MA2252 Introduction to computing

lectures 3-4

Variables and Arrays

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Variables

- Variables in MATLAB are used to store data e.g. a number or a word.
- Variable names examples: x, y, z, t_1, t_2, theta, etc.
- Variable names can contain letters, numbers or underscore.

Note: Variable name must start with a letter.

Variables assignment

- The assignment operator '=' is used to store a value to a variable.
- IMPROTANT, the assignment operator '=' in MATLAB is different from equality sign '=' in Mathematics.
- The assigned variables are stored in workspace.

Useful tips:

- semicolon ';' suppresses the variable assignment output in command window.
- '**clear all**' deletes all variables in workspace.
- '**clc**' clears text in command window.

Arrays

- 'Matrices' in Mathematics are 'arrays' in MATLAB.
- Arrays are used to store and organise data.
- Arrays in MATLAB can be multi-dimensional.

Different types of arrays. Example:

- **Double array**: stores numbers
- **Char array**: stores alphanumeric characters

Creating arrays

Basic method to create an array

Put elements of array inside square brackets with a comma or space between elements. Separate rows by semicolons.

Create random arrays with **rand**

Easy way to create 1D arrays (row vectors)

- Use the colon operator ':'.
- Use the function **linspace**.

Note: Many functions can take as an input an array.

Special matrices

- Matrix of ones: use the function '**ones**'
- Matrix of zeros: use the function '**zeros**'
- Identity Matrix: use the function '**eye**'
- Diagonal Matrix: use the function '**diag**'

Manipulating matrices

Copying and resizing:

- The function '**repmat**' creates copies of a given matrix
- The function '**reshape**' transforms the size of a given matrix

Arithmetic operations with arrays:

- Operations between a constant (say c) and a matrix (say A)
  Examples: A+c, A-c, A*c, A/c, A^c
- Operations between two matrices (say A and B)
  Examples: A+B, A-B, A*B, A/B, A.*B, A./B, A.^B

Transpose of A is A'

Array indexing

Extracting elements of array. **Examples**

- Let A=[5 3 1 0]. Then A(1)=5, A(2)=3 and so on.
- If B =

$$\begin{bmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{bmatrix},$$

  Then $B(2,1) = 2$, $B(3,2) = 6$, etc
- Use of special characters to extract elements of the array in many ways: colons, end, subarrays, using boolean variables, etc.

Char arrays

- Char Arrays store alphanumeric characters such as numbers and letters.
- 1-D char array is called a ‘string’.
- Can also use ’**sprintf**’ for more interesting applications.

Other ways of handling data

- **Struct** arrays.
- **Cell** arrays.