
CS1371

Introduction to Computing for Engineers

Strings

1

9/9/03

Characters and Strings

Learning Objectives

Learn about
characters and
strings

Topics

Data Types
Character Strings
Summary

2

Storing More Than Numbers

- MATLAB arrays store only numeric results
 - *What about words, names, strings?*
 - *What about arrays of arrays?*
- MATLAB provides three more “containers” (data types or classes) to store data:
 - *Character strings (arrays)*
 - *Cell arrays*
 - *Structures*
- Examples:
 - *Gradebooks* (names, grades, letter grades...)
 - *Hierarchical geographic data*
 - *Material properties* (name, heat treat, properties...)

3

What are Character Strings (arrays)?

Example:

```
» C = 'Hello'; %C is a 1x5 character array.
» D = 'Hello there'; %D is a 1x11 character array.
» A = 43; %A is a 1x1 double array.
» T = 'How about this character string?'
» size(T)
ans =
     1     32
» whos % What do you observe? Learn?
Name      Size      Bytes  Class
A         1x1         8  double array
C         1x5        10  char array
D         1x11       22  char array
T         1x32       64  char array
ans       1x2        16  double array
Grand total is 51 elements using 120 bytes
```

4

How are Characters Stored?

Character arrays are similar to vectors, except:
Each element contains a single character

Conversion between Character and Numeric:

```
>> u = double(T) % double is a built-in function.  
>> char(u)      % performs the opposite function.
```

Example:

```
>> u=double(C)  
u =  
    72    101    108    108    111  
>> char(u)  
ans =  
Hello
```

Questions: What is the numerical value of 'a' and what does it mean?

5

Manipulating String Arrays (on your own)

Strings can be manipulated like arrays.

Exercises

```
» u = T(16:24)  
» u = T(24:-1:16)  
» u = T(16:24)'  
» v = 'I can't find the manual!' % Note quote in string  
» u = 'If a woodchuck could chuck wood, '  
» v = 'how much wood could a woodchuck chuck?';  
» w = [u,v] % string concatenation in Matlab  
» disp(u) % works just like for arrays
```

Lessons?

It is always useful to know how to concatenate strings and this is a very **nonstandard** way as languages go!

6

Character Strings in Multiple Rows

```
>> v = ['Character strings having more than'  
       'one row must have the same number '  
       'of columns just like arrays!      ']  
  
% But CHAR will pad with trailing blanks if needed:  
>> engineers=char('Timoshenko','Maxwell','Mach','von Braun')  
engineers =  
Timoshenko  
Maxwell  
Mach  
von Braun  
>> size (engineers)  
ans =  
     4     10
```

On Your Own:

- » help char
- » help str2mat
- » help strvcat
- » help strcat

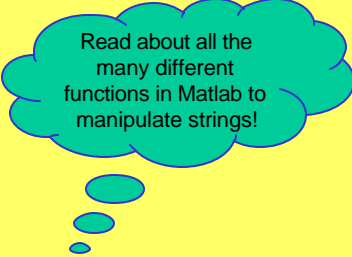
Lesson?

7

String Construction / Manipulation

Character strings can be manipulated like arrays:

```
>> engineers=char('Timoshenko','Maxwell','Mach','von Braun');  
  
>> engineers(2,:)  
ans =  
Maxwell  
  
>> engineers(1,1:4)  
ans =  
Timo  
  
>> engineers(1,end:-1:1)  
ans =  
oknehsomiT  
  
>> engineers(2,:)=[]  
engineers =  
Timoshenko  
Mach  
von Braun
```



Read about all the many different functions in Matlab to manipulate strings!

8

Converting Strings to/from Numbers

- Matlab provides lots of functions to convert numbers to strings (e.g., for display) or the reverse:

```
>> a=num2str(123.45)
a =
123.45
>> class(a)
ans =
char
% Concatenating strings lets you combine data in disp():
>> disp(['The weight is ' num2str(234.5) ' grams.'])
The weight is 234.5 grams.
% This is a better way (we'll discuss in a later lecture)
>> fprintf('The weight is %.4g grams.', 234.5)
The weight is 234.5 grams.
```

9

Special Notes on Characters & Strings

- Each language seems to treat strings differently and Matlab is no exception!
 - *Matlab strings are really character arrays and can be treated essentially like a numeric array*
 - *Matlab strings can be extended and truncated just like numeric arrays can (lots of dynamic memory management is going on behind the scenes, though!)*
- Some languages like **Java** and **Python** define basic strings as “immutable” objects. That is, strings can be created and destroyed but not modified once created.
 - *To modify these strings, one must create a new string*
 - *The old string is destroyed either automatically or manually, depending on how you handle it...*

10

Summary

Learning

Matlab can store and manipulate much more than simply numbers

Action Items

Review the lecture

Review the material on the websites?

11

Questions?

12