Input/Output Functions

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MATLAB Basics: Data Files

- save *filename var1 var2 ...*
  - save homework.mat x y → binary
  - save x.dat x –ascii → ascii
- load *filename*
  - load filename.mat → binary
  - load x.dat –ascii → ascii

The textread Function

- It is designed to read ASCII files that are formatted into columns of data
- Each column can be of a different type
- It is useful for importing tables of data printed out by other applications

The textread Function

- [a,b,c,...] = textread(filename,format,n)
  - filename: a string that is the name of the file to be read
  - format: a string containing the format primitives (just like in fprintf)
  - n: number of lines to read (if not specified, the file is read until the end)

The textread Function

- Example: Assume that you have a file called phones.txt

```
Varol Akman Prof 1538
Selim Aksoy AsstProf 3405
Erol Arkun Prof 2249
Cevdet Aykanat Prof 1625
Mehmet Baray Prof 1208
Cengiz Çelik Instructor 2613
Ilyas Çiçekli AsstProf 1589
David Davenport AsstProf 1248
...
```


The textread Function

- [fname,lname,rank,phone] = textread('phones.txt', '%s %s %s %d')
  - fname = 'Varol' 'Selim' 'Erol' 'Cevdet' 'Mehmet' 'Cengiz' ... (cell array)
  - phone = 1537 3405 2249 1625 1208 2613 ... (double array)

The textread Function

- The textread function skips the columns that have an asterisk (*) in the format descriptor
  - [fname, phone] = textread('phones.txt', '%s %*s %*s %d')
- The load command (with ASCII option) assumes all of the data is of a single type but textread is more flexible

The textread Function

- Example: Searching for telephone numbers

```
name = 'Selim';
for ii = 1:length(fname),
    if ( strcmp( fname(ii), name ) ),
        disp( phone(ii) );
    end
end
```

be careful about the usage of cell arrays

File Processing

- File types:
  - Binary files
    - Data is stored in program readable format
    - Processing is fast
  - Text (ASCII) files
    - Data is stored in human readable format
    - Processing is slower
    - Can be used to export/import data that can be used in programs other than MATLAB

Opening Files

- fid = fopen(filename, permission)
  opens the file filename in the mode specified by permission
  - fid is the file id (a positive integer) that is assigned to the file by MATLAB
  - fid is used for all reading, writing and control operations on that file
  - file id 1 is the standard output device and file id 2 is the standard error device
  - fid will contain -1 if the file could not be opened

Opening Files

- Permission can be:
  - 'r': open file for reading (default)
  - 'w': open file, or create a new file, for writing; discard existing contents, if any
  - 'a': open file, or create a new file, for writing; append data to the end of the file
  - 'r+': open file for reading and writing
  - 'w+': open file, or create a new file, for reading and writing; discard existing contents, if any
  - 'a+': open file, or create a new file, for reading and writing; append data to the end of the file
- Add 't' to the permission string for a text file

Opening Files

- Examples:
  - fid = fopen('example.dat', 'r')
    opens a binary file for input
  - fid = fopen('example.dat', 'wt')
    opens a text file for output (if example.dat already exists, it will be deleted)
  - fid = fopen('example.dat', 'at')
    opens a text file for output (if example.dat already exists, new data will be appended to the end)

Closing Files

- status = fclose(fid)
  closes the file with file id fid
  - If the closing operation is successful, status will be 0
  - If the closing operation is unsuccessful, status will be -1
- status = fclose('all')
  closes all open files (except for standard output and standard error)

Writing Formatted Text Data

- count = fprintf(fid,format,val1,val2,...)
  writes formatted text data in a user-specified format
  - fid: file id (if fid is missing, data is written to the standard output device (command window)
  - format: same as what we have been using (combination of format specifiers that start with %)
  - count: number of characters written

Writing Formatted Text Data

- Make sure there is a one-to-one correspondence between format specifiers and types of data in variables
- Format strings are scanned from left to right
- Program goes back to the beginning of the format string if there are still values to write (format string is recycled)
- If you want to print the actual % character, you can use %% in the format string

Reading Formatted Text Data

- [array,count] = fscanf(fid,format,size)
  reads formatted text data in a user-specified format
  - fid: file id
  - format: same as format in fprintf
  - size: same as size in fread
  - array: array that receives the data
  - count: number of elements read

Reading Formatted Text Data

- line = fgetl(fid)
  reads the next line excluding the end-of-line characters from a file as a character string
  - line: character array that receives the data
  - line is set to -1 if fgetl encounters the end of a file

Reading Formatted Text Data

- line = fgets(fid)
  reads the next line including the end-of-line characters from a file as a character string
  - line: character array that receives the data
  - line is set to -1 if fgets encounters the end of a file

Formatted Text I/O Examples

```
%  Script file: table.m
%  Purpose: To create a table of square roots, squares, and cubes.

% Open the file.
fid = fopen('table.dat', 'wt');

% Print the title of the table.
fprintf(fid, ' Table of Square Roots, Squares, and Cubes\n\n');

% Print column headings
fprintf(fid, ' Number  Square Root    Square     Cube\n');
fprintf(fid, ' ======  ===========    ======     ====\n');

% Generate the required data
ii = 1:10;
square_root = sqrt(ii);
square = ii.^2;
cube = ii.^3;

% Print the data
for ii = 1:10
    fprintf (fid, '   %2d    %11.4f    %6d    %8d\n', ...
       ii, square_root(ii), square(ii), cube(ii));
end

% Close the file.
status = fclose(fid);
```


Formatted Text I/O Examples

```
%Updates the phone number of a person

%Get the name and new phone number
name = input( 'Enter the last name of the person: ', 's' );
new_phone = input( 'Enter the new phone number: ' );

%Read the phone numbers
[fname,lname,rank,phone] = textread( 'phones.txt', '%s %s %s %d' );

%Find the person and update the phone number
for i = 1:length(lname),
    if ( strcmp( lname(i), name ) ),
        phone(i) = new_phone;
    end
end

%Write the updated phone numbers
fid = fopen( 'phones2.txt', 'wt' );
for i = 1:length(fname),
    fprintf( fid, '%s %s %s %d\n', fname{i}, lname{i}, rank{i},
   phone(i) );
end
fclose( fid );
```


Formatted Text I/O Examples

```
%Updates the name of a person

%Get the old and new names
old_name = input( 'Enter the old name: ', 's' );
new_name = input( 'Enter the new name: ', 's' );

%Open the input file
fid1 = fopen( 'phones.txt', 'rt' );
%Open the output file
fid2 = fopen( 'phones3.txt', 'wt' );

%Read lines one by one
line = fgets( fid1 );
while ( line > 0 ),
    %Replace the old name with the new name
    line2 = strrep( line, old_name, new_name );
    %Write to the new file
    fprintf( fid2, '%s', line2 );
    %Read the next line
    line = fgets( fid1 );
end

%Close the file
status = fclose( 'all' );
```


The exist Function

- ident = exist(‘item’, ‘kind’)
  checks the existing of ‘item’
  - item: name of the item to search for
  - kind: optional value for restricting the search for a specific kind of item (possible values are ‘var’, ‘file’, ‘builtin’, ‘dir’)
  - ident: a value based on the type of the item

The exist Function

- Values returned by exist can be:
  - 0: item not found
  - 1: item is a variable in the current workspace
  - 2: item is an m-file or a file of unknown type
  - 5: item is a built-in function
  - 7: item is a directory

Examples

- exist('phones.txt')
  ans =
  2
- exist('phones5.txt')
  ans =
  0
- clear
- x = 5;
- exist('x')
  ans =
  1
- exist('y')
  ans =
  0
- exist('sum')
  ans =
  5