Matlab Programming

a logical approach

Outline

- Announcements:
  - Homework I: due Wed. by 5, by e-mail
  - Last day to add/drop or change credit/audit
- Iteration
- Conditionals and logic
- M-files

Iteration

- For loops in Matlab use index-notation:
  ```
  for j=st:step:en;
     <commands involving j> ;
  end
  ```
- Example: u'*v
  ```
  tot=0;
  for j=1:length(u);
     tot=tot+u(j)*v(j);
  end
  ```

Conditionals

- Conditional statements control flow of a program

```
if(logic);
    <commands executed if true>;
else;
    <commands executed if false>;
end
```

- Matlab also has switch:

```
switch(j);
    case a: <commands if a=j>;
    case b: <commands if b=j>; …
    otherwise: <default commands>;
end
```

Logic

- Relational operators: (R x R -> B)
  - <, >, <=, >=, ==, ~=
  - isnan(a), isinf(a)
- Logical operators: (B x B -> B)
  - &, |, ~, xor (which is just ~=)

a	b	a&b	a|b	xor(a,b)	a~=b
T	T	T	T	0	0
T	0	0	T	T	T
0	T	0	T	T	T
0	0	0	0	0	0

Logic

- Matlab's Boolean type is a double
  - 0=> false; anything else => true
- Logical operators are defined for arrays:
  - a=1:5;
  - b=a<3
    - b= 1 1 0 0 0

Logic--searching with find

- Find--searches for the truth (or not false)
  - b=[1 0 -1 0 0];
  - I=find(b)
    - I=1 3   --b(I) is an array without zeros
  - I=find(ones(3,1)*[1 2 3]==2)
    - I= 4 5 6
  - [I,J]=find(ones(3,1)*[1 2 3]==2)
    - I= 1 2 3
    - J= 2 2 2

Programming

- Matlab programs are stored in "m-files"
  - Text files containing Matlab commands and ending with .m
  - Script m-files--commands executed as if entered on command line
  - Function m-files--analogous to subroutines or methods, maintain their own memory (workspace)

Functions

- First line of file must be function [outputs]=fname(inputs)
  - outputs and inputs can be blank
  - Comments immediately following are returned by help
  - Functions must be in current directory or in Matlab's search path

Example: Geostrophy

- We want to create a function to compute velocity from SSH data

```
lon  SSH  →  SSHvel.m  →  U
     lat              V
```

Matlab Path

- Matlab maintains a list of directories where it searches for files
- Type "path" to see
- Can add directories using addpath or through GUI
- To make permanent, place addpaths in startup.m
  - a special script that is executed at startup

Summary

- Iteration with for (while exists too)
- Conditionals with if and switch
- Logical operators and vectorized
- 0=false
- find searches for truth
- Extend matlab with m-file functions
  - [output]=fname(input)