

CS1112 Fall 2012 Project 4 Part A due Thursday 10/25 at 11pm

You must work either on your own or with one partner. If you work with a partner you must first register as a group in CMS and then submit your work as a group. *Adhere to the Code of Academic Integrity.* For a group, “you” below refers to “your group.” You may discuss background issues and general strategies with others and seek help from the course staff, but the work that you submit must be your own. In particular, you may discuss general ideas with others but you may not work out the detailed solutions with others. It is not OK for you to see or hear another student’s code and it is certainly not OK to copy code from another person or from published/Internet sources. If you feel that you cannot complete the assignment on you own, seek help from the course staff.

Objectives

Completing this project will solidify your understanding of 2-dimensional and 3-dimensional arrays. You will also work with the jpeg image format and the type `uint8`. Pay attention to the difference between `uint8` and MATLAB’S default type `double`.

1 How much do you tip?

When you get the check (bill) at a restaurant, sometimes you see a handy table of tip percentages and the corresponding total amounts. (Or you may have seen the electronic version that shows up on the tiny screen of a hand-held credit/debit card reader.) You will write a MATLAB application consisting of three functions to produce this very handy table. An example call to the main function of the application is shown below:

```
>> m = tipCalculator(100,'CO',1);
Tip and total bill calculation for state CO
Original price not including tax is $100.00
Calculate total bill including tax? Yes
```

Tip%	Tip Amount	TOTAL
10.0	10.00	117.44
15.0	15.00	122.44
20.0	20.00	127.44
25.0	25.00	132.44
19.0	19.00	126.44

The main function is `tipCalculator`, which has three parameters: the price on which to calculate the tip (the bill excluding tax), the state name abbreviation, and an indicator for whether to add the tax amount to the total bill. The second argument given in the function call is a *string*, i.e., characters. In MATLAB, one uses single quotation marks to enclose a string of characters.

Function `name2index` is given. Download it from the website and read it. Observe the use of Matlab’s built-in function `error`, which allows us, the programmer, to create a specific error message that can be displayed for a specific run-time error that occurs. Try the following two function calls in the Command Window now to make sure that you understand the behavior of function `name2index`:

```
ind = name2index('CO') % Get the index (row number) of Colorado, whose abbreviation is 'CO'
ind = name2index('FFA') % An improper state abbreviation is used. What happens?
```

Notice that the state abbreviation, which is a string, is enclosed in single quotes.

1.1 Tip and Tax Data

We provide the tax and tip data of the 50 states in the partially completed function `stateRateMatrix`. Download it and complete the implementation according the specifications given in the function comments.

1.2 Tip and Total Amount calculation

Implement function `tipCalculator` as specified:

```
function payMat = tipCalculator(price, stateAb, addTax)
% Compute and return a range of tip and total amounts; if addTax is 1,
%   include tax in the total amount.
% price - the basis on which to calculate tips (and tax)
% stateAb - a state name abbreviation, e.g., 'AK' for Arkansas. See
%           function name2index for the proper state name abbreviations.
% addTax - indicator for whether tax should be added to the total amount:
%           add tax if addTax is 1; do not add Tax if addTax is 0.
% payMat - a 5-by-2 matrix where column 1 stores the tip amounts and
%           column 2 stores the total payment amounts:
%   payMat(1,1), payMat(2,1), payMat(3,1), payMat(4,1) are the tip amounts
%   corresponding to the tip rates of 10%, 15%, 20%, and 25%, respectively.
%   payMat(5,1) is the tip amount according to the average tip rate for
%   the state indicated by stateAb. If the average tip rate for the
%   state is not known, use the average tip rate across all states.
%   payMat(r,2) is the total amount to be paid given the tip amount in
%   payMat(r,1), where r is 1,2,...,5. Add the tax amount to payMat(r,2)
%   if addTax is 1; do not add tax if addTax is 0.
% Display the results in payMat neatly in a table and say whether tax is
%   included in the total.
```

Note that the tip should be calculated on the original bill amount excluding tax, and the tax amount should be calculated on the original bill amount excluding the tip. Make effective use of functions `name2index` and `stateRateMatrix`. Your function should display output in a format similar to that given above.

Below are some tips on working with strings; you may not need all of them:

- Given a variable that stores a string, you can print its values (characters) using the format sequence `%s`. For example, if `stateAb` stores the string 'NY' then the statement `fprintf('State is %s', stateAb)` will print to the Command Window `State is NY`
- To create a variable that stores a string, simply assign a string to a variable name. For example, this statement creates a string variable `yn`: `yn='Yes'`
- Note the difference between the variable name and the values that it stores, in this case the values are characters (a string):

```
stateAb = 'CO';
ind = name2index('CO');           % Argument is the string 'CO'. ind gets 6.
ind = name2index(stateAb);        % Argument is the variable name stateAb. ind gets 6.
ind = name2index('stateAb');      % Argument is the string 'stateAb'. ERROR!
```
- To print a percent sign (`%`), you need to type `%%` in an `fprintf` statement. For example, `fprintf('Tax%% is')` will print to the Command Window `Tax% is`. We have to type the double percent sign because the single percent sign in the `fprintf` string indicates the beginning of a format sequence.

Submit your files `stateRateMatrix.m` and `tipCalculator.m` on CMS.

Part B of Project 4 will appear in a separate document. Part B has the same deadline as Part A.