

Part 1a: Water consumption charges

The following charts explain how a water supply company charges its single-family residential customers. The base charge is the minimum monthly service charge per meter per month. The AWC (average winter consumption) is the average amount of water used between September and February. This value will differ between customers and are updated every March. The rate changes depending on the amount of water used with respect to the AWC and time of year.

Write a function M-file named `WaterCharge` to compute the total amount to be billed to the customer. The input arguments are the meter size, AWC, kgal usage and the month (1-12). The output argument is the billed amount for that month.

Base Charges	
Meter Size	Charge
0.75 inch	\$16.00
1 inch	\$26.71
1.5 inch	\$53.26

	Cost per kgal (March to Aug)	Cost per kgal (Sep to Feb)
0-AWC	\$4.65 per kgal	\$4.65 per kgal
AWC-(AWC+40)	\$7.2 for each kgal over AWC	\$6.45 per kgal over AWC
Over (AWC+40)	\$6.94 for each kgal >AWC+40	\$6.14 per kgal > AWC+40

Examples

```
>> WaterCharge(1,4,86,6)
ans =
    624.7900
```

```
>> bill=WaterCharge(0.75,3,[45 63 15 27],[3 6 11 1])
bill =
    331.8300    456.7500    107.3500    184.7500
```

Input Restrictions:

The function should halt and return a red error message if the following conditions are not met:

- The input meter size must be a scalar and only one of the values: 0.75, 1 and 1.5
- AWC must be a positive scalar
- Array input is allowed for kgal and month, but the arrays must be the same length
- Input kgal must be positive; kgal may be = 0.
- The month must be a integer between 1 and 12

Testing & Submission

Submit to Cody for correctness verification, and publish the two example cases to a pdf file. Upload `WaterCharge.m` and `WaterCharge.pdf` to Blackboard

Part 1b: Average Winter Consumption

Water customers must know their Average Winter Consumption (AWC) in order to calculate their water bill. The AWC is the average amount of water that a customer uses between September and February. This value will differ between customers. AWC values are updated every March. The data from the previous year is used for calculation of the AWC that is then used for calculation of water charges for the next year.

The utility company stores the water usage data in a matrix form for its customers (each customer represented by a number 1,2, 3,...etc). The first column carries information about the customer (numbers 1, 2, 3,...), the second column is information about the month (numbers 1-12 representing the months January to December respectively) and the third column is the amount of water used in that month in kgals. However, due to an error in the system the data for the three customers got mixed up so that the chronology in the rows is lost.

Write a function M-file that will accept the input `data` that consists of jumbled-up information about three customers as described above. The outputs to your function should be the three AWC values for the three customers (output A is AWC for customer 1, output B is AWC for customer 2, and output C is AWC for customer 3).

Do not use the built-in functions, `sort`, or `find`, that work on an entire array.

Example

A **part** of the data is shown on the right.

```
>> [A,B,C]=AWC(data)
A =
    3.3243
B =
    15.1137
C =
    22.4133
```

3	4	71
2	6	21
3	10	31
1	1	4
2	7	28
3	8	52

Input Restrictions:

The function should halt and return a red error message if the following conditions are not met:

- The input data must have size 36 x 3
- The first column of data must consist of only 1, 2, or 3.
- The second column of data must consist of integers between 1 and 12.
- The third column of data must be positive numbers (including 0).

Testing & Submission

Submit to Cody for correctness verification., and publish to a pdf file using the data given in the file `WaterUsage.xlsx`, sheet1. Upload `AWC.m` and `AWC.pdf` to Blackboard.

Hint: Use built-in function `xlsread` for reading an excel file on MATLAB

Part 1c: Water usage Report

The **customer 3 who has a meter size of 1.5 inches** has asked for a report of their water usage for the cycle 2015-2016. The utility company has data for two cycles 2014-15 and 2015-16 respectively in sheet1 and sheet2 of the file `WaterUsage.xlsx`. The data in both cases is corrupt in the way described in (1.b).

Write a MATLAB script M-file named `WaterReport.m` that uses the water usage data from `WaterUsage.xlsx` and prints the following information to the screen

- Table of kgal usage and charge for each season
- Average kgal usage & charge for each season

Also produce a bar graph for the water consumption with respect to the months (Mar2015-Feb2016).

To calculate the charge for a month you need to know the average winter consumption (AWC) of customer 3. This will be done by calling the function `AWC` with the data for cycle 2014-2015 as input, from script file `WaterReport`. Using this AWC value, the charges for Mar2015-Feb2016 will be calculated by calling function `WaterCharge` using data for 2015-2016 cycle as input.

The output to the screen should exactly look like:

Summer billing:

Month	Usage	Bill
=====	=====	=====
March	26.00	\$174.16
April	57.00	\$396.94
May	85.00	\$593.64
June	71.00	\$496.48
July	69.00	\$482.60
August	55.00	\$382.53

Average summer bill = \$421.06

Average summer consumption = 60.50 kgal

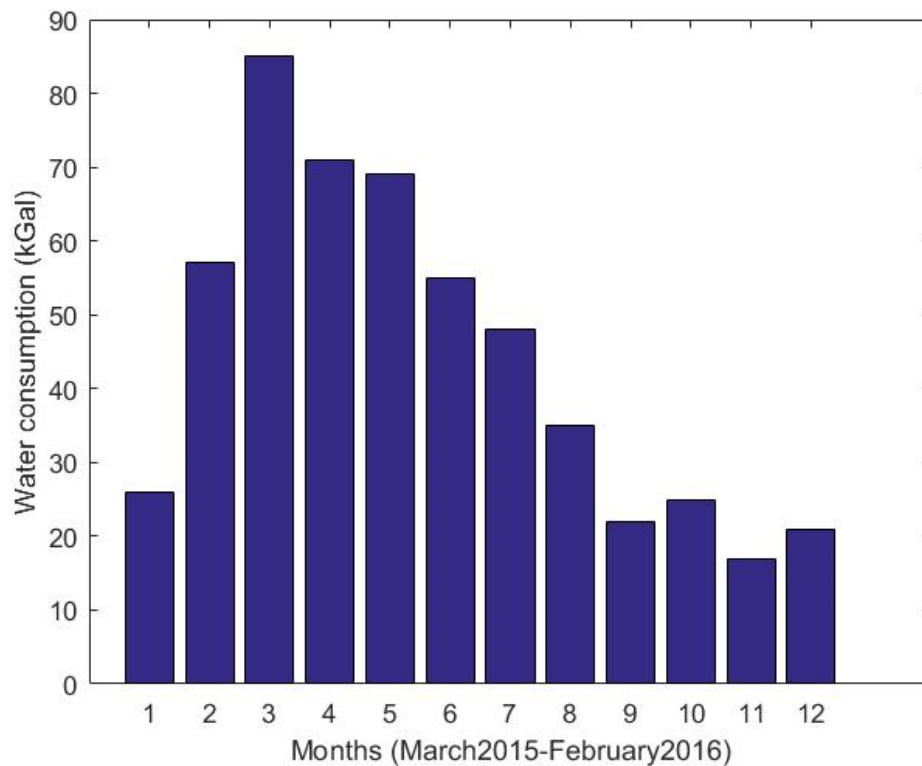
Winter billing:

Month	Usage	Bill
=====	=====	=====
September	48.00	\$315.76
October	35.00	\$231.91
November	22.00	\$155.56
December	25.00	\$169.51
January	17.00	\$132.31
February	21.00	\$150.91

Average winter bill = \$192.66

Average winter consumption = 28.00 kgal

The bar graph should look like:



The data is plotted over one cycle, i.e., March2015-February2016. The bar denoted by the number '1' represents the water consumption (in kGal) for the 1st month of the cycle, i.e., March2015, the bar denoted by '2' represents the same for the month of April2015, and so on till the bar denoted by '12' denoting the water consumption for February2016. Include labels for x and y axes as shown in the plot above.

Code Requirements:

- **Do not** use the built-in functions, `sort`, or `find`, that work on an entire array.
- Download and use `WaterUsage.xlsx` Blackboard. The script M-file must load data from this file. **Hint:** Use built-in function `xlsread` for reading an excel file
- The script M file must call (use) the functions `WaterCharge.m` and `AWC.m`
- **No credit will be given** if the amount is computed any other way.
- The script M-file must print the results exactly as shown in the example.

Testing & Submission

Publish and upload `WaterReport.m` and `WaterReport.pdf` to Blackboard. We will look at your pdf to grade the actual output. There will not be a Cody for this part.