Input and Output

ENGR 1187
MATLAB 5
Input and Output In The Real World

Script files (which provide outputs given inputs) are important tools in MATLAB to make calculations, graph results or even play a game. Script files should be general enough to be used by someone unfamiliar with the program.
Today's Learning Objectives

- Create a basic program that can be used over and over or given to another person to use.

- Demonstrate proper use of the `input` command, which is the simplest command for interacting with the user.

- Use `fprintf`, which allows the student control over how results are displayed in the command window.
GPA Calculator Example – Background

- Script files can be used to complete known calculations or tasks the same way every time
- How is GPA calculated?
  - \((\text{Grade Points}) \times (\text{Credit Hours}) / \text{Total Credit Hours}\)
- EX:
  - ENGR 1181 (2 CH) – A (4.0),
  - MATH 1151 (5 CH) – B- (2.7),
  - PHYSICS 1200 (5 CH) – B+ (3.3)
  - \((4.0 \times 2 + 2.7 \times 5 + 3.3 \times 5) / (2 + 5 + 5) = 3.167\)
GPA Calculator Example – Using Script File

- Ex: Write a MATLAB program for the GPA calculation. Use variables so the program can be used for any set of grades/credits.

Steps:

1. Create variables for the grades as grade1, grade2 etc.

2. Create variables for the credit hours credit1, credit2 etc.

3. Write the formula for the GPA calculation using the values on the previous slide. Values are: Grade1 = 4, Grade2 = 2.7, Grade3 = 3.3, Credit1 = 2, Credit2 = 5, Credit3 = 5
clear                %initialization of variables
clc

disp(‘Your Name’)    
disp(‘Seat Number’)  

%Assign the grades for 3 subjects

grade1 = 4.0;    
grade2 = 2.7;    
grade3 = 3.3;
%Assign the credit hours for the 3 subjects

credit1 = 2; %now complete the program!

credit2 = 5;

credit3 = 5;

%Calculate the GPA from the equation

GPA =
((grade1*credit1) + (grade2*credit2) + (grade3*credit3)) / (credit1 + credit2 + credit3)
The same program could be more efficiently written using vectors.

Now write a program for calculating the GPA using vectors for the grades and credit hours.

Steps:

1. Create a vector called “grade” to input grades.
2. Create a vector called “credit” to input credit hours.
3. Write a formula to calculate the GPA with vectors using element arithmetic.
GPA Calculator Example – Using Script File with Vectors

clear %initialization of variables
clc

disp('Your Name')
disp('Seat Number')

grade = [4 2.7 3.3]; %Assign the grades for 3 subjects in a vector

credit = [2 5 5]; %Complete the program!!!

GPA = sum(grade.*credit)./sum(credit) %Calculate the GPA by doing element by element arithmetic
Data Inputs to Programs

- Both of the previous programs defined and assigned values to variables for grades and credit hours inside the program.

- If we wish to run these programs for a different set of grades or credits, the program must be changed.

- Once a program is written and verified, it is best not to change it – instead change input data.
Input to a Script File

- Sometimes the user does not know what to enter or what is required for the program to execute.
- We can prompt the user to enter values. This makes the program more robust and user-friendly.
- This is done by using the `input()` command:

  ```
  x = input('text')
  ```

  Note the use of single apostrophes around the text
Interactive Example

- For example, create a script file with:

```python
x = input('Please enter a value for x: ')
```

- Execute the script, the command window asks you:

```
Please enter a value for x: 5
```

```
x = 5
```

User input
Input a String to a Script File

- The `input()` command can also be used for a string input.

- The user does not need to know or understand what a string is or what is happening in the code.

```python
y = input('text','s')
```

Adding the ,’s’ will convert the input to a string.
Interactive Example Using Vectors

- The GPA calculation program can also be written using vectors in the script file with inputs

```matlab
%ask the user to enter the 3 grades/CH as a vector
grade = input('Enter the Grades as a vector: ');
credit = input('Enter the corresponding Credit Hours as a vector: ');

%Calculate the GPA by doing element by element arithmetic
GPA = sum(grade.*credit)./sum(credit)
```
Interactive Example Output

Enter the Grades as a vector: [4.0 2.7 3.3]
Enter the corresponding Credit Hours as a vector: [2 5 5]

GPA =

3.1667

- The values in red are entered following the prompt.
Input Dialog

- The input command is useful however does not work well with MATLAB’s publishing:

- An alternative is the `inputdlg` function.

- Similar to the input command only a dialog box will appear asking the user to enter in information.

- Example:
  - `x = inputdlg( 'Please enter a value for x' );` % Ask user for input
    - `x = str2num(x{:});` % Data is stored in a cell as a string. Extract and convert.

- Cells in MATLAB are arrays that contain data of varying types and sizes. The command above will be the only use of cells in this class.
Display to the Command Window

- At any time in the program, variables (or answers) can be displayed in the command window.

- Any variable that has been defined and is stored in the program and can be referenced.

- If x is defined, then it can be displayed:

\[
\text{disp}(x)
\]
Using fprintf Command

- First of all, fprintf is similar to disp() but allows more information in a single line.
- It can display 1 line of text.
  ```c
  fprintf('Text and more text. \n')
  ```
- It can show a combination of text and variable output(s) on the same line.
  ```c
  fprintf('Text and %valuedisplay and text. \n','variable')
  ```
- It can create tables (next slide).
Using fprintf Command

- To create a table using fprintf:
  1. Assemble the data in rows according to the order it will be displayed as columns.
  2. Print appropriate headers for the table.
  3. Print the body of the table reserving space for the numbers.
%Put grades and credit hours together as a table
TBL = [credit; grade];

%Print headers (can be disp or fprintf)
fprintf(‘\n Grade Summary  \n\n’)
disp(‘Credit’)
disp(‘Hours Grade’)

%body of table
fprintf(‘  %li %3.1f\n’,TBL)

%final results
fprintf(‘\n The overall GPA is: %0.2f\n’,GPA)
Using fprint Command – Table Example

- The previous script file produces:

Grade Summary

<table>
<thead>
<tr>
<th>Credit</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4.0</td>
</tr>
<tr>
<td>5</td>
<td>2.7</td>
</tr>
<tr>
<td>5</td>
<td>3.3</td>
</tr>
</tbody>
</table>

The overall GPA is: 3.17
Important Takeaways

- Use the `input()` command to prompt a user to enter the necessary information. e.g.: `x = input('Weight: ')`

- This can be automatically converted to a string by using `s`. e.g.: `y = input('Enter your name: ',',s')`

- The `disp()` command can display any variable at any time. e.g.: `disp(x)`

- The `fprintf()` command is a more complicated but robust way to display information.
Preview of Next Class

- Logical Expressions
  - Relational and logical expressions
  - True and False outputs
  - Various logical operators, how are they used?
  - Order of precedence for logical operators
What’s Next?

- Review today’s Quiz #05
- Open the in-class activity from the EEIC website and we will go through it together.
- Then, start working on MAT-05 homework.
- Before next class, you will read about basic for loops. For loops are the beginning of more complex programming. For loops set the conditions and limitations for which a program will execute multiple runs of code. Loops can be *nested* within other loops.