Storing it away for safe keeping

Reading and writing text files

CS112 Scientific Computation
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Reading a text file into a cell array

Large amounts of text data can be stored in text files, with a .txt extension, e.g. mobydick.txt

> Call me Ishmael. Some years ago – never mind how long precisely – having little or no money in my purse, and nothing particular to interest me on shore, I thought I would sail about a little and see the watery part of the world. It is a way I have of driving off the spleen and regulating the circulation…

Successive lines of a text file can be read into the cells of a cell array using the textread function.

```
>> lines = textread('mobydick.txt', '%s', 'delimiter', '\n');
>> lines{1}
ans =
Call me Ishmael.  Some years ago – never mind how long precisely - having
>> lines{2}
ans =
little or no money in my purse, and nothing particular to interest me on shore,
```


More on textread

Suppose we have a text file elements.txt that contains a combination of numerical data and strings, in a *fixed format*

```
1 hydrogen H 1.01
2 helium He 4.00
3 lithium Li 6.94
4 beryllium Be 9.01
5 boron B 10.81
6 carbon C 12.01
7 nitrogen N 14.01
8 oxygen O 16.00
9 fluorine F 19.00
10 neon Ne 20.18
...
```

Reading formatted data

The format string can incorporate other types:

```
>> [atomNums names symbols masses] = ...
     textread('elements.txt', '%u %s %s %f');
```

format string:
%u integer
%s string
%f float

Recall our text file elements.txt with numerical data and strings:

```
>> atomNums'
     1   2   3   4   5   6   7   8   9   10  ...
>> names'
   'hydrogen'  'helium'  'lithium'  'beryllium'  'boron'  'carbon'  ...
>> symbols'
   'H'  'He'  'Li'  'Be'  'B'  'C'  'N'  'O'  'F'  'Ne'  ...
>> masses'
    1.0100    4.0000    6.9400    9.0100   10.8100   12.0100   14.0100  ...
```

' is the transpose operator

Sometimes life is not so simple…

Suppose we want to compute the total value of our toy inventory, from a text file toys.txt with the following format:

name	price	quantity
mr. potato head	$3.29	80
slinky	$1.29	120
hoola hoop	$2.19	60
monopoly	$3.89	50

```
lines = textread('toys.txt', '%s', 'delimiter', '\n');
totalValue = 0.0;
for index = 2:length(lines)
    line = lines{index};
    …                          % extract price and quantity from each line
    totalValue = totalValue + price * quantity;
end
```


vice versa: Writing formatted data

Suppose you have data in the MATLAB workspace that you want to store in a text file in a desired format

```
>> atomNums = [1  2  3  4 …];
>> names = {'hydrogen'  'helium' 'lithium'  'beryllium' …};
>> symbols = {'H'  'He'  'Li'  'Be' …};
>> masses =[1.01  4.00  6.94  9.01 …];
```

```
1 hydrogen  H  1.01
2 helium  He  4.00
3 lithium  Li  6.94
4 beryllium  Be  9.01
…
```

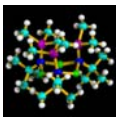
elements.txt

Formatting strings with sprintf

```
>> sprintf('%u  %s  %s  %f', 1, 'hydrogen', 'H', 1.01)
ans =
1 Hydrogen  H  1.010000
>> sprintf( '%4u  %12s  %4s  %8.2f', 1, 'hydrogen', 'H', 1.01)
ans =
    1    hydrogen    H    1.01

for i = 1:4
    disp(sprintf('%4u %12s %4s %8.2f', atomNums(i), names{i}, …
                 symbols{i}, masses(i)))
end
```

```
   1    hydrogen   H    1.01
   2      helium  He    4.00
   3     lithium  Li    6.94
   4   beryllium  Be    9.01
```



Finally… Writing data to a text file

(1) Open file for writing
(2) Write text to file
(3) Close file

```
fid = fopen('elements.txt', 'w') ;
for i = 1:length(atomNums)
    fprintf(fid, '%4u %12s %4s %8.2f \n', atomNums(i), …
            names{i}, symbols{i}, masses(i));
end
fclose(fid);
```

Write a vector of numbers all at once

A vector of numbers can be written to a file all at once:

```
xdata = [1.0   3.2   7.4   8.7   9.1];
ydata = [32.8   21.9   17.6   29.2   30.4];
results = [1.09   2.13   3.48   2.87   0.98];
fid = fopen('results.txt', 'w');
fprintf(fid, 'experimental results:');
fprintf(fid, '\nxdata: ');
fprintf(fid, '%6.2f', xdata);
fprintf(fid, '\nydata: ');
fprintf(fid, '%6.2f', ydata);
fprintf(fid, '\nresults: ');
fprintf(fid, '%6.2f', results);
fclose(fid);
```

results.txt

```
experimental results:
xdata:   1.00  3.20  7.40  8.70  9.10
ydata:  32.80 21.90 17.60 29.20 30.40
results:   1.09  2.13  3.48  2.87  0.98
```


Writing files with literal strings

```
data = {{'mary'   5   6.2   85.7} ...
        {'karen'  3   5.5   89.8} ...
        {'betty'  7   3.4   92.4} ...

        ... };
```

cs112.txt

```
data for CS112 assignment work
Spring 2007

mary
used drop-in 5 times
average assignment time 6.2 hours
assignment grade 85.7

karen
used drop-in 3 times
average assignment time 5.5 hours
assignment grade 89.8
...
```

```
fid = fopen('cs112.txt', 'w');
fprintf(fid, 'data for CS112 assignment work \nSpring 2007 \n\n');
for i = 1:length(data)
   fprintf(fid, ...
     '%s\nused drop-in %u times\naverage assignment time %3.1f hours\nassignment grade %4.1f\n\n', ...
     data{i}{1}, data{i}{2}, data{i}{3}, data{i}{4});
end
fclose(fid);
```


Reading files with literal strings

```
[names dropin times grades] = textread('cs112.txt', ...
   '%s used drop-in %u times average assignment time %f hours assignment grade %f\n', ...
   'headerlines', 3, 'delimiter', '\n');
```

```
data for CS112 assignment work
Spring 2007

mary
used drop-in 5 times
average assignment time 6.2 hours
assignment grade 85.7

karen
used drop-in 3 times
average assignment time 5.5 hours
assignment grade 89.8
...
```

cs112.txt

Reading the contents of a web page

The following webpage contains a nice table of the average global temperature for each year from 1880-2005:

http://www.earth-policy.org/Indicators/Temp/2006Temp_data.htm

Can we get this data into MATLAB?

urlread reads the contents of a URL into a *string:*

```
>> str = urlread('http://www.earth-policy.org/Indicators/Temp/2006Temp_data.htm');
```

But beware!!

This string contains *raw html code* that can be pretty ugly!

Parsing the string of html code

A peek at the substring of str containing html code for creating the first two rows of the table:

```
<tr>
  <td><div align="center"><span class="style3">1880</span></div></td>
  <td><div align="right" class="style3">
    <div align="center">13.88</div>
  </div></td>
</tr>
<tr>
  <td><div align="center"><span class="style3">1881</span></div></td>
  <td><div align="right" class="style3">
    <div align="center">13.88</div>
  </div></td>
</tr>
```

How can we get the numbers out?
see urlTest.m

Average Global Temperature, 1880-2005	
Year	Temperature Degrees Celsius
1880	13.88
1881	13.88
1882	14.00
1883	13.96
1884	13.59

Other file formats

MATLAB also supports a variety of industry standard formats and custom file formats

This allows MATLAB to exchange data with other programs

Text: MAT, CSV, DLM, TAB

Scientific data: CDF, FITS, HDF

Spreadsheet: XLS, WK1