CS368 MATLAB Programming

Lecture 4

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

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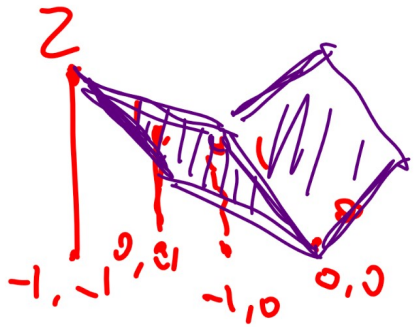
Surface Plotting, Bowl

Quiz

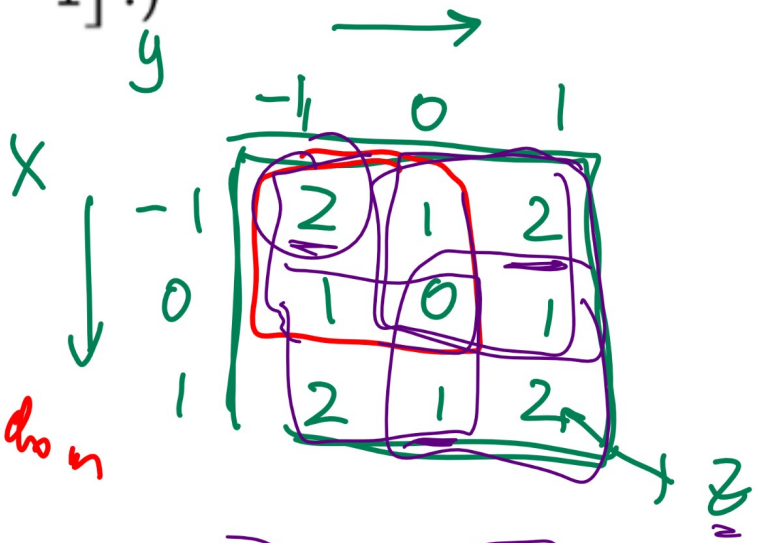
Q1

surf(z)



- (Plot $z = x^2 + y^2$ for $x = y = [-1 \quad 0 \quad 1]$.)

1. $x = repmat(-1:1, [3\ 1]);\ y = x';$
   - B : $surf(x,\ y,\ x\ .\hat{}\ 2 + y\ .\hat{}\ 2)$
   - C : $surf(x,\ y,\ x\ \hat{}\ 2 + y\ \hat{}\ 2)$
   - D : $surf(x,\ y,\ x' * x + y' * y)$



random

$x * y$

x
-1 -1 -1
0 0 0
1 1 1

y
-1 0 1
-1 0 1
-1 0 1

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 yo 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

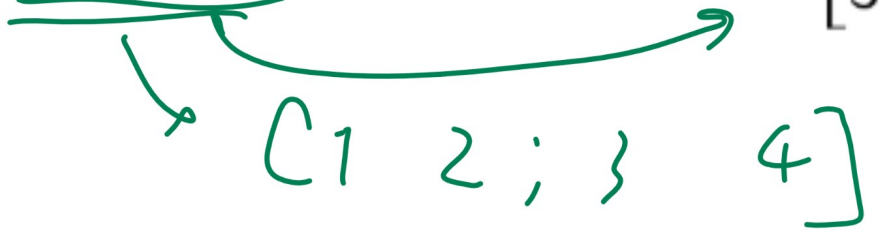
Code

- 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 $x, y, \ldots$, for example, *append('Hello ', 'World', '! ')* returns *'Hello World! '*.
- *strcat (x, y, ...)* combines (or conCATenate) the strings $x, y, \ldots$, and removes trailing spaces, for example, *strcat ('Hello ', 'World', '! ')* returns *'HelloWorld!'*.

String Conversion

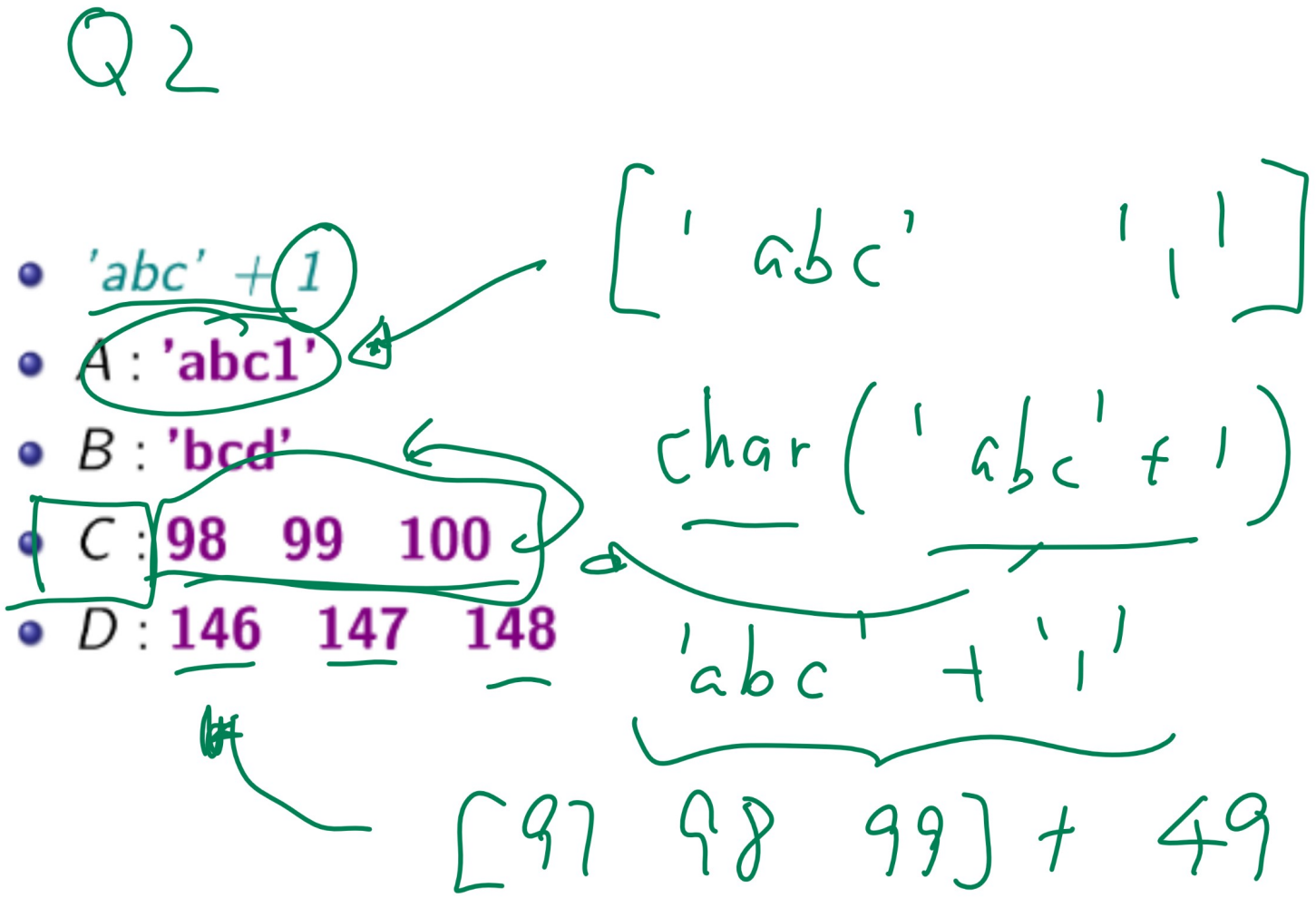
Code

- *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



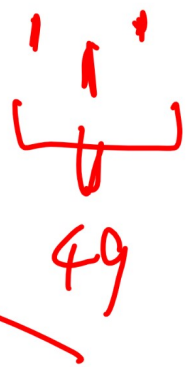
String Operations, Number Conversion

Quiz

Q3

'1' = 49

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



String Operations, as Vectors

Quiz

Q4

'abcde'

'bcd'

text(2:4)

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

substring

text(end:-1:1)+0

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'*.

"A" → "4.0" → 4.0

replace

str2num

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 $v_1, v_2, \ldots$

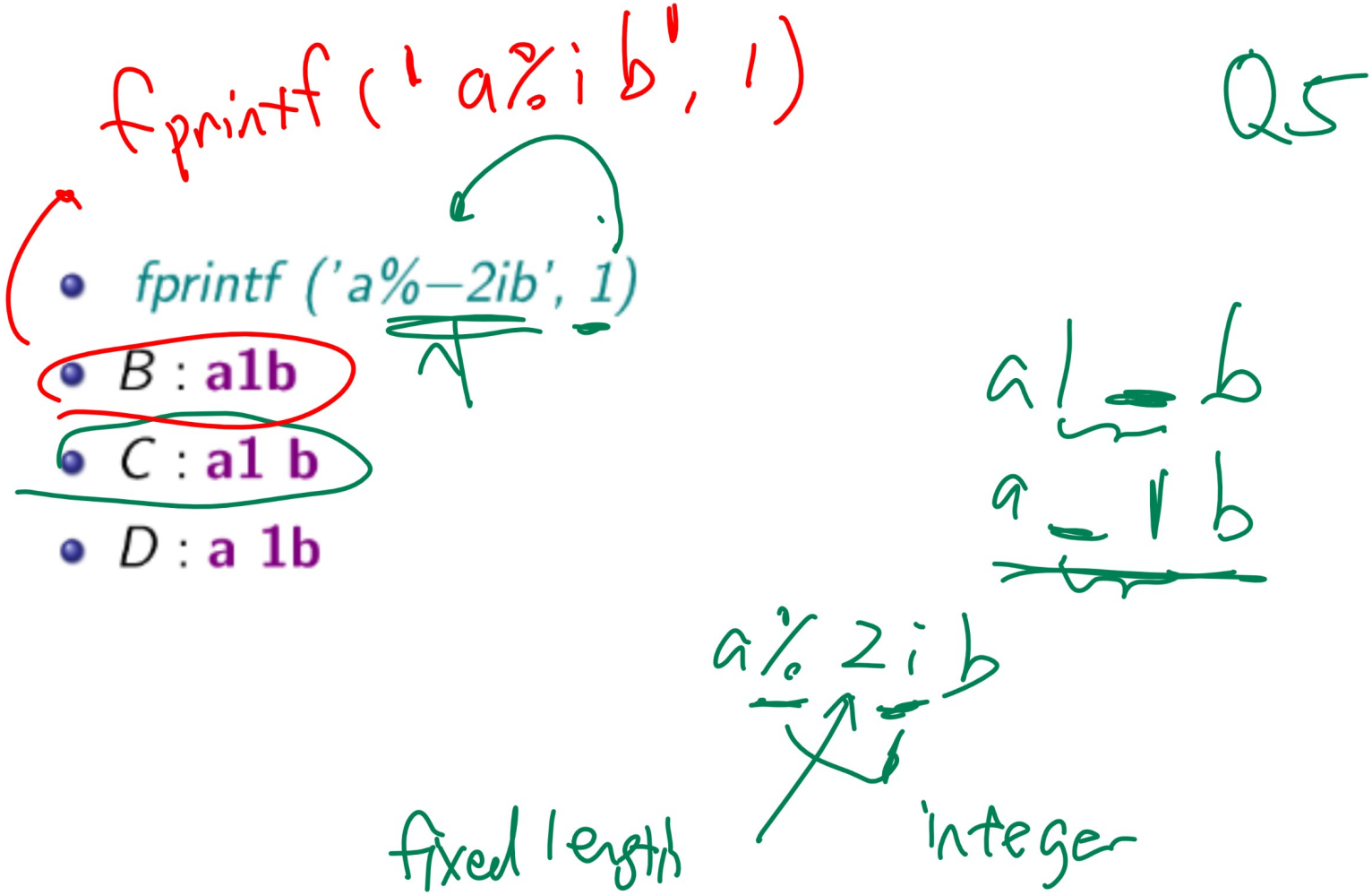
Formatted Text

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 $\geqslant 5$ 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.

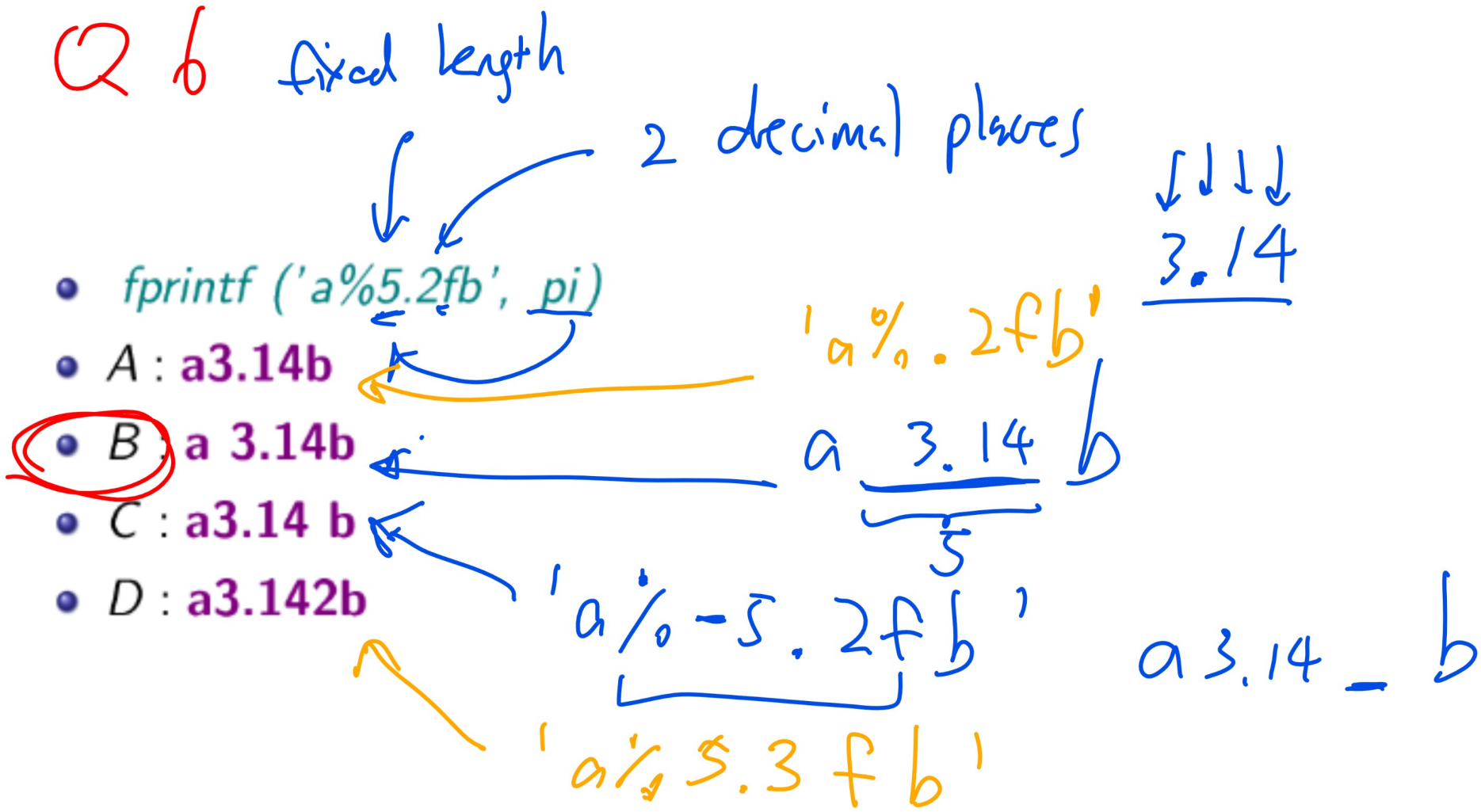
Text Formatting, Integer

Quiz



Text Formatting, Floating

Quiz



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 $c_1, c_2, ...$, and returns the index.

Text Input, Input

Code

Q7

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

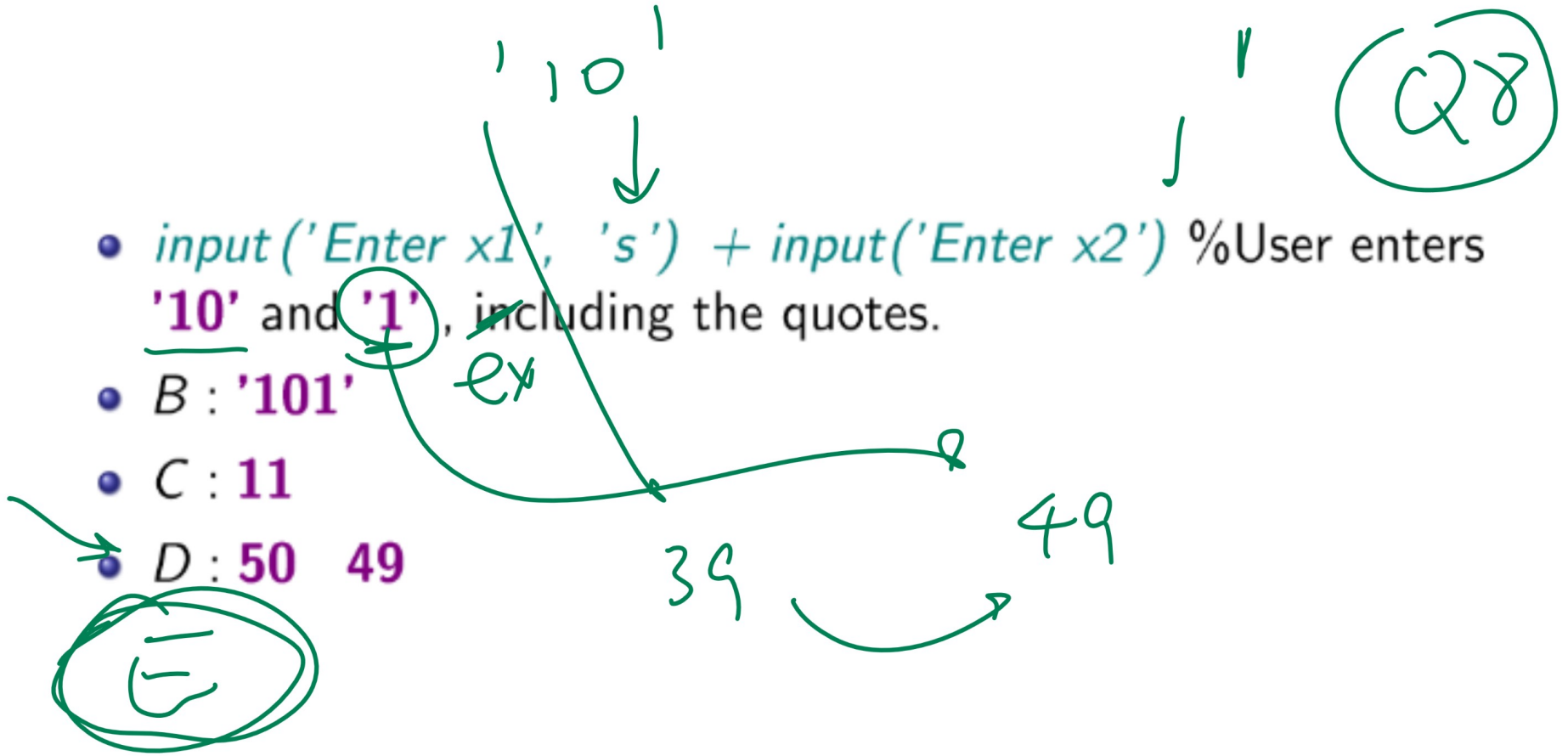
no 's'

10

input('Enter a string')

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.

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