APSC 1001 Functions and Flow Control

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1 Functions

Up to this point, all of our .m MATLAB files have been scripts, which execute a set of commands in order. There is another type of .m file called a function, which allows us to create our own MATLAB function. Much like the built in MATLAB functions that we use on a regular basis, the functions we write can take input and output arguments of scalars, vectors, or matrices. A function file contains at a minimum the following code:

```matlab
function [ output_args ] = function_example( input_args )
%function_example Summary of this function goes here
%   Detailed explanation goes here


end
```

There are several important parts here. First, the file must be declared a function right at the beginning; this is how MATLAB can tell the difference between a function or a script .m file. Next come the output arguments (if any), then an '=' sign, then the name of the function, then the input arguments (if any). This format mirrors the way you would call the function in the command window.

1.1 Function example

Below is an example function file that takes in the side lengths of a triangle and returns the internal angles.

```matlab
1  function [ angles ] = triangle( sides )
2  %triangle Takes as inputs the side lengths of a triangle and returns the
3  %internal angles
4  %    Using the law of cosines, find the 3 internal angles in radians ...
       for a
5  %    given triangle
6  %       Input Aruguments:
7  %           sides: vector of three side lengths
8  %
9  %       Output Arguments:
10 %           angles: vector of three angles
11 %            note: angles will be sorted smalles to largest.
12
13 s = sort(sides);
14 a = s(1);
15 b = s(2);
16 c = s(3);
17
18 if (c> a+b) %check to make sure the input satisfies the triangle ...
       inequality
19     disp('This is not a triangle!');
20     return % if not, exit the function.
21 end
22
23 A = acos((a^2 - b^2 - c^2)/(2*b*c)); %law of cosines used to calculate
24 B = acos((b^2 - a^2 - c^2)/(2*a*c));
25 C = acos((c^2 - a^2 - b^2)/(2*a*b));
26
27 angles = [A B C]; %vector to return
28 end
```

Notice the comments in the function at the very beginning. These are what come up when you type 'help' into the command window, so make them useful! Additional comments throughout the function can also be helpful to anyone, including yourself, who looks at the code inside the function.

Try writing your own function to do the reverse - it should take as input arguments the internal angles and return the side lengths of a triangle.

2 FLOW CONTROL

There is one line in the code above that might not be familiar, and that is the *if statement*. Often when programming, we want to do something more involved than simply executing a list of commands. Sometimes, we might want to execute a block of code only if a certain condition is met. Other times, we want to execute the same block of code multiple times. This is generally called flow control of a program, and the most common methods are the *if-else statement*, the *for loop*, and the *while loop*.