More on matrices

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Sub matrices

- To get sub matrices, we use the syntax

  A $(r_i:r_j, c_i:c_j)$

For example, to pick out elements in the second and third row that are also in the first and second columns we have:

>> A(2:3, 1:2)

ans =

    21 22

    31 32

Changing values of matrix Elements

- For example,

  >> A =[11 12 13 14; 21 22 23 24; 31 32 33 34]

  A =

11	12	13	14
21	22	23	24
31	32	33	34

We can change the element in row 1 column 1
  to -34 as follows:

  >> A (1, 1)= -34

Creating empty arrays

- This is deleting a row or a column in a matrix.

Example, considering A, let us delete the second row:

>> A (2,:)= [ ]

A =

-34 12 13 14

31 32 33 34

Creating new matrices from row and column referencing

- E.g., Given a matrix A, we can copy the 2nd row four times as follows:

  >>A = [1 2 3; 4 5 6; 7 8 9];

  >>B = A([2 2 2 2], :)

Exercise (5min)

1. Suppose that $B = \begin{pmatrix} 6 & 7 & 8 \\ 3 & 2 & 5 \\ 4 & 9 & 10 \end{pmatrix}$, use it to create

$C = \begin{pmatrix} 4 & 9 & 10 \\ 4 & 9 & 10 \\ 3 & 2 & 5 \end{pmatrix}$ in MATLAB

2. Given that $A = \begin{pmatrix} 12 & -13 & 8 & 23 \\ 9 & 3 & 0 & 27 \\ 13 & 20 & -7 & 18 \\ 8 & 4 & 2 & 11 \end{pmatrix}$

(i) Enter A in MATLAB

(ii) Using (i) Change the value 0 to -13 and 13 to 29

Operations

- Field operations/ array operations
- Division operations

Field/Array operations

- These are operations done term by term.
- In MATLAB, an array operation is done by placing a period ' . ' before the operation symbol.

  Example, An * alone implies matrix multiplication while, C .* is an array multiplication

Example

>> V = [1 -2 6 -2 0 9];

>> W = V^2   % squaring the elements

>>W = V.^2

The square function is only possible if the matrix
   is a square (n x n)

Division Operations

- The right and left division (/) (\ )

Some Matrix Operations

- Determinant of a matrix
- Inverse of a matrix

Determinant of a matrix

- Given that $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$

  det A = ad − bc

- Given that $B = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$

  det B = $a \begin{vmatrix} e & f \\ h & i \end{vmatrix} - b \begin{vmatrix} d & f \\ g & i \end{vmatrix} + c \begin{vmatrix} d & e \\ g & h \end{vmatrix}$

Determinant of a matrix

- In MATLAB, Given $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -1 \\ 2 & 0 \end{bmatrix}$

>> A = [1 2; 3 4];

>> B = [2 -1; 2 0];

>> det(A)

>> det(B)

Inverse of a matrix

- The inverse can be found with the inv command

The Rank of a matrix

- The rank of a matrix is computed using the, rank(A) command.

E.g., >> A = [2 3 1; 1 2 3; 3 1 2];

>> rank(A)