Math 323
Linear Algebra and Matrix Theory I
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Lesson 2
Matrices and Matrix Elements, Sub-Matrices and Multiplication of a Matrix and a Vector

2.1 Matrices and Matrix Elements

- Example 2.1.1
  Enter a matrix A with first row [1 2 3], second row [-2 3 5] and third row [3 4 17]. Then extract the element in the second row and the third column. Finally change the element in the first row and the second column to 100.

  The elements of a matrix are entered a row at a time, and rows are separated by semicolons.

```
A=[1 2 3; -2 3 5; 3 4 17]

A =
      1      2      3
     -2      3      5
      3      4     17
```

  The (i, j) element of A, a_{ij}, can be extracted using the syntax A(i,j)

```
A(2, 3)

ans =
      5
```

  Individual element of a matrix can be changed by using a simple assignment statement. The software will automatically reprint the new matrix.

```
A(1, 2)=100

A =
      1    100      3
     -2      3      5
      3      4     17
```

2.2 Sub-Matrices

- Example 2.2.1
  Extract the second column and the third row from the matrix A defined in example 2.1.1. Then extract the matrix B containing the elements of A in the first two rows and the first and third column of A.

  > An entire row or column can be extracted from a matrix using a colon in the corresponding position of the element syntax.

```
A=[1 2 3; -2 3 5; 3 4 17]

A =
     1     2     3
    -2     3     5
     3     4    17

second_column=A(:, 2), third_row=A(3, : )

second_column =
     2
     3
     4
third_row =
     3     4    17
```

> The colon operator can also be used to extract the first two rows (because they are successive rows). However to pluck the first and third column out of the matrix, a [1,3] syntax is applied.

```
A, B=A(1:2, [1,3])

A =
     1     2     3
    -2     3     5
     3     4    17
B =
     1     3
    -2     5
```
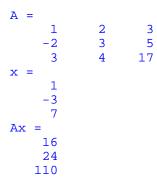
2.3 Multiplication of a Matrix and a Vector

- Example 2.3.1
  Multiply the matrix A defined in example 2.1.1. and the column vector x= (1, -3, 7): First by using columns, second by using rows, third by using MATLAB's multiplication operator.
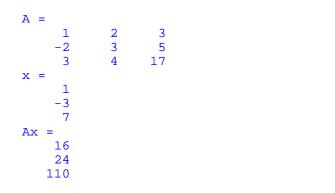
  > 1) The column approach. For clarity we first reprint the matrix A.

```
A, x=[1; -3; 7], Ax=x(1)*A(:, 1)+x(2)*A(:, 2)+x(3)*A(:, 3)
```

```
A =
     1     2     3
    -2     3     5
     3     4    17
x =
     1
    -3
     7
Ax =
    16
    24
   110
```

2) The row approach.

```
A, x, Ax=[A(1, : )*x; A(2, : )*x; A(3, : )*x]
```

```
A =
     1     2     3
    -2     3     5
     3     4    17
x =
     1
    -3
     7
Ax =
    16
    24
   110
```

3) Using MATLAB's multiplication operator.

```
A, x, Ax=A*x
```

```
A =
     1     2     3
    -2     3     5
     3     4    17
x =
     1
    -3
     7
Ax =
    16
    24
   110
```