WORKSHOP PROBLEM 4

Matrix Manipulation

Objectives:

- Perform a matrix manipulation exercise.

Procedure:

1. Read in the following matrix, [A].

$$[A] = \left[\begin{array}{c|c} B & D \\ \hline C & E \end{array}\right] = \left[\begin{array}{cc|cc} 11 & 12 & 13 & 14 \\ 21 & 22 & 23 & 24 \\ \hline 31 & 32 & 33 & 34 \\ 41 & 42 & 43 & 44 \end{array}\right]$$

2. Partition and rearrange matrix [A] to form matrix [F] as shown below:

$$[F] = \left[\begin{array}{c|c} D & E \\ \hline B & C \end{array}\right] = \left[\begin{array}{cc|cc} 13 & 14 & 33 & 34 \\ 23 & 24 & 43 & 44 \\ \hline 11 & 12 & 31 & 32 \\ 21 & 22 & 41 & 42 \end{array}\right]$$

3. Perform the following operation:

   [G] = [A] * [F] + [A]

4. Append matrix [G] to itself ncol times, where ncol is the size of matrix [G].

5. Normalize and print out the appended matrix.

Hints:

- Use MATGEN to generate a partitioning vector.
- Use PARTN and MERGE to rearrange matrix [A].
- Use the APPEND module to append matrix [G].
- Other possible useful modules include:
  - MPYAD
  - PARAML
  - NORM

Solution Input File:

soln4.dat

```
$
$              B  |   D
$    [A]  =    --------
$              C  |   E
$
$
$              D  |   E
$    [F]  =    --------
$              B  |   C
$
$    [G]  =    [A]*[F] + [A]
$
$    [Gappnd] = [G | G | G ...]
$
sol 100
compile userdmap $
alter 2
type parm,,i,n,count=1 $
dmiin dmi,dmindx/A,,,,,,,,,/s,n,yes1 $
matprn A// $
matgen ,/cp/6/4/2/2 $
partn A,cp,/b,c,d,e $
merge d,b,e,c,cp,/f $
mpyad a,f,a/g $
$
paraml g//'trailer'/1/s,n,ncol $
message //' ncol = '/ncol $
file gappnd=append $
do while (count<=ncol) $
   append g,/gappnd/2 $
   count = count + 1 $
enddo $
norm gappnd/gnorm $
matprn gnorm $
cend
$
begin bulk
$
dmi,a,0,6,1,0,,4,4
dmi,a,1,1,11.,21.,31.,41.
dmi,a,2,1,12.,22.,32.,42.
dmi,a,3,1,13.,23.,33.,43.
dmi,a,4,1,14.,24.,34.,44.
$
enddata
```

Comparison of Results:

Compare the results obtained in the **.f06** file with the results below:

```
0
0      MATRIX A        (GINO NAME 101 ) IS A DB  PREC           4 COLUMN X           4 ROW SYMMETRC
MATRIX.
0COLUMN      1      ROWS      1 THRU      4     ----------------------------------------------------
    ROW
      1)    1.1000D+01  2.1000D+01  3.1000D+01  4.1000D+01
0COLUMN      2      ROWS      1 THRU      4     ----------------------------------------------------
    ROW
      1)    1.2000D+01  2.2000D+01  3.2000D+01  4.2000D+01
0COLUMN      3      ROWS      1 THRU      4     ----------------------------------------------------
    ROW
      1)    1.3000D+01  2.3000D+01  3.3000D+01  4.3000D+01
0COLUMN      4      ROWS      1 THRU      4     ----------------------------------------------------
    ROW
      1)    1.4000D+01  2.4000D+01  3.4000D+01  4.4000D+01
0THE NUMBER OF NON-ZERO TERMS IN THE DENSEST COLUMN =       4
0THE DENSITY OF THIS MATRIX IS 100.00 PERCENT.
 ^^^ NCOL =          4
1
...
0
0      MATRIX GNORM    (GINO NAME 101 ) IS A DB  PREC          16 COLUMN X           4 ROW RECTANG
MATRIX.
0COLUMN      1      ROWS      1 THRU      4     ----------------------------------------------------
    ROW
      1)    2.9520D-01  5.3013D-01  7.6507D-01  1.0000D+00
0COLUMN      2      ROWS      1 THRU      4     ----------------------------------------------------
    ROW
      1)    2.9537D-01  5.3024D-01  7.6512D-01  1.0000D+00
0COLUMN      3      ROWS      1 THRU      4     ----------------------------------------------------
    ROW
      1)    2.9484D-01  5.2989D-01  7.6495D-01  1.0000D+00
0COLUMN      4      ROWS      1 THRU      4     ----------------------------------------------------
    ROW
      1)    2.9493D-01  5.2995D-01  7.6498D-01  1.0000D+00
0COLUMN      5      ROWS      1 THRU      4     ----------------------------------------------------
    ROW
      1)    2.9520D-01  5.3013D-01  7.6507D-01  1.0000D+00
0COLUMN      6      ROWS      1 THRU      4     ----------------------------------------------------
...
```

```
...
    ROW
      1)    2.9537D-01  5.3024D-01  7.6512D-01  1.0000D+00
0COLUMN      7      ROWS      1 THRU      4     ---------------------------------------------------
    ROW
      1)    2.9484D-01  5.2989D-01  7.6495D-01  1.0000D+00
0COLUMN      8      ROWS      1 THRU      4     ---------------------------------------------------
    ROW
      1)    2.9493D-01  5.2995D-01  7.6498D-01  1.0000D+00
0COLUMN      9      ROWS      1 THRU      4     ---------------------------------------------------
    ROW
      1)    2.9520D-01  5.3013D-01  7.6507D-01  1.0000D+00
0COLUMN     10      ROWS      1 THRU      4     ---------------------------------------------------
    ROW
      1)    2.9537D-01  5.3024D-01  7.6512D-01  1.0000D+00
0COLUMN     11      ROWS      1 THRU      4     ---------------------------------------------------
    ROW
      1)    2.9484D-01  5.2989D-01  7.6495D-01  1.0000D+00
0COLUMN     12      ROWS      1 THRU      4     ---------------------------------------------------
    ROW
      1)    2.9493D-01  5.2995D-01  7.6498D-01  1.0000D+00
0COLUMN     13      ROWS      1 THRU      4     ---------------------------------------------------
    ROW
      1)    2.9484D-01  5.2989D-01  7.6495D-01  1.0000D+00
0COLUMN      8      ROWS      1 THRU      4     ---------------------------------------------------
    ROW
      1)    2.9493D-01  5.2995D-01  7.6498D-01  1.0000D+00
0COLUMN      9      ROWS      1 THRU      4     ---------------------------------------------------
    ROW
      1)    2.9520D-01  5.3013D-01  7.6507D-01  1.0000D+00
0COLUMN     10      ROWS      1 THRU      4     ---------------------------------------------------
    ROW
      1)    2.9537D-01  5.3024D-01  7.6512D-01  1.0000D+00
0COLUMN     11      ROWS      1 THRU      4     ---------------------------------------------------
    ROW
      1)    2.9484D-01  5.2989D-01  7.6495D-01  1.0000D+00
0COLUMN     12      ROWS      1 THRU      4     ---------------------------------------------------
    ROW
      1)    2.9493D-01  5.2995D-01  7.6498D-01  1.0000D+00
0COLUMN     13      ROWS      1 THRU      4     ---------------------------------------------------
   ROW
...
```

```
1
...
0
0    MATRIX  GNORM      CONTINUED


      1)    2.9520D-01  5.3013D-01  7.6507D-01  1.0000D+00
0COLUMN     14      ROWS      1 THRU      4     ------------------------------------------------
    ROW
      1)    2.9537D-01  5.3024D-01  7.6512D-01  1.0000D+00
0COLUMN     15      ROWS      1 THRU      4     ------------------------------------------------
    ROW
      1)    2.9484D-01  5.2989D-01  7.6495D-01  1.0000D+00
0COLUMN     16      ROWS      1 THRU      4     ------------------------------------------------
    ROW
      1)    2.9493D-01  5.2995D-01  7.6498D-01  1.0000D+00
0THE NUMBER OF NON-ZERO TERMS IN THE DENSEST COLUMN =       4
0THE DENSITY OF THIS MATRIX IS 100.00 PERCENT.
1                                        * * * END OF JOB * * *
```