MATLAB Tutorial - Week 3

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NOTE: at any point, typing `help` *functionname* in the Command window will give you a description and examples for the specified function

1 Flow control: For-loops and IF statements

1.1. For-loops

- For-loops are very powerful and are often used in MATLAB. The basic syntax goes as follow:

```
for index = start :  increment :  end

    statements

end
```

Example: Display the index

```
for ii = 1:2:10

    ii

end
```

The loop is repeated n-times, where n is the length of the index vector (ii in this example), and `statements` is evaluated every time.

Example: Calculate a sum

To calculate s=$\sum_{n=1}^{1000} n$, we can use a for loop

```
s=0;

for n = 1:1000

    s= s + n

end
```

Example: Plot the first 6 days of a time series on 6 different subplots

1. Load the 'wind_Sable_Island.mat' file from tutorial #2.

2. You want to plot the first 6 days on 6 different subplots. A for-loop can be (one of) the solution for such a problem. The time series time step is 1 hour. Therefore, you need an increment of 24 in your for-loop.

```
counter=1;
% The 'counter' is a good way to keep track of the number of iterations completed
(The name counter can obviously be changed to anything else). In this example,
it is going to be used to assign the truncated time series to a specific subplot
and generate a title.
figure % Create a new figure
for tt = 1:24:6*24
subplot(3,2,counter) % create 6 (3*2) subplots to plot the first 6 days of the
wind speed time series
plot(time(tt:tt+24),WSPD(tt:tt+24))
xlabel('Time'); ylabel('WSPD');
title(['Day #',num2str(counter)])
counter=counter+1; % Keep track of the number of iterations
end
```

NOTE: The num2str() function transforms an integer to a string. It is useful to generate titles, or labels, that change at each iteration. The [ ] symbols used in the title() function are here to concatenate both string inputs into one string argument.

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1.2. the IF statement

- The IF statement is also very useful when a condition needs to be applied to the data. It can also be used within a for-loop. The basic syntax goes as follow:

```
if condition 1

    statement 1

elseif condition 2

    statement 2

else

    statement 3

end
```

- IF statements must be used with caution! MATLAB goes through the conditions linearly. If *condition 1* is true, then it runs *statement 1* and ignore the other conditions and statements. So if your data point satisfies the first two conditions, only *statement 1* will be executed. If none of the conditions are satisfied, then *statement 3* is executed.

- The conditions are defined using the logical operators

'<' → less than

'<=' → less than or equal to

'==' → equal to

'∼=' → not equal to

'>=' → greater than or equal to

'>' → greater than

- You can also include several conditions using AND or OR operators:

'&' $\rightarrow$ element-wise AND

'|' $\rightarrow$ element-wise OR

'&&' $\rightarrow$ short-circuit AND

'||' $\rightarrow$ short-circuit OR

Example: Same as before but plot in red if the average is greater than 20km/h, in black otherwise

```
counter=1;

figure

for tt = 1:24:6*24

    subplot(3,2,counter)

    if mean(WSPD(tt:tt+24))>20

        plot(time(tt:tt+24),WSPD(tt:tt+24),'r')

    else

        plot(time(tt:tt+24),WSPD(tt:tt+24),'k')

    end

    xlabel('Time'); ylabel('WSPD');

    title(['Day #',num2str(counter)])

    counter=counter+1;

end
```

NOTE: The text indentation is a good way to keep track of the different loops.

- As an exercise, try to re-use this example to plot

    – in red winds that have a daily average between 20 km/h and 30 km/h,

    – in green winds that have a daily average greater than 30 km/h,

    – in black the rest

Solution

```
counter=1;

figure

for tt = 1:24:6*24

    subplot(3,2,counter)

    if mean(WSPD(tt:tt+24))>20 && mean(WSPD(tt:tt+24))<30

        plot(time(tt:tt+24),WSPD(tt:tt+24),'r')

    elseif mean(WSPD(tt:tt+24))>30

        plot(time(tt:tt+24),WSPD(tt:tt+24),'g')

    else

        plot(time(tt:tt+24),WSPD(tt:tt+24),'k')

    end

    xlabel('Time'); ylabel('WSPD');

    title(['Day #',num2str(counter)])

    counter=counter+1;

end
```