Week 2: Steps In Problem Solving & Some MATLAB Basics

Concepts:

- review variable assignment, structural elements of MATLAB
- identify 6 types of action involved in algorithm
- preview of arrays (link to lab 1)
- use built-in functions (link to lab 1)

Reading for next week:

For Tues: pg. 35-40 (review), 40-60, 266-267
there will be a quiz on the material on pages 35-60.
For lab: pg. 443-456
For Thurs: pg. 60-69

TA hours, EOS-Main 203 – make sure to note these carefully!

Thurs (wks 3,4,5,6,8,9,10,11): 9:30am – 10:30am
Mon (wks 7,10 **only**): 11:00am – noon

Lab due on Canvas by 4pm Friday

Types of Action in Algorithm

use example from last time, maximum earthquake magnitude

1. read mag1
2. read mag2

3. Is mag2 > mag1 ?
3a. YES: biggest = mag2
3b. NO: biggest = mag1

4. read mag3
5. Is mag3 > biggest ?
5a. YES: biggest = mag3
5b. NO: don't need to update biggest

6. Loop over 4-5b until reach end of list
7. write out biggest

Types of Actions

- Input
- Operation
- Selection
- Repetition
- Output
- Stop

Question

Case Sensitivity: what happens when…..

```
>> if = 2;
??? if = 2;
       |
Error: The expression to the left of the equals sign is not a valid target for an assignment.
```

What went wrong? I tried to use ``if'' as a variable name, BUT "if" is a reserved word so I cannot redefine it.

```
>> IF = 2;
```

Because MATLAB is case sensitive I AM allowed to do this. However, it is very bad programming practice

Review from Lab
(1) Variable Assignment

Worksheet A: What is output in words of this code snippet?
Worksheet B: Identify variables etc

```
% radius of Earth in km
radius = 6371;
area = 4*pi*radius*radius;
% radius of Moon in km
radius = 1739;
area = 4*pi*radius*radius
```

``pi'' in MATLAB returns the value of pi

pi = 4*atan(1) and imag(log(-1))

Worksheet C & D:

Review from Lab
(2) Arrays in MATLAB (see next week)

Recall: In lab 1 you loaded a file lab1.mat that contained 2 variables:

```
>> load lab1
>> whos
  Name                  Size              Bytes  Class     Attributes

  temperature       12213x1                97704  double
  time              12213x1                97704  double
```

`Temperature` 12213 measurements
this is an array, dimensions 12213 by 1

A big advantage of MATLAB is the ease of dealing with vectors and matrices

Analogy: think of a table / EXCEL file

- each VALUE in the table is defined by its POSITION (row #, col #)
- conversely each POSITION in the table (row #, col #) has associated with it a VALUE

Arrays in MATLAB

Let's look at e.g.,10 entries in a list of eq magnitudes:

```
>> clear
>> mags = [4.2; 4.1; 4.1; 4.1; 4.3; 4.2; 4.3; 4.5; 4.0; 4.7];
```

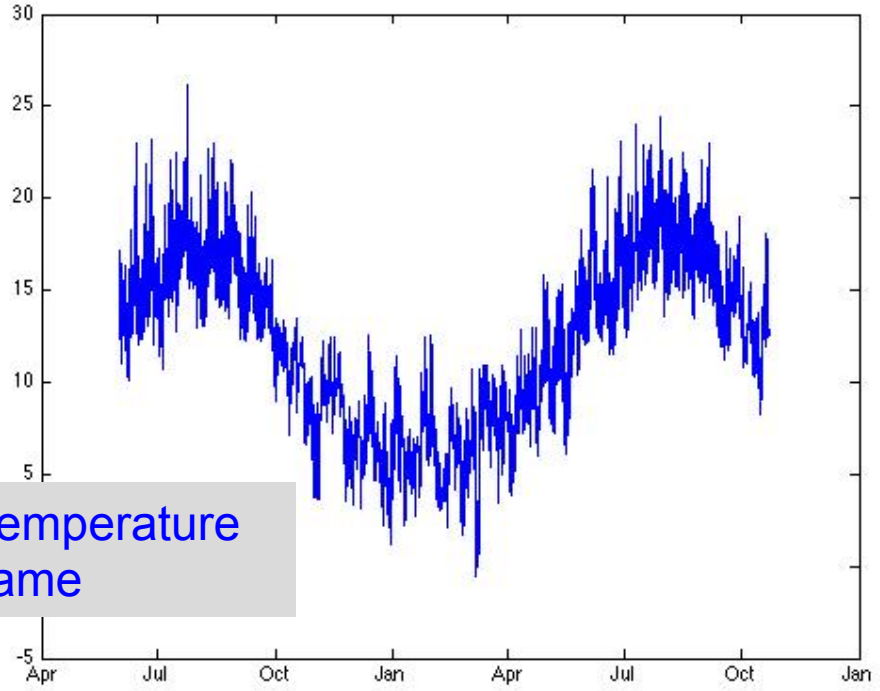
SEE NEXT WEEK

```
>> whos
  Name          Size                Bytes  Class     Attributes

  mags          10x1                   80  double

 >> mags

 mags =

     4.2000
     4.1000
     4.1000
     4.1000
     4.3000
     4.2000
     4.3000
     4.5000
     4.0000
     4.7000
```

Worksheet E

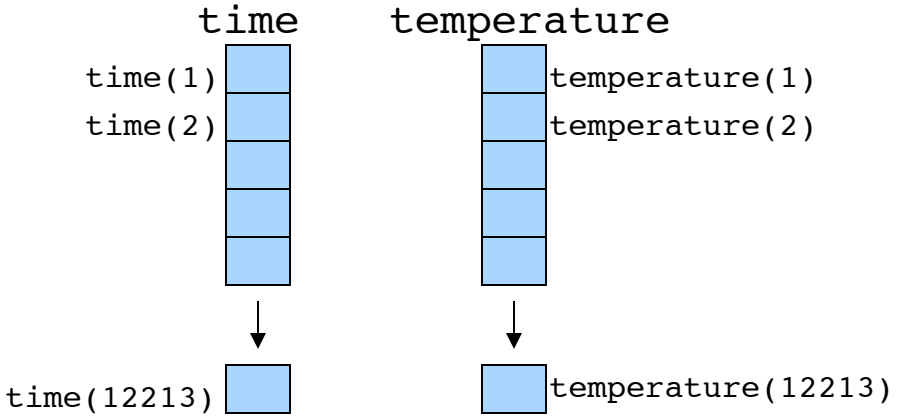
Arrays and Plotting

```
load lab1;
figure(1)

plot(time,temperature)
datetick('x',3)
```



# of points in time and temperature
MUST be the same

What has happened to make the plot?



Just like plotting by hand the plot command has made a figure that consists of pairs of points

temp(1), temperature(1)
time(2), temperature(2)

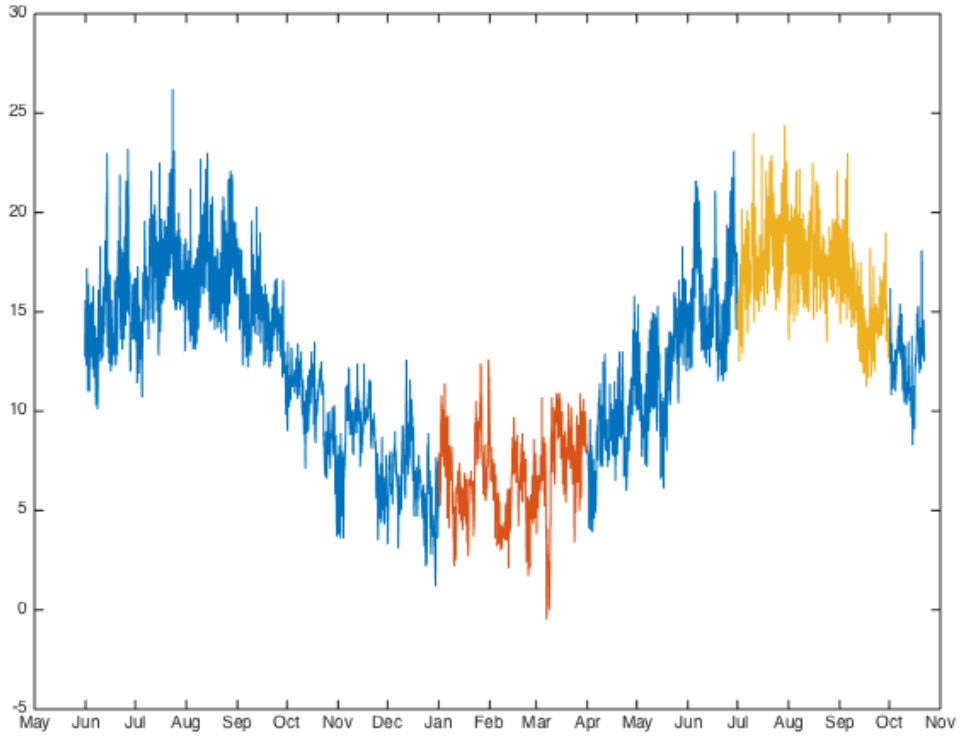
↓

time(12213), temperature(12213)

Arrays and Plotting

What does this do?

```
>> plot(time,temperature,time(5149:7308),temperature(5149:7308),....
    time(9493:11700),temperature(9493:11700)
```

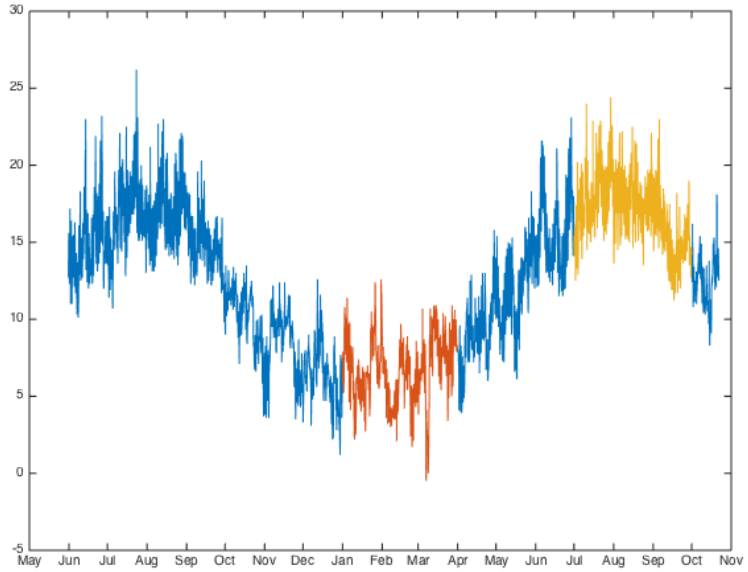


Defining new arrays

```
>> plot(time,temperature,time(5149:7308),temperature(5149:7308),....
    time(9493:11700),temperature(9493:11700)
```

This is error prone if there are many commands involving the winter or summer parts of the time and temperature arrays. So we defined new arrays

```
wtime = time(5149:7308);
wtemp = temperature(5149:7308);
stime = time(9493:11700);
stemp = temperature(9493:11700);
```



Programming Style Hint:
Use variable names that are easy to understand and try to keep them short

e.g. wtemp vs. winter_temperature

See text p. 28-29 for Programming style guidelines & common pitfalls

Using Built-In Functions

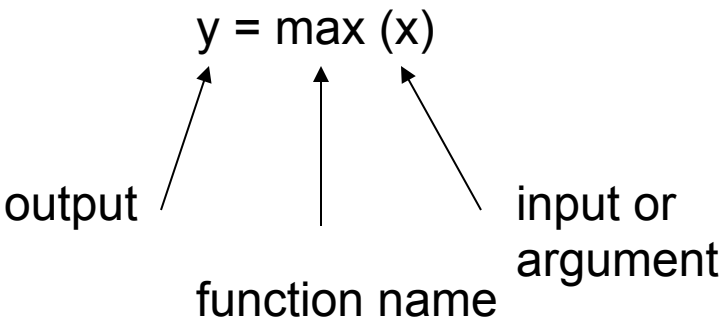
Worksheet F:

```
y3 = max(mags(3:8))
```

Steps:

1. select a subset of mag that includes the 3rd thru 8th values
2. calculate the maximum of these using the built-in function “max”
3. assign the output to a variable called y3
4. no semi-colon so echo the value of y3 to the screen

General Syntax:



Advantage of MATLAB: many built-in functions

Why Arrays and Built-In Functions are Slick:
Finding the Largest Earthquake

my algorithm that we could code up explicitly (i.e. write code that looks pretty much like this set of instructions):

0. load data file with magnitudes
1. read mag1
2. read mag2

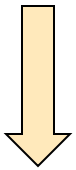
3. Is mag2 > mag1 ?
3a. YES: biggest = mag2
3b. NO: biggest = mag1

4. read mag3
5. Is mag3 > biggest ?
5a. YES: biggest = mag3
5b. NO: don't need to update biggest

6. Loop over 4-5b until reach end of list
7. write out biggest

BUT we've learned we can load arrays and use them as the input to built-in functions in MATLAB:

So this can be coded in 2 lines!



```
% load array of earthquake magnitudes
load mags;
% find biggest and echo to screen
biggest = max(mags)
```