

MA1710: Key points in week 5 Matlab session

Creating matrices with [and]

In mathematical notation consider the following.

$$A = \begin{pmatrix} 2 & -3 & 1 \\ 3 & 4 & -5 \\ 5 & -1 & -3 \end{pmatrix}, \quad \underline{b} = \begin{pmatrix} 0 \\ 2 \\ 1 \end{pmatrix}, \quad C = \begin{pmatrix} 2 & -3 & 1 & 0 \\ 3 & 4 & -5 & 2 \\ 5 & -1 & -3 & 1 \end{pmatrix},$$

In Matlab these can be created with the following statements.

```
A = [2 -3 1; 3 4 -5; 5 -1 -3]
b = [0; 2; 1]
C = [A, b]
```

Creating a column of all the entries

$$C = \begin{pmatrix} 2 & -3 & 1 & 0 \\ 3 & 4 & -5 & 2 \\ 5 & -1 & -3 & 1 \end{pmatrix},$$

Consider the following statements.

```
y = C(2, :)
y = y(:)
```

The second statement creates a column vector of all the entries.

Referring to entries and blocks of entries

$$C = \begin{pmatrix} 2 & -3 & 1 & 0 \\ 3 & 4 & -5 & 2 \\ 5 & -1 & -3 & 1 \end{pmatrix},$$

In the Matlab version you can have the following.

```
v = C(3, 2)      % 3,2 entry
y = C(2, :)      % 2nd row
z = C(:, 3)      % 3rd column
```

Basic operations including the matrix product

We can multiply matrices by scalars, we can add them and the operator * means matrix multiplication. As examples you can do the following.

```
A = [2 -3 1; 3 4 -5; 5 -1 -3]
B = 5+2*A
x = [1; 1; 1]
z = A*x
```

The matrix product continued

In the following we create A and B and we create the matrix products AB and BA .

```
A = [2 -3 1; 3 4 -5; 5 -1 -3]
```

```
B = 5+2*A
```

```
AB = A*B
```

```
BA = B*A
```

The functions zeros, ones and eye

The following Matlab statements

```
Z = zeros(3, 5)
```

```
O = ones(3)
```

```
I3 = eye(3)
```

create the following output.

```
Z =
    0    0    0    0    0
    0    0    0    0    0
    0    0    0    0    0
O =
    1    1    1
    1    1    1
    1    1    1
I3 =
    1    0    0
    0    1    0
    0    0    1
```

Solving linear equations using \

When A is a $n \times n$ matrix and \underline{b} is a $n \times 1$ matrix we often wish to attempt to solve the linear equations

$$A\underline{x} = \underline{b}.$$

In Matlab this can be done with the following statement.

```
x = A\b
```

The functions inv and rref

In your linear algebra lectures you learn about the matrix inverse and the reduced row echelon form. Matlab has functions for these which can be used as follows.

```
C = [2 -3 1 -1; 3 4 -5 -4; 5 -1 -3 -6];
```

```
A3 = C(:, 1:3)
```

```
A3I = inv(A3)
```

```
rC = rref(C)
```

```
A3 =
     2     -3     1
     3     4     -5
     5     -1     -3
A3I =
    1.8889    1.1111   -1.2222
    1.7778    1.2222   -1.4444
    2.5556    1.4444   -1.8889
rC =
     1     0     0     1
     0     1     0     2
     0     0     1     3
```