

CS368 MATLAB Programming

Lecture 4

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Based on lecture slides by Michael O'Neill and Beck Hasti

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Surface Plotting, Bowl

Quiz

- (Plot $z = x^2 + y^2$ for $x = y = [-1 \ 0 \ 1]$.)
- ① $x = \text{repmat}(-1:1, [3 \ 1]); y = x'$;
- $B : \text{surf}(x, y, x.^2 + y.^2)$
- $C : \text{surf}(x, y, x^2 + y^2)$
- $D : \text{surf}(x, y, x' * x + y' * y)$

String
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Text Output
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Text Input
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Files
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Surface Plotting, Bowl

Quiz

ASCII Code

Code

- ASCII stands for American Standard Code for Information Interchange.
- Each character is stored as an integer (its ASCII code).
- *0* to *9* are stored as 48 to 57.
- *A* to *Z* are stored as 65 to 90.
- *a* to *z* are stored as 97 to 122.

String as Vectors

Code

- A string is a list of characters.
- A string is stored as a (row) vector of integers with *char* variable type in MATLAB.
- *'Hello World!'* is a string, and *char([72 101 108 108 111 32 87 111 114 108 100 33])* represents the same string.

Combining Strings

Code

- Two strings can be combined the same way two vectors are combined, for example, `['Hello ' 'World' '! ']` is the same as `'Hello World! '`.
- `append(x, y, ...)` also combines the strings `x, y, ...`, for example, `append('Hello ', 'World', '!')` returns `'Hello World! '`.
- `strcat(x, y, ...)` combines (or conCATenate) the strings `x, y, ...`, and removes trailing spaces, for example, `strcat('Hello ', 'World', '!')` returns `'HelloWorld!'`.

String Conversion

Code

- `num2str(x, n)` converts a number x (not ASCII code) to a string, rounded to n significant digits (different from n decimal places), for example, `num2str(pi, 4)` is the same as `'3.142'` or `char([51 46 49 52 50])`.
- `str2num(x)` converts a string back to a number or a matrix, for example, `str2num('3.142')` returns the number 3.142 and `str2num('1 2; 3 4')` returns the matrix $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$.

String Operations, Addition

Quiz

- $'abc' + 1$
- $A: 'abc1'$
- $B: 'bcd'$
- $C: 98 \ 99 \ 100$
- $D: 146 \ 147 \ 148$

String Operations, Number Conversion

Quiz

- $str2num('1') + num2str(1)$
- A: **'11'**
- B: **11**
- C: **50**

String Operations, as Vectors

Quiz

- `text = 'a ':' e ';` `text(end:-1:1)`
- `B : 'edcba'`
- `C : 101 100 99 98 97`

String vs Character Array

Code

- In MATLAB, there is *string* variable type that stores multiple characters as a single object so that multiple strings can be stored in a vector without getting combined into one, for example, `['a' 'b' 'c']` is the same as `'abc'` but `["a" "b" "c"]` stays a vector and `"a" + "b" + "c"` is the same as `"abc"`.
- To convert between the two types of strings, `string('abc')` becomes `"abc"` and `char("abc")` becomes `'abc'`.

Useful String Functions, Comparison

Code

- *strcmp(x, y)* compares two strings *x* and *y* and returns 1 if they are the same and 0 otherwise, for example, *strcmp('abc', ['a' 'b' 'c'])* returns 1 and *strcmp('abc', 'AbC')* returns 0.
- *strcmpi(x, y)* compares two strings *x* and *y* ignoring cases, for example, *strcmpi('abc', 'AbC')* returns 1.
- *upper(x)* and *lower(x)* converts the string *x* to upper and lower cases.

Useful String Functions, Find and Replace

Code

- *strfind* (*x*, *y*) finds the indices of all occurrences of *y* in *x*, for example, *strfind* ('aabb', 'a') return [1 2].
- *strrep* (*x*, *o*, *n*) or *replace* (*x*, *o*, *n*) replaces all occurrences of *o* in *x* by *n* and returns the new string, for example, *strrep* ('aabb', 'b', 'c') returns 'aacc' and *replace* ('aabb', ["a", "b"], ["c", "d"]) returns 'ccdd'.

Special Text Symbols

Code

- *blanks(n)* creates a string with *n* spaces.
- '' (two single quotation marks, not one double quotation mark) is ' '.
- %% is %.
- \\ is backslash \.
- \n is new line.
- \t is tab.

Text Output

Code

- *disp(x)* displays the string *x*. It does not store *x* in the variable *ans*.
- *fprintf(x, v1, v2, ...)* displays a string with *%s* (string), *%i* (integer), *%f* (floating point), *%e* (scientific notation) replaced by *v1, v2, ...*

Formatted Text

Code

- Add a number after `%` to set the field width (text length) for the string, for example, `%5s` and `%-5i` make sure that the displayed string has length ≥ 5 by adding spaces when necessary. A positive number means added spaces are on the left and a negative number means added spaces are on the right.
- Add a `.` followed by a number for `%f` to set the precision, the number of digits after the decimal point, for example, `%.4f` rounds the number to 4 decimal places, adding 0s when necessary.

Text Formatting, Integer

Quiz

- `fprintf ('a%-2ib', 1)`
- `B : a1b`
- `C : a1 b`
- `D : a 1b`

Text Formatting, Floating

Quiz

- `fprintf('a%5.2fb', pi)`
- A : **a3.14b**
- B : **a 3.14b**
- C : **a3.14 b**
- D : **a3.142b**

Text Input

Code

- *input(x)* gets a user input in MATLAB syntax. String *x* is the prompt.
- *input(x, 's')* gets a user input as a string.
- Sometimes the user input may need to be validated or reformatted before being used in subsequent computations. More details in a later lecture.
- *menu(x, c1, c2, ...)* or *listdlg('ListString', c1, c2, ..., 'PromptString', x)* gets a user input from a list of choices c_1, c_2, \dots , and returns the index.

Text Input, Input Code

- `length(input('Enter a string ', 's'))` %User enters **'10'** , including the quotes.
- `B : 2`
- `C : 4`
- `D : 10`

Text Input, Multiple Inputs

Code

- `input('Enter x1', 's') + input('Enter x2')` %User enters **'10'** and **'1'** , including the quotes.
- `B` : **'101'**
- `C` : **11**
- `D` : **50 49**

Text Input, Options

Code

- 1 `opt = ['one', 'two', 'three'];`
- 2 `opt(menu('Select a string ', '1', '2', '3'))` %User selects **2**.
 - **B : 'two'**
 - **C : '2'**
 - **D : 2**
 - **E : None of the above**

File Input

Code

- `load(x, '-ascii')` loads the text file with name `x`.
- `load(x)` can load a `.mat` binary file.
- `readmatrix(x)` loads the text or spreadsheet file with name `x` into a single matrix.
- Under the "HOME" tab, there is a "Import Data" tool that can be used to import data in various formats from files.

File Output

Code

- `save(x, v, ..., '-ascii')` saves the variables with names `v, ...`, to the file with name `x`.
- `save(x, v, ...)` saves the variables in a `.mat` binary file, not human-readable.
- `writematrix(v, x)` saves the variable `v` to the file with name `x`.

String File Input Output

Code

- *fileread* (*x*) reads the text file with name *x* as a string with *char* type.
- *readlines* (*x*) reads the text file with name *x* as a vector of lines, each line has the *string* type.
- *fopen*(*x*, 'w'); *fprintf* (*x*, *v*); *fclose* (*x*); writes the string *v* to the file with name *x*.

String
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Text Output
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Text Input
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Files
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