Eng 101

Matlab again

Misc.

- Exams back in lab Tues/Wed.
  - Exam scores posted on Tuesday.
- Don't have final numbers yet, but with 80% graded and recorded:
  - Average 76, Median 79, high 100, low 11, STDEV 16

Matlab

- Half of today will be review. Then we will start on a problem.
  - We will spend the next 2 weeks on:
    - The language
    - Plotting
    - Curve fitting
    - Problem solving

On-line Help

- help — lists topics on which help is avail
- helpwin — opens interactive help window
- helpdesk — opens web browser based help
- help *topic* — provides help on topic
- lookfor *string* — lists help topics containing string
- demo — runs the demo program
- *http://www.engin.umich.edu/group/ctm/basic/basic.html*

Workspace Info

- who lists variables currently workspace
- whos lists variables currently in workspace with their size
- what lists m-files in current directory
- clear clears workspace, all variables are removed
- clear x y z clears only variables x,y,z

arithmetic calculations

- + addition
- - subtraction
- * multiplication
- / division
- \ left division
- ^ exponentiation
- ‘ transpose

Examples:

if don’t specify a variable, MATLAB uses ans

```
>>2+2
ans =
   4

>>x=2+2
x =
       4
```

Examples: “;”

```
>>y = 2^2 + log(pi)*sin(x);
>>y
y =
       3.1337
```

; at the end suppresses screen output

pi MATLAB constant

```
>> theta = acos(-1)
theta =
        3.1416

>> format short e
>> theta
theta =
        3.1416e+000
```

```
format short          31.4159
format short e        e.1416e+001
format long           31.41592653589793
format long e         3.141592653589793e+001
format short g        31.416
format long g         31.4159265358979
```

(There are other formats such as hex, bank & ratio)

arrays

```
>> x = [1 2 3]
x =
        1  2   3
>>y = [2 ; 1 ; 5]
y =
        2
        1
        5
```

arrays

```
a = [1  2  ;  3  4]        % 2 x 2 matrix
a =
        1   2
        3   4
```

```
>> z
z =
   2   1   0
>> x
x =
  1   2   3

>> a = x.*z
a =
      2   2   0
```

multiply elem of 2 same-sized vectors term by term
.*
./ can also divide term-by-term

Can multiply by a scalar. Each item affected.

```
>>a
a =
      2   2   0
>>b = 2 * a
a =
  4   4   0
```

transpose

swap rows & columns

```
>>A = [1 2 ; 3 4]
A =
      1   2
      3   4
>>A'
ans =
      1   3
      2   4
```

```
A = [16   3    2   13;
      5  10   11    8;
      9   6    7   12;
      4  15   14    1];

>> sum(A)              %sums cols
ans =
     34    34    34    34
```

con't

```
>> sum(A')';
   % sums rows
ans =
   34
   34
   34
   34
```

```
>>diag(A)
ans =
      16
      10
       7
       1
>>sum(diag(A))
ans =
      34
```

the other diag

```
>>sum(diag(fliplr(A)))
ans =
   34
```

fliplr slips a matrix from left to right

sum all rows = 34
sum all cols = 34
sum both diags = 34
MAGIC

Magic Square

```
B = magic(4)
B =
   16    2    3   13
    5   11   10    8
    9    7    6   12
    4   14   15    1
```

eye

```
c = eye(3,3)
c =
     1  0  0
     0  1  0
     0  0  1
```

arrays

d = zeros(4,4); %4x4 matrix of all 0's

linspace

>>x = linspace(0,10,5)

x =

0 2.5000 5.0000 7.5000 10.0000

create a vector x with 5 elements linearly spaced between 0 and 10

Subscripts

element in row i

column j

noted as A(i,j)

A(1,4) + A(2,4) + A(3,4) + A(4,4)

not elegant

Watch assignments

t = A(4,5)

Index exceeds matrix dimensions

HOWEVER,

X = A;

X(4,5) = 17

outside of the range of X

EXPANDS to accommodate

Colon Operator

one of MATLAB's most important operators

1:10

row vector containing integers 1-10

1 2 3 4 5 6 7 8 9 10

non-unit spacing

- specify an increment

100: -7: 50

is

100 93 86 79 72 65 58 51

and

0 : pi/4 : pi

is

0 0.7854 1.5708 2.3562 3.1416

Subscript expressions

A (1 : k,j)
first k elements of the jth column of A

sum(A(1:4,4)
sums the 4th column (assuming there are only 4 rows)

: by itself refers to entire row/col
keyword end refers to last row/col
sum(A (: , end))
sums elem of last col of A

Elementary Math Functions Availible

- help elfun

- More advanced math fns
- help specfun
- help elmat

Useful Constants

- pi 3.14159265…
- i imaginary unit $\sqrt{-1}$
- j same i
- eps floating-point relative precision 2^{-52}
- realmin smallest floating PT 2^{-1022}
- realmax largest floating PT $(2-\varepsilon)2^{1023}$
- Inf infinity
- NaN not-a-number

load command

- create a data file

16.0 3.0 2.0 13.0
5.0 10.0 11.0 8.0
9.0 6.0 7.0 12.0
4.0 15.0 14.0 10
save as magik.dat

- load magik.dat
  - reads the file and creates a variable magik which contains the matrix

M-files

- files that contain MATLAB code
- save using *.m extension
- magik.m
- command magik
  - reads the file and executes the code

Concatenation

- process of joining items together
- join smaller arrays to make larger ones

```
A=[1 2; 3 4];
B=[A A+3; A+4 A+1]
B=
   1  2  4  5
   3  4  6  7
   5  6  2  3
   7  8  4  5
```

Deleting Rows & Columns

X = A;

- delete 2nd column of X

X(:, 2) = []

X =

1

2

Delete One

- Delete a single element: ERROR

  X = [1 2 ; 3 4]

  X(1,2) = []

No longer a matrix