Matlab Workshop I

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- Matlab is an interactive program for numerical computation and data visualization

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- `help function-name`

  information about a specific function. For example, `help eye` gives information about generating an identity matrix.

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    `A = [1 2 3; 4 5 6; 7 8 9]`
  - Generated by built-in functions. For example,
    `eye(m,n), zeros(m,n), ones(m,n), linspace(a, b, n), 1:n, randn(m,n), rand(m,n), diag(v,k), diag(A), blkdiag`

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- Empty Matrix: `[]`

Values of Useful Constants

`pi`	$3.14159265\ldots$
`i`	Imaginary unit, $\sqrt{-1}$
`j`	Same as `i`
`eps`	Floating-point relative precision, $\epsilon = 2^{-52}$
`realmin`	Smallest floating-point number, 2^{-1022}
`realmax`	Largest floating-point number, $(2-\epsilon)^{1023}$
`Inf`	Infinity
`NaN`	Not-a-number

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- `save filename x y z`

  This creates a file `filename.mat` which contains variables `x y z`

Format Functions

`format`	Default. Same as `short`
`format short`	Fixed point with 5 decimal places
`format long`	Fixed point with 15 decimal places
`format short e`	Floating point with 5 decimal places
`format long e`	Floating point with 15 decimal places
`format short g`	Best of fixed or floating point with 5 DPs
`format long g`	Best of fixed or floating point with 15 DPs
`format hex`	Hexadecimal format
`format compact`	Suppress extra line-feeds
`format loose`	Put the extra line-feeds back in

Try the example `t = [4/3 1.2345e-6]`

Sub-matrices and Colon Notation

`1:5`	`[1 2 3 4 5]`
`0.4:0.2:1.2`	`[0.4,0.6,0.8,1.0,1.2]`
`A(1:4,3)`	the column vector with the first four entries of the third column
`A(:,3)`	the third column of `A`
`A(1:4,:)`	the first four rows of `A`
`A(:, [2 4]) = [ ]`	delete columns 2 and 4 of `A`
`A(:, [2 4]) = B(:,1:2)`	replacing columns `2,4` with the first two columns of `B`

Effort should be made to become familiar with them!!!

Standard Operators

+	addition
$-$	subtraction
$*$	multiplication
^	power
'	conjugate transpose
$\backslash$	left division
/	right division
$x = A\backslash b$	the solution of $A * x = b$
$x = b/A$	the solution of $x * A = b$

Pointwise Operation

`+`	addition
`-`	subtraction
`.*`	Element-by-element multiplication
`.^`	Element-by-element power
`.\`	Element-by-element left division
`./`	Element-by-element right division
`.'`	Unconjugate array transpose (same as `transpose(A)`)

Pointwise Operation: Some Examples

Matlab Command	Output
`[1,2,3].*[5,6,7]`	`[5,12,21]`
`[10:-2:0].^2`	`[100,64,36,16,4,0]`
`2.^[1:6]`	`[2,4,8,16,32,64]`
`[2,4,6]./2`	`[1,2,3]`
`2./[2,4,6]`	`[1.000 0.5000 0.3333]`
`[2,2,2]./[2,4,6]`	`[1.000 0.5000 0.3333]`
`[2,4,6].\2`	`[1.000 0.5000 0.3333]`
`[1 1+2*i; i 3].'`	`1.0000 0+1.0000i` `1.0000+2.0000i 3.0000`

Math Functions

The Matlab command `help elfun` gives a list of elementary math functions

- Trigonometric: `sin, sinh, asin, asinh, cos, cosh, acos, acosh, tan, tanh, atan, atan2, atanh, sec, sech, asech, csc, csch, acsc, acsch, cot, coth, acot, acoth`

The variables of these functions could be matrices!!!

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- Rounding and remainder: `fix, floor, ceil, round, rem, sign`

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Hardcopy

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  `diary` *filename*

  causes what appears subsequently on the screen (except graphics) to be written to the named diskfile (if no file is specified, the file '`diary`' is used). To save space, don't forget the command `format compact`

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  turns `diary` back on