Machine Learning

Prof. Jose L. Mendoza-Cortes

Scientific Computing Department, Dirac Science Building
Materials Science and Engineering, High Performance Materials Institute
Florida State University
jmendozacortes@fsu.edu

Condensed Matter Theory, National High Magnetic Field Laboratory
Florida State University
mendoza@magnet.fsu.edu

Chemical and Biomedical Engineering
Florida State University — Florida A&M University — College of Engineering
mendoza@eng.famu.fsu.edu

Web: http://mendoza.eng.fsu.edu/

Overview

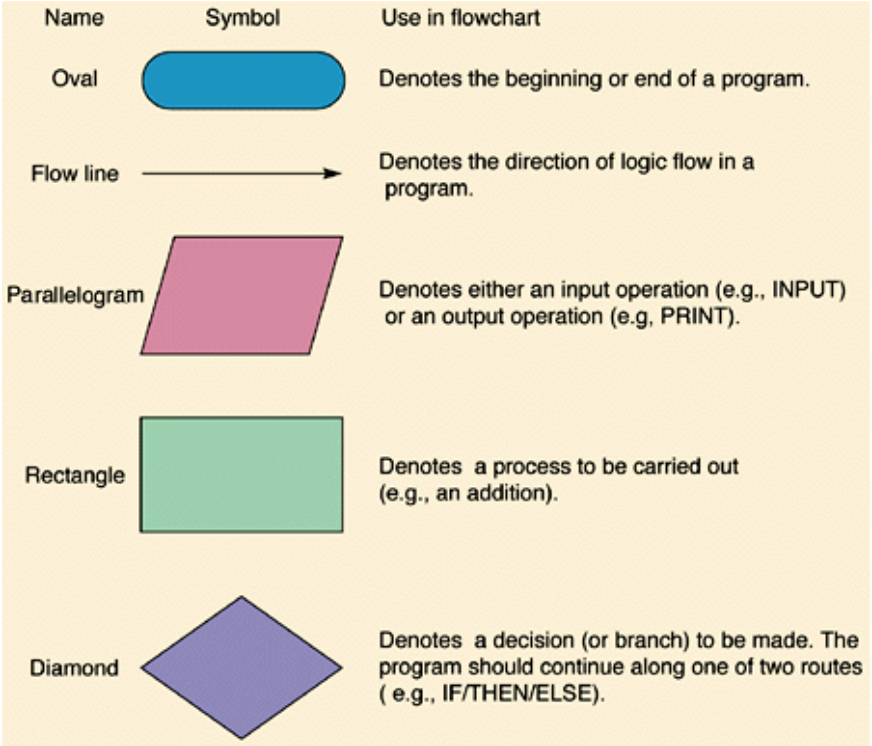
Lecture: MATLAB Programming Environment
Lecture: Vector and Matrix Operations

1. MATLAB Environment

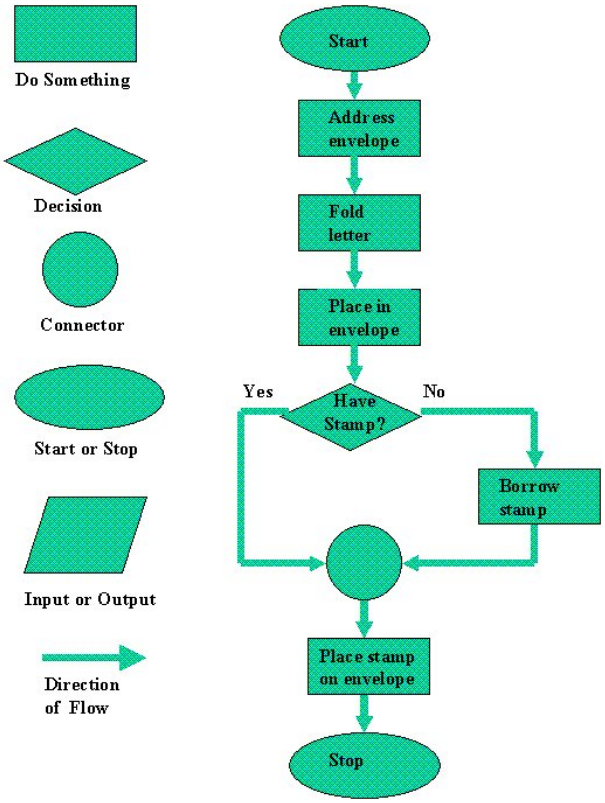
"The first principle is that you must not fool yourself - and you are the easiest person to fool"
-Richard P. Feynman

Notes: Programming

A computer does two things, and two things only: it performs calculations and it remembers the results of those calculations



Notes: Programming



Cooking

1.- Boil water
2.- Add water to instant noodle cup
3.- Let it be for 3 minutes
4.- Taste it and see if you like it
5.- Add some sauce or other things
6.- stir
7.- EAT

Notes: MATLAB

Why MATLAB is great?

* It was built with the intention to work with matrices (e.g. like column vectors)
* MATLAB is at least as good as your calculator

```
a = 2;
b = 3;
a + b
v=[0 1 2]
u=[3; 4; 5]
w=[1 2 3; 4 5 6; 7 8 9]
transpose(u)
z = u'
v + u'
u(2)
v(1)
w(:,2)
w(2,:)
x=[5 6 7]
x * v % invalid, why?
x .* v % valid. why?
% This is IMPORTANT!
```


Notes: MATLAB- Concatenation (More info)

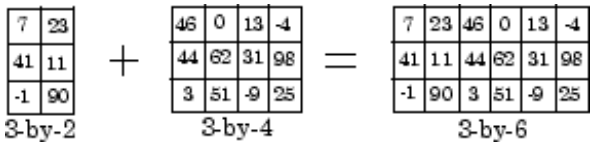
```
C=1:0.5:2.5
C=[1:0.5:2.5]
C(2)     => 1.5
C(1,2)   => 1.5
C2=C'
C2(2)    => 1.5
C2(2,1) => 1.5

%Concatenation
c=1:3    => [1 2 3]
d=2:3    => [2 3]
e=[c d] => [1 2 3 2 3]
d2=3:4   => [3 4]
c2=2:4   => [2 3 4]

d3=[d;d2] => 2by2 matrix
c3=[c c2] => 2by3 matrix
```

Semicolon operator;

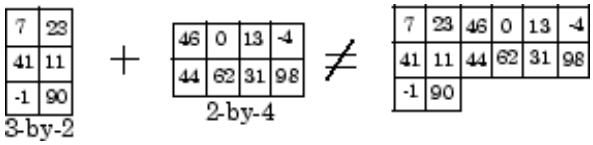
When used at the end of the line, it suppress any display of numerical operations. When used in brackets, it does a vertical concatenation.

```
s=[d;c] % Error, columns match?
f=[c;c3] % Error, rows match?
```

Same Height



Not the Same Height



Notes: MATLAB - Loops (More info)

There are two types of loops in MATLAB:

1. `for` statements loop a specific number of times, and keep track of each iteration with an incrementing index variable.

```
for i=1:10
i
end
```

2. `while` statements loop as long as a condition remains true.

```
i=1
while i < 10
i=i+1
end
```

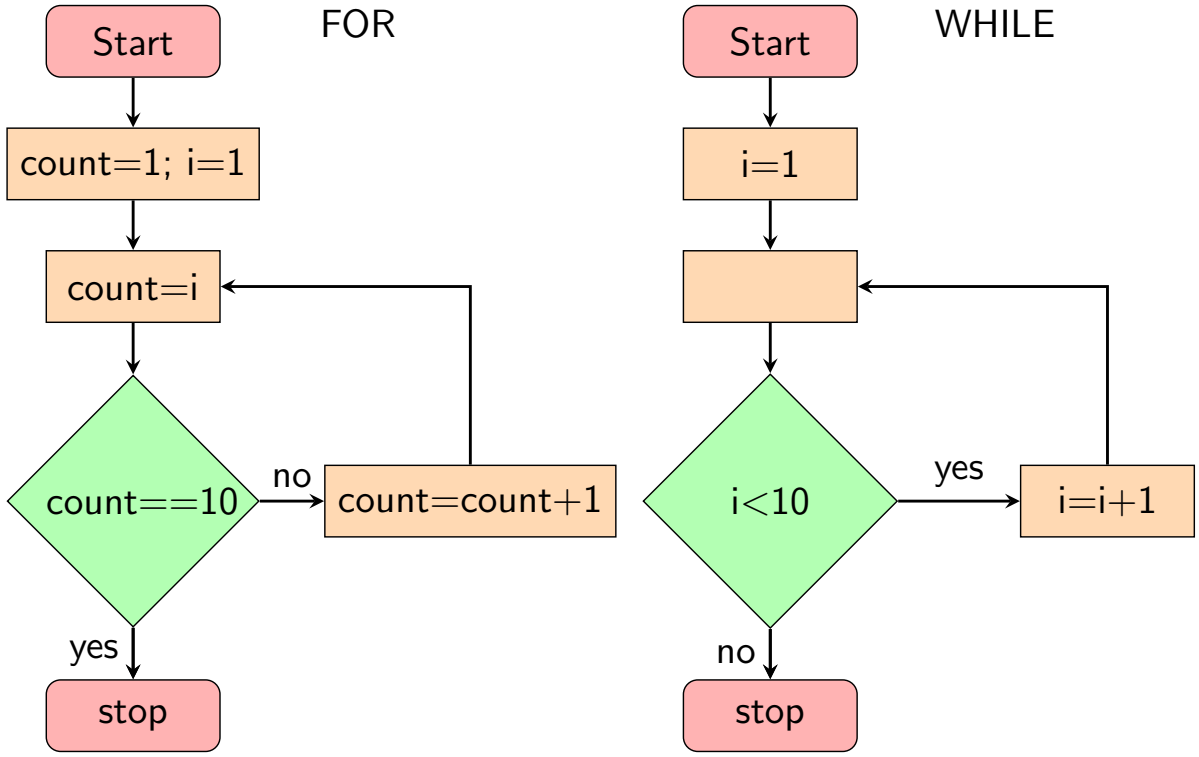
Either can be used for this purpose. Another way to look at them is:

- `for` loops continue a set number of iterations
- `while` loops continue until a condition is met

Class Exercise

Draw the flow diagram of each case

Notes: MATLAB - Loops (More info)



In class we discuss how to make a `while` loop infinetly, do you remember how?

Notes: MATLAB - Loops (More info)

More on Loops and Conditions

```
for i=1:5 % try for i=1:2:10
x(i)=i
v(i)=i^2
end
plot(x,v)
```

As some of you might have recognized, you can get the same effect by the following:

```
x=[1:1:5];
v=x.^2; % notice our friend
".^", what if you used only ^?
plot(x,v)
```

Example

Solve $\sum_{i=1}^{10} i^2$

Remember it is a good technique to start with your flow diagram

```
sum = 0
for i=1:10
sum=sum+i^2
end
```


Lecture: MATLAB - Decisions if/elseif/else (More info)

Example:

```
% note the == to test
% equality

if i==1
disp('i=1')
elseif i<1
disp('i<1')
else
disp('i>1')
end

%Now give different values
%to i and test it
```

Problem: A single iteration can be skipped by using the `continue` command
Solve $\sum_{i=1}^{10} i^2$ with $i \neq 4$
is equivalent to $\sum_{i=1}^{3} i^2 + \sum_{i=5}^{10} i^2$

```
sum=0
for i=1:10
if i=4
continue
end
i
sum = sum + i^2
end
%What happen if you comment out
%the continue subroutine
```

There are other ways to solve this problem. Can you write them down?

Review

Notes: MATLAB Programming Environment
Notes:Vector and Matrix Operations

1. Programming Environment
2. Vectors
3. Matrix Operations

Remember

- The percent sign % denotes the start of a comment, and MATLAB ignores it.
- The operators .* tellw MATLAB to do element by element multiplication. The sign ./ tells an element by element division.

How to look for Help

- You can always get help on a command (say `plot`) by typing `help plot` in MATLAB's command window.
- You can also use the upper right corner section called "Search Documentation"
- And of course, there is also Google. Just make sure that in your search you include 'MATLAB and the question'

Appendix: Scripts included

Code 1: Introduction.m

```
a = 2;
b = 3;
a + b
v=[0 1 2]
u=[3; 4; 5]
w=[1 2 3; 4 5 6; 7 8 9]
transpose(u)
z = u'
v + u'
u(2)
v(1)
w(:,2)
w(2,:)
x=[5 6 7]
%x * v %matrix multiplication
% invalid, why?
%x .* v %elementbyelement
% valid. why?
% This is IMPORTANT!
```

Try these commands in your own workstation, i.e. have the lectures on one half side of your screen and Matlab/Octave-GUI on the other half.

Check the scripts/functions under the directory for this note number (X): /NX_Notes_directory