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MATLAB
Unit 5-Lecture 18

BTech (CSBS) -Semester VII

20 Septemer 2022, 09:35AM

*few figures/content have been prepared/referred from internet source/books

Introduction to programming

1) Introduction,
2) M-File Scripts,
3) script side-effects,
4) M-File functions,
5) anatomy of a M- File function,
6) input and output arguments,
7) input to a script file,
8) output commands.

Scripts with input and output

circleIO.m

```
% This script calculates the area of a circle
% It prompts the user for the radius

% Prompt the user for the radius and calculate
% the area based on that radius
fprintf('Note: the units will be inches.\n')
radius = input('Please enter the radius: ');
area = pi * (radius ^2);

% Print all variables in a sentence format
fprintf('For a circle with a radius of %.2f inches,\n',...
     radius)
fprintf('the area is %.2f inches squared\n',area)
```

Executing the script produces the following output:

```
>> circleIO
Note: the units will be inches.
Please enter the radius: 3.9
For a circle with a radius of 3.90 inches,
the area is 47.78 inches squared
```

Example

plotonepoint.m

```
% This is a really simple plot of just one point!

% Create coordinate variables and plot a red '*'
x = 11;
y = 48;
plot(x,y,'r*')

% Change the axes and label them
axis([9 12 35 55])
xlabel('Time')
ylabel('Temperature')

% Put a title on the plot
title('Time and Temp')
```

Example

plot2figs.m

```
% This creates 2 different plots, in 2 different
%  Figure Windows, to demonstrate some plot features

clf
x = 1:5; % Not necessary
y1 = [2 11 6 9 3];
y2 = [4 5 8 6 2];
% Put a bar chart in Figure 1
figure(1)
bar(x,y1)
% Put plots using different y values on one plot
% with a legend
figure(2)
plot(x,y1,'k')
hold on
plot(x,y2,'ko')
grid on
legend('y1','y2')
```

Example

sinncos.m

```
% This script plots sin(x) and cos(x) in the same Figure Window
%  for values of x ranging from 0 to 2*pi

clf
x = 0: 2*pi/40: 2*pi;
y = sin(x);
plot(x,y,'ro')
hold on
y = cos(x);
plot(x,y,'b+')
legend('sin', 'cos')
xlabel('x')
ylabel('sin(x) or cos(x)')
title('sin and cos on one graph')
```

Question

Sometimes files are not in the format that is desired. For example, a file "expresults.dat" has been created that has some experimental results, but the order of the values is reversed in the file:

```
4   53.4
3   44.3
2   50.0
1   55.5
```

How could we create a new file that reverses the order?

Answer: We can **load** from this file into a matrix, use the **flipud** function to "flip" the matrix up to down, and then **save** this matrix to a new file:

```
>> load expresults.dat
>> expresults
expresults =
    4.0000   53.4000
    3.0000   44.3000
    2.0000   50.0000
    1.0000   55.5000
>> correctorder = flipud(expresults)
correctorder =
    1.0000   55.5000
    2.0000   50.0000
    3.0000   44.3000
    4.0000   53.4000
>> save neworder.dat correctorder -ascii
```

Question

Could we pass a vector of radii to the *calcarea* function?

Answer: This function was written assuming that the argument was a scalar, so calling it with a vector instead would produce an error message:

```
>> calcarea(1:3)
    Error using *
    Inner matrix dimensions must agree.

    Error in calcarea (line 6)
         area = pi * rad * rad;
```

This is because the * was used for multiplication in the function, but .* must be used when multiplying vectors term by term. Changing this in the function would allow either scalars or vectors to be passed to this function:

calcareaii.m

```
function area = calcareaii(rad)
% calcareaii returns the area of a circle
% The input argument can be a vector of radii
% Format: calcareaii(radiiVector)

area = pi * rad .* rad;
end
```

```
>> calcareaii(1:3)
ans =
  3.1416 12.5664 28.2743

>> calcareaii(4)
ans =
  50.2655
```

Note that the .* operator is only necessary when multiplying the radius vector by itself. Multiplying by **pi** is scalar multiplication, so the .* operator is not needed there. We could have also used:

```
area = pi * rad .^ 2;
```

Question

Nothing is technically wrong with the following function, but what about it does not make sense?

Answer; Why pass the third argument if it is not used?

fun.m

```
function out = fun(a,b,c)
out = a*b;
end
```

Practise Question

PRACTICE 3.1

Write a script to calculate the circumference of a circle ($C = 2\pi r$). Comment the script.

PRACTICE 3.2

Create a script that would prompt the user for a length, and then 'f' for feet or 'm' for meters, and store both inputs in variables. For example, when executed it would look like this (assuming the user enters 12.3 and then m):

```
Enter the length: 12.3
Is that f(eet) or m(eters)?: m
```

PRACTICE 3.3

Write a script to prompt the user separately for a character and a number, and print the character in a field width of 3 and the number left-justified in a field width of 8 with 3 decimal places. Test this by entering numbers with varying widths.

PRACTICE 3.4

Modify the script *plotonepoint* to prompt the user for the time and temperature, and set the axes based on these values.

Practise Question

PRACTICE 3.5

Modify the *plot2figs* script using the **axis** function so that all points are easily seen.

PRACTICE 3.6

Write a script that plots exp(x) and log(x) for values of x ranging from 0 to 3.5.

PRACTICE 3.7

Prompt the user for the number of rows and columns of a matrix, create a matrix with that many rows and columns of random integers, and write it to a file.

Practise Question

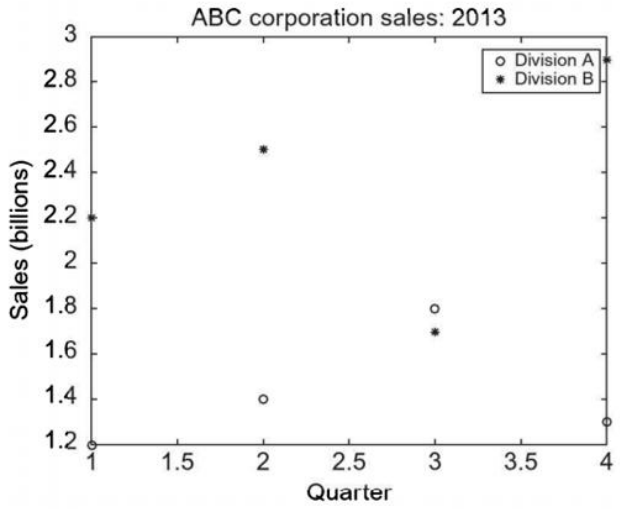
PRACTICE 3.8

The sales (in billions) for two separate divisions of the ABC Corporation for each of the four quarters of 2013 are stored in a file called "salesfigs.dat":

```
1.2 1.4 1.8 1.3
2.2 2.5 1.7 2.9
```

- First, create this file (just type the numbers in the Editor, and Save As "salesfigs.dat").
- Then, write a script that will

  load the data from the file into a matrix
  separate this matrix into 2 vectors.
  create the plot seen in Fig. 3.7 (which uses black circles and stars as the plot symbols).



Practise Question

PRACTICE 3.9

Write a script that will prompt the user for the radius and height, call the function *conevol* to calculate the cone volume, and print the result in a nice sentence format. So, the program will consist of a script and the *conevol* function that it calls.

PRACTICE 3.10

For a project, we need some material to form a rectangle. Write a function *calcrectarea* that will receive the length and width of a rectangle in inches as input arguments, and will return the area of the rectangle. For example, the function could be called as shown, in which the result is stored in a variable and then the amount of material required is printed, rounded up to the nearest square inch.

```
>> ra = calcrectarea(3.1, 4.4)
ra =
    13.6400

>> fprintf('We need %d sq in.\n', ceil(ra))
We need 14 sq in.
```