BKGD. E.S.D. (FROM RANGE) ' ,IES
WRITE (2,*(A121) ) 'BKGD. MEDIAN ' ,IMX
WRITE (2,*(A,12.3) ) 'C.F.U. TIME ' ,TX(1)
END

SUBROUTINE HEAPSORT (N,IA)
INTEGER N,IA(N)
IF(N.LT.2) RETURN
L=N/2+1
IR=N
CONTINUE
IF(L.GT.1) THEN
   L=L-1
   ITP=IA(L)
ELSE
   ITP=IA(IR)
   IA(IR)=IA(1)
   IR=IR-1
   IF(IR.EQ.1) THEN
      IA(1)=ITP
      RETURN
   END IF
   END IF
   L=L-1
   J=J+L
IF(J.LE.IR) THEN
   IF(J.LT.IR) THEN
      IF(IA(J).LT.IA(J+1)) J=J+1
      END IF
   IF(ITP.LT.IA(J)) THEN
      IA(J)=IA(J)
      J=J+J
   ELSE
   END IF
J=IR+1
END IF
GOTO 20
END IF
IA(I)=ITP
GOTO 10
END
**OUTPUT 1. OUTPUT FILE FOR SPOTMD (MIDRANGE METHOD)**

SPOTMD (1.0.0) CMSL (1996)
PROGRAM FOR LOCATION OF ANOMALY BASES
INPUT = PLATE.DAT ; OUTPUT = SPOTMD.OUT

+++
+++ DATA ++++
+++ Data ++++

**LEGEND**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>151.</td>
</tr>
<tr>
<td>1</td>
<td>200.</td>
</tr>
<tr>
<td>2</td>
<td>249.</td>
</tr>
<tr>
<td>3</td>
<td>299.</td>
</tr>
<tr>
<td>4</td>
<td>348.</td>
</tr>
<tr>
<td>5</td>
<td>397.</td>
</tr>
<tr>
<td>6</td>
<td>447.</td>
</tr>
<tr>
<td>7</td>
<td>496.</td>
</tr>
<tr>
<td>8</td>
<td>545.</td>
</tr>
<tr>
<td>9</td>
<td>594.</td>
</tr>
<tr>
<td>A</td>
<td>643.</td>
</tr>
<tr>
<td>B</td>
<td>693.</td>
</tr>
<tr>
<td>C</td>
<td>742.</td>
</tr>
<tr>
<td>D</td>
<td>791.</td>
</tr>
<tr>
<td>E</td>
<td>840.</td>
</tr>
<tr>
<td>F</td>
<td>890.</td>
</tr>
<tr>
<td>G</td>
<td>939.</td>
</tr>
<tr>
<td>H</td>
<td>988.</td>
</tr>
<tr>
<td>I</td>
<td>1038.</td>
</tr>
<tr>
<td>J</td>
<td>1087.</td>
</tr>
<tr>
<td>K</td>
<td>1136.</td>
</tr>
<tr>
<td>L</td>
<td>1185.</td>
</tr>
<tr>
<td>M</td>
<td>1234.</td>
</tr>
<tr>
<td>N</td>
<td>1284.</td>
</tr>
<tr>
<td>O</td>
<td>1333.</td>
</tr>
<tr>
<td>P</td>
<td>1382.</td>
</tr>
<tr>
<td>Q</td>
<td>1432.</td>
</tr>
<tr>
<td>R</td>
<td>1481.</td>
</tr>
<tr>
<td>S</td>
<td>1530.</td>
</tr>
<tr>
<td>T</td>
<td>1579.</td>
</tr>
<tr>
<td>U</td>
<td>1628.</td>
</tr>
<tr>
<td>V</td>
<td>1678.</td>
</tr>
<tr>
<td>W</td>
<td>1727.</td>
</tr>
<tr>
<td>X</td>
<td>1776.</td>
</tr>
<tr>
<td>Y</td>
<td>1825.</td>
</tr>
<tr>
<td>Z</td>
<td>1875.</td>
</tr>
</tbody>
</table>
### Statistics

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Pixels Scanned</td>
<td>15266</td>
</tr>
<tr>
<td>Number of Pixels Flagged</td>
<td>110</td>
</tr>
<tr>
<td>Peak Threshold</td>
<td>289</td>
</tr>
<tr>
<td>Background Average (Midrange)</td>
<td>222</td>
</tr>
<tr>
<td>Background E.S.D. (From Range)</td>
<td>44</td>
</tr>
<tr>
<td>Background Median</td>
<td>222</td>
</tr>
<tr>
<td>C.P.U. Time</td>
<td>0.042</td>
</tr>
</tbody>
</table>
### OUTPUT 2. OUTPUT FILE FOR SPOTMN (MEAN METHOD)

SPOTMN (1.0.0) CMSL (1996)
PROGRAM FOR LOCATION OF ANOMALY BASES
INPUT = PLATE.DAT : OUTPUT = SPOTMN.OUT

+++++++
+++++++
RAW DATA +++++++
+++++++

**LEGEND**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>151.</td>
</tr>
<tr>
<td>1</td>
<td>200.</td>
</tr>
<tr>
<td>2</td>
<td>249.</td>
</tr>
<tr>
<td>3</td>
<td>299.</td>
</tr>
<tr>
<td>4</td>
<td>348.</td>
</tr>
<tr>
<td>5</td>
<td>397.</td>
</tr>
<tr>
<td>6</td>
<td>447.</td>
</tr>
<tr>
<td>7</td>
<td>496.</td>
</tr>
<tr>
<td>8</td>
<td>545.</td>
</tr>
<tr>
<td>9</td>
<td>594.</td>
</tr>
<tr>
<td>A</td>
<td>643.</td>
</tr>
<tr>
<td>B</td>
<td>693.</td>
</tr>
<tr>
<td>C</td>
<td>742.</td>
</tr>
<tr>
<td>D</td>
<td>791.</td>
</tr>
<tr>
<td>E</td>
<td>840.</td>
</tr>
<tr>
<td>F</td>
<td>890.</td>
</tr>
<tr>
<td>G</td>
<td>939.</td>
</tr>
<tr>
<td>H</td>
<td>988.</td>
</tr>
<tr>
<td>I</td>
<td>1038.</td>
</tr>
<tr>
<td>J</td>
<td>1087.</td>
</tr>
<tr>
<td>K</td>
<td>1135.</td>
</tr>
<tr>
<td>L</td>
<td>1185.</td>
</tr>
<tr>
<td>M</td>
<td>1234.</td>
</tr>
<tr>
<td>N</td>
<td>1284.</td>
</tr>
<tr>
<td>O</td>
<td>1333.</td>
</tr>
<tr>
<td>P</td>
<td>1382.</td>
</tr>
<tr>
<td>Q</td>
<td>1432.</td>
</tr>
<tr>
<td>R</td>
<td>1481.</td>
</tr>
<tr>
<td>S</td>
<td>1530.</td>
</tr>
<tr>
<td>T</td>
<td>1579.</td>
</tr>
<tr>
<td>U</td>
<td>1628.</td>
</tr>
<tr>
<td>V</td>
<td>1678.</td>
</tr>
<tr>
<td>W</td>
<td>1727.</td>
</tr>
<tr>
<td>X</td>
<td>1776.</td>
</tr>
<tr>
<td>Y</td>
<td>1825.</td>
</tr>
<tr>
<td>Z</td>
<td>1875.</td>
</tr>
</tbody>
</table>
BASE MAP

STATISTICS
NUMBER OF PIXELS SCANNED : 15376
NUMBER OF PIXELS CENSORED  : 121
BKGD. THRESHOLD            : 284
BKGD. AVERAGED (MIDRANGE)  : 219
BKGD. E.S.D. (FROM RANGE)  : 42
C.P.U. TIME                : 0.113
OUTPUT 3. OUTPUT FILE FOR SPOTSK (SKEW METHOD)

SPOTSK (1.0.0) CMSL (1996)
PROGRAM FOR LOCATION OF ANOMALY BASES
INPUT = PLATE.DAT : OUTPUT = SPOTSK.OUT

+++++++++
+++++++ RAW DATA ++++++++
+++++++++

LEGEND+++++++++++++++++++++++++++

0 =  151.
L =  200.
2 =  249.
3 =  299.
4 =  349.
5 =  397.
6 =  447.
7 =  496.
8 =  545.
9 =  594.
A =  643.
B =  693.
C =  742.
D =  791.
E =  840.
F =  890.
G =  939.
H =  988.
I =  1038.
J =  1087.
K =  1136.
L =  1185.
M =  1234.
N =  1284.
O =  1333.
P =  1382.
Q =  1432.
R =  1481.
S =  1530.
T =  1579.
U =  1628.
V =  1678.
W =  1727.
X =  1776.
Y =  1825.
Z =  1875.
### BASE MAP

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Pixels Scanned</td>
<td>15376</td>
</tr>
<tr>
<td>Number of Pixels Censored</td>
<td>206</td>
</tr>
<tr>
<td>Peak Threshold</td>
<td>272</td>
</tr>
<tr>
<td>Background Average (Midrange)</td>
<td>213</td>
</tr>
<tr>
<td>Background E.S.D. (from Range)</td>
<td>38</td>
</tr>
<tr>
<td>Background Median</td>
<td>221</td>
</tr>
<tr>
<td>Central Processing Unit Time</td>
<td>0.305</td>
</tr>
</tbody>
</table>