Mixed bags

Working with strings and cell arrays

CS112 Scientific Computation
Department of Computer Science
Wellesley College

Strings

Program input/output

```
month = input('Enter a month:  ');
disp(['There are  '  num2str(numDays(month))  '  days in that month']);
myTitle = get(handles.titleBox,  'String');
set(handle.sourceToggle,  'String',  'consume');
```

Text labels and graph properties

```
plot(xcoords, ycoords, 'g:*',  'Linewidth',  2);
title('golden ratio data');
```

Cell arrays of strings

```
names={'Betts'  'Martinez'  'Benintendi'  ...  'Bradley'  'Leon'};
```

Reading/writing image files

```
im = imread('albright.jpg');
imwrite(im,  'myImage.jpg');
```

What lies beneath – the ASCII code

ASCII code, established by the American Society for Communication and Information Interchange, is a numerical code for representing letters, digits, punctuation, and control signals

Original ASCII code represents characters using a 7-bit code (numbers 0 to 127)

new international standard – Unicode – has thousands of characters, allows representation of multiple languages

Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
0	00	Null	32	20	Space	64	40	@	96	60	`
1	01	Start of heading	33	21	!	65	41	A	97	61	a
2	02	Start of text	34	22	"	66	42	B	98	62	b
3	03	End of text	35	23	#	67	43	C	99	63	c
4	04	End of transmit	36	24	$	68	44	D	100	64	d
5	05	Enquiry	37	25	%	69	45	E	101	65	e
6	06	Acknowledge	38	26	&	70	46	F	102	66	f
7	07	Audible bell	39	27	'	71	47	G	103	67	g
8	08	Backspace	40	28	(	72	48	H	104	68	h
9	09	Horizontal tab	41	29	)	73	49	I	105	69	i
10	0A	Line feed	42	2A	*	74	4A	J	106	6A	j
11	0B	Vertical tab	43	2B	+	75	4B	K	107	6B	k
12	0C	Form feed	44	2C	,	76	4C	L	108	6C	l
13	0D	Carriage return	45	2D	-	77	4D	M	109	6D	m
14	0E	Shift out	46	2E	.	78	4E	N	110	6E	n
15	0F	Shift in	47	2F	/	79	4F	O	111	6F	o
16	10	Data link escape	48	30	0	80	50	P	112	70	p
17	11	Device control 1	49	31	1	81	51	Q	113	71	q
18	12	Device control 2	50	32	2	82	52	R	114	72	r
19	13	Device control 3	51	33	3	83	53	S	115	73	s
20	14	Device control 4	52	34	4	84	54	T	116	74	t
21	15	Neg. acknowledge	53	35	5	85	55	U	117	75	u
22	16	Synchronous idle	54	36	6	86	56	V	118	76	v
23	17	End trans. block	55	37	7	87	57	W	119	77	w
24	18	Cancel	56	38	8	88	58	X	120	78	x
25	19	End of medium	57	39	9	89	59	Y	121	79	y
26	1A	Substitution	58	3A	:	90	5A	Z	122	7A	z
27	1B	Escape	59	3B	;	91	5B	[	123	7B	{
28	1C	File separator	60	3C	<	92	5C	\	124	7C	|
29	1D	Group separator	61	3D	=	93	5D	]	125	7D	}
30	1E	Record separator	62	3E	>	94	5E	^	126	7E	~
31	1F	Unit separator	63	3F	?	95	5F	_	127	7F	⌂

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MATLAB character strings

Character strings in MATLAB are stored in special numerical vectors of ASCII values

The double and char functions translate between a character string and its ASCII values:

```
>> string1 = 'violet';
>> numcode = double(string1)
numcode =
     118   105   111   108   101   116
>> char(numcode)
ans =
violet
```

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String processing freebies

```
>> string1 = 'spring break';
>> length(string1)
ans =

>> string1(6)
ans =

>> string1(3:6)
ans =

>> string1([6  3  11  8])
ans =

>> string1(8:12) = 'fling'
ans =

>> string1(20) = '*';
```

string1

s	p	r	i	n	g		b	r	e	a	k
1	2	3	4	5	6	7	8	9	10	11	12

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Conditional expressions & strings

```
>> string1 == 'g'
ans =
  0 0 0 0 0 1 0 0 0 0 0 1
```

string1

s	p	r	i	n	g		f	l	i	n	g
1	2	3	4	5	6	7	8	9	10	11	12

ans

0	0	0	0	0	1	0	0	0	0	0	1
1	2	3	4	5	6	7	8	9	10	11	12

```
>> string1(string1 == 'f') = 'b'
string1 =

>> string1 == 'CS112'
```

* remember strcmp

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More fun with strings

```
>> string2 = 'to be or not to be';
>> find(string2 == ' ')
ans =

>> string2Letters = string2(string2 ~= ' ')
string2Letters =

>> string2(string2 == ' ') = []
string2 =
```

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String processing newbies

```
>> lower('To Be Or Not To Be')
ans =
```
converts letters to lower case

```
>> upper(ans)
ans =
```
converts letters to upper case

```
>> strrep('to be or not to be', 'be', 'play')
ans =
```
replaces occurrences of 2nd input string in 1st input string, with 3rd input string

```
>> strfind(ans, 'ay')
ans =
```
finds all occurrences of 2nd input string in 1st input string, returns indices of first character

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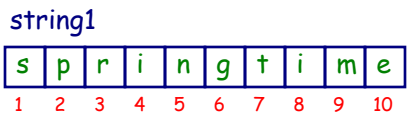
Time out exercises

What actions are performed by these statements?

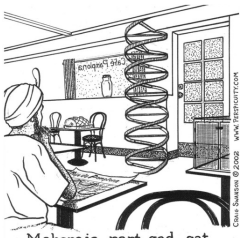



```
newString = ' ';
for letter = string1
    newString = [letter   newString];
end
```

What test is performed by this function?

```
function answer = test(str)
str = str(str ~= ' ');
str = lower(str);
answer = all(str == str(end:-1:1));
```

```
>> answer = test('Murder for a jar of red rum')
```



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Collecting strings with cell arrays

We have used a cell array to store a collection of strings

```
>> myPets = {'mona'  'cleo'  'trot'};
```

We can access the contents of individual locations of a cell array using an index placed *inside curly braces:*

```
>> myPets{1}
ans =
mona
```

```
for index = 1:length(myPets)
      disp(myPets{index});
end
```

Exercise: Write a function with two inputs, a cell array and a string, and one output, a logical value that is true if the string is contained in the cell array, and false otherwise

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Collecting multiple types of data

The *real power* of cell arrays is that they allow us to store multiple types of data in one place:

```
>> myCell = {'Ellen'  3.14159  [2  5  1  7]  [1  2;  3  4]}
myCell =
    'Ellen'    [3.14159]    [1x4 double]    [2x2 double]
```

```
>> celldisp(myCell)
myCell{1} =
Ellen
myCell{2} =
    3.1416
myCell{3} =
    2  5  1  7
myCell{4} =
    1  2
    3  4
```

Create a cell array from scratch with the cell function:

```
>> newCell = cell(1,3);
>> newCell{1} = 'Sohie';
>> newCell{2} = 'SCI E127';
>> newCell{3} = sohieImage;
```

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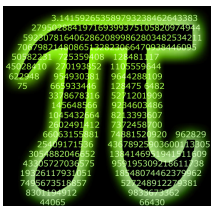
Accessing the contents of cell arrays

Contents of individual locations of a cell array can be accessed with an index surrounded by curly braces:

```
>> myCell = {'Ellen'  3.14159  [2  5  1  7]  [1  2;  3  4]};
>> disp([myCell{1} '''s favorite number is ' num2str(myCell{2})])
ans =
>> myCell{3}(2)
ans =
>> sum(sum(myCell{4}))
ans =
```



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Into thin air…

```
mountains = {{'Everest'  'K2'  'Kanchenjunga'  'Lhotse I'  'Makalu I'  …
              'Lhotse II'  'Dhaulagiri'  'Manaslu I'  'Cho Oyu' …
              'Nanga Parbat'  'Annapurna'} …
             {'Himalayas'  'Karakoram'  'Himalayas'  'Himalayas'
              'Himalayas'  'Himalayas'  'Himalayas'  'Himalayas' …
              'Himalayas'  'Himalayas'  'Himalayas'} …
             {'Nepal-China' 'Kashmir'  'Nepal-India'  'Nepal-China' …
              'Nepal-China'  'Nepal-China'  'Nepal'  'Nepal'  'Nepal-China' …
              'Kashmir'  'Nepal'} …
             [29028  28250  28208  27923  27824  27560  26810  …
              26760  26750  26660  26504]};
mount = input('Enter the name of a mountain: ',  's');
```

Exercise: Write a loop that prints all of the information about the user's input mountain

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