Author: Peter A. Dranishnikov
Lab number: 3
Course number, section: EEL4685C, 01
Due time, date, semester: February 12th, 17:20, Spring of 2019

This lab uses data from an ODBII (on-board debugger v2) logger from the professor's motor vehicle.
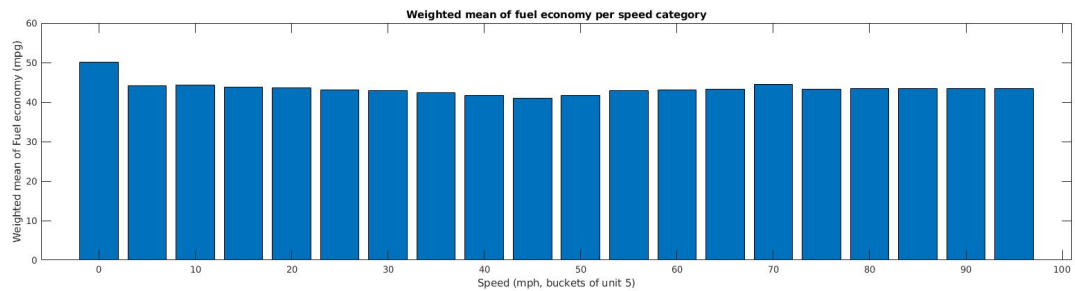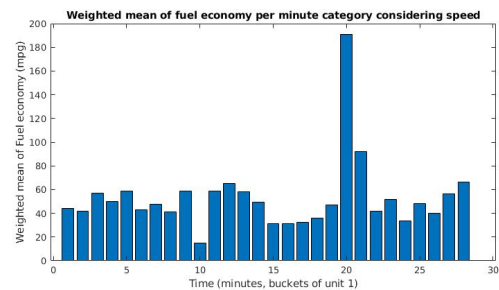Images (in order per dataset):
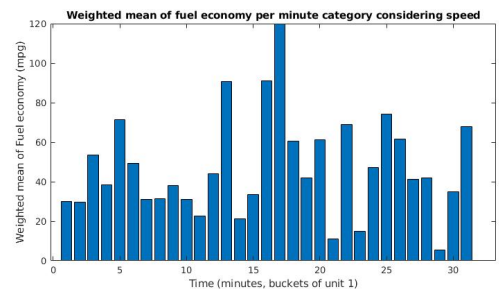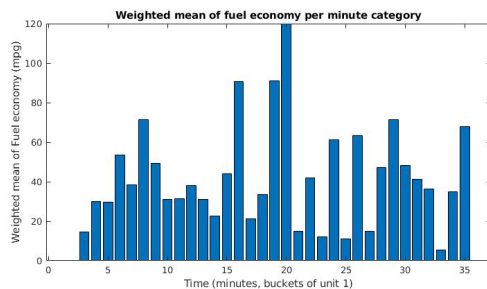
Author: Peter A. Dranishnikov
Lab number: 3
Course number, section: EEL4685C, 01
Due time, date, semester: February 12th, 17:20, Spring of 2019

Weighted mean of fuel economy per speed category

Weighted mean of fuel economy per minute category

Weighted mean of fuel economy per minute category considering speed

Weighted mean of fuel economy per speed category

Weighted mean of fuel economy per minute category
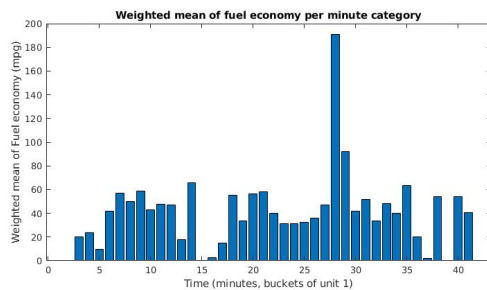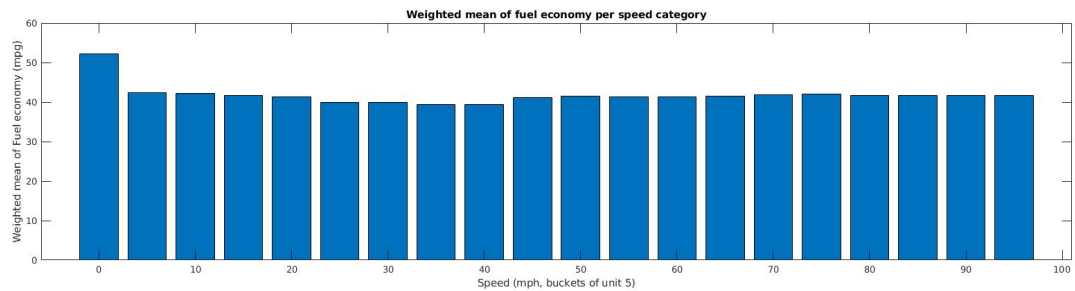

Weighted mean of fuel economy per minute category considering speed
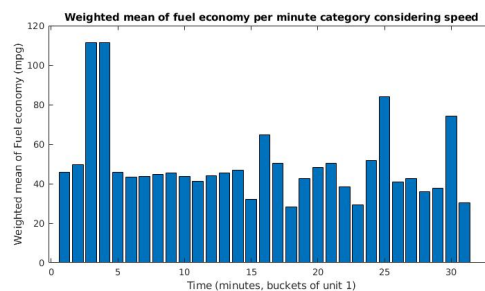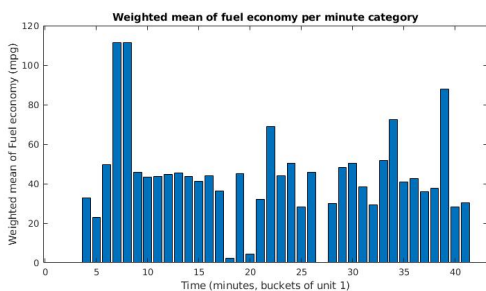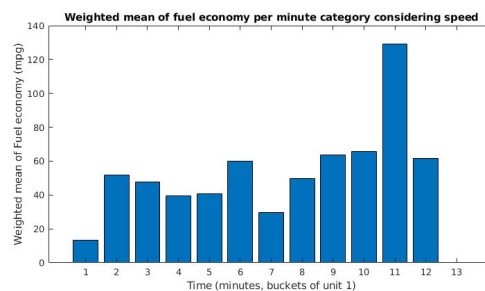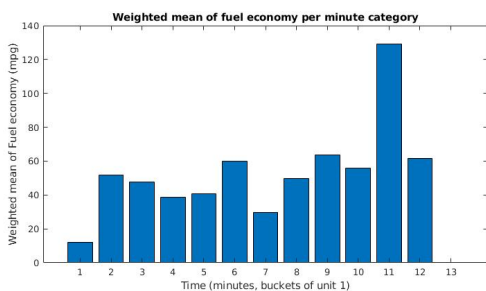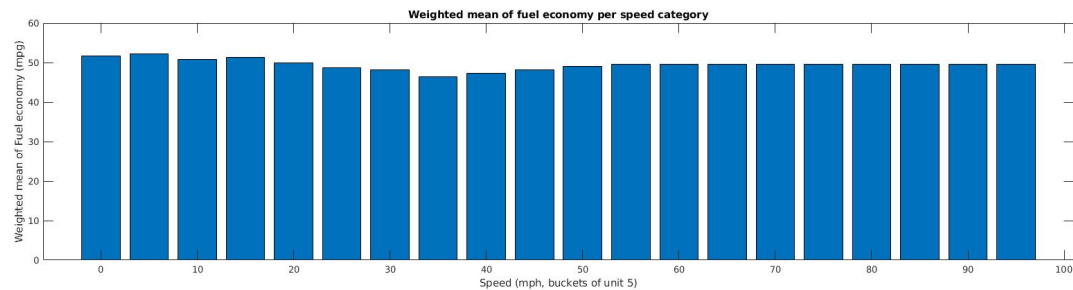
Author: Peter A. Dranishnikov
Lab number: 3
Course number, section: EEL4685C, 01
Due time, date, semester: February 12th, 17:20, Spring of 2019

Author: Peter A. Dranishnikov
Lab number: 3
Course number, section: EEL4685C, 01
Due time, date, semester: February 12th, 17:20, Spring of 2019

Weighted mean of fuel economy per speed category

Weighted mean of fuel economy per minute category

Weighted mean of fuel economy per minute category considering speed

Scripts:
Part 1:

```
%Author: Peter A. Dranishnikov
%Lab number: 3
%Course number, section: EEL4685C, 01
%Due time, date, semester: February 12th, 17:20, Spring of 2019
%Function that accepts the log file's filename as argument
%returns an array containing the data in
%columns: timestamp, elapsed time from previous sample, average of
%continuous readings
%example usage: readdatalog('datalog1.csv')

function [result] = part1(filename)

    TIME = 1;
    GEAR = 5;
    RPM = 7;

    f = fopen(filename,'r');

    junk = fgetl(f);  % remove header line w/o worrying about contents
    % Assume: Time (sec), Accel. Position (%), Boost (PSI), Fuel Economy (MPG), Gear Position
(Gear), Engine RPM (RPM), Vehicle Speed (mph)
    % read file, one data point per row
    data = reshape(fscanf(f,'%f, %f, %f, %f, %d, %d, %d'), 7,[])';
    disp(sprintf('%d data points read', size(data,1)));    %report how many points were read from file
    datalen = size(data, 1);
```
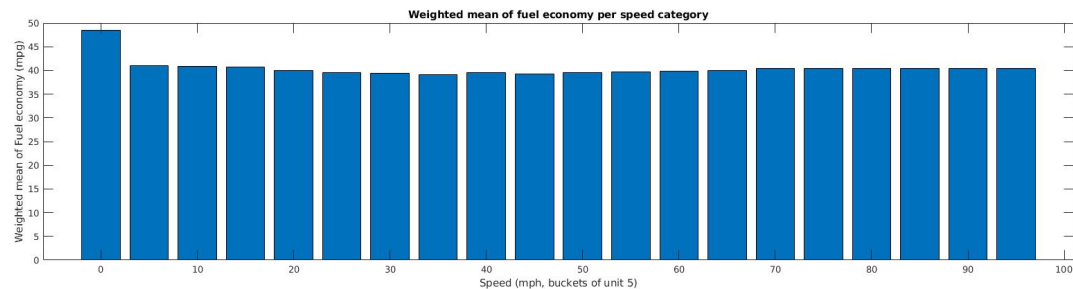
Author: Peter A. Dranishnikov
Lab number: 3
Course number, section: EEL4685C, 01
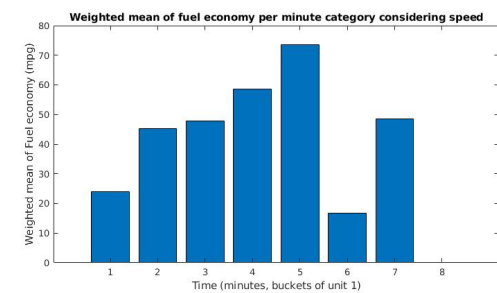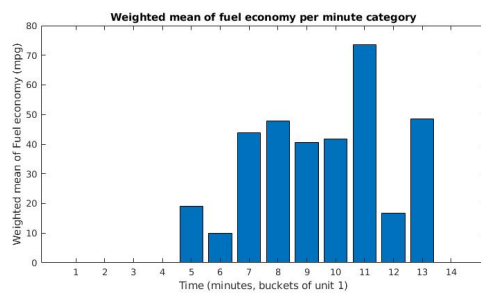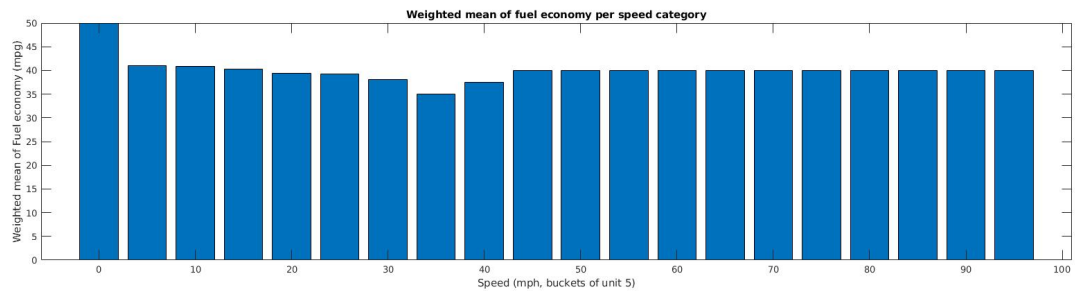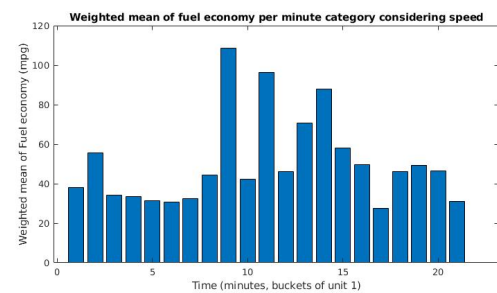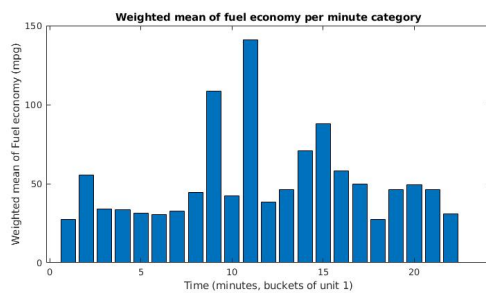Due time, date, semester: February 12th, 17:20, Spring of 2019

```matlab
    result = [data(2:datalen,1), data(2:datalen,1)-data(1:datalen-1,1),
(data(2:datalen,2:4)+data(1:datalen-1,2:4))/2, data(2:datalen,5),
(data(2:datalen,6:7)+data(1:datalen-1,6:7))/2];
    fclose(f);
end


Part 2:
%Author: Peter A. Dranishnikov
%Lab number: 3
%Course number, section: EEL4685C, 01
%Due time, date, semester: February 12th, 17:20, Spring of 2019
%Function for weighted average of fuel econ and time difference
%returns a double of the resulting weighted average of the inputs
%also displays result to console
function [result] = part2(time_arr, fuel_econ)

    result = sum(fuel_econ .* time_arr)/sum(time_arr);

    disp(sprintf("The weighted mean of fuel economy is: %.2f mpg", result));
end


Part 3:
%Author: Peter A. Dranishnikov
%Lab number: 3
%Course number, section: EEL4685C, 01
%Due time, date, semester: February 12th, 17:20, Spring of 2019
%Function for weighted average excluding zero speed values
%Params: time_arr (values, vector), fuel_econ (weights, vector), speed
%(filter/mask, vector)
%Returns a double with the resulting weighted, filtered average
%also displays result to console
function [result] = part3(time_arr, fuel_econ, speed)

    time_arr(speed == 0) = [];
    fuel_econ(speed == 0) = [];

    result = sum(fuel_econ .* time_arr)/sum(time_arr);

    disp(sprintf("The weighted mean of fuel economy considering speed is: %.2f mpg", result));
end


Part 4a:
%Author: Peter A. Dranishnikov
%Lab number: 3
%Course number, section: EEL4685C, 01
%Due time, date, semester: February 12th, 17:20, Spring of 2019
%Function for bounded weighted average
%Params: values (vector), weights (vector), paramvals (filter, vector),
%bupper (upper bound, numeric), blower (lower bound, numeric)
%Returns a double with the resulting weighted average within the filtered bounds
function [result] = part4a(values, weights, paramvals, bupper, blower)
```
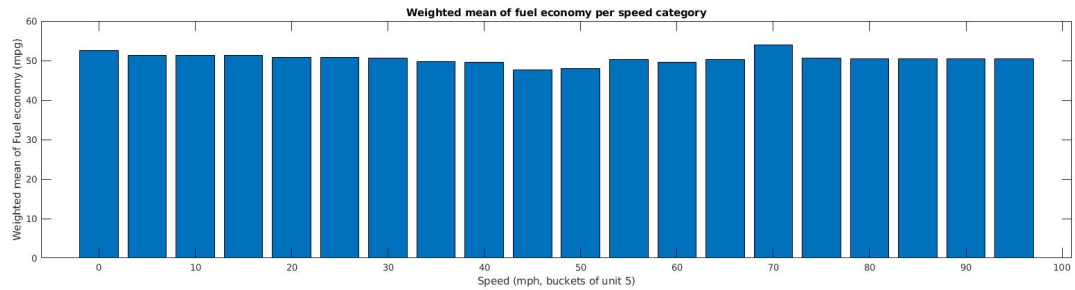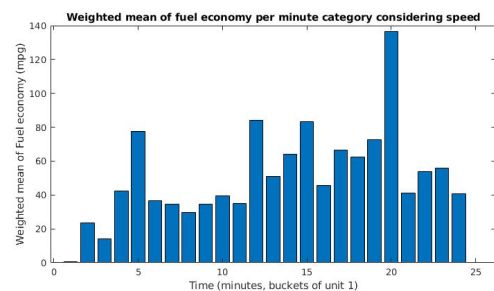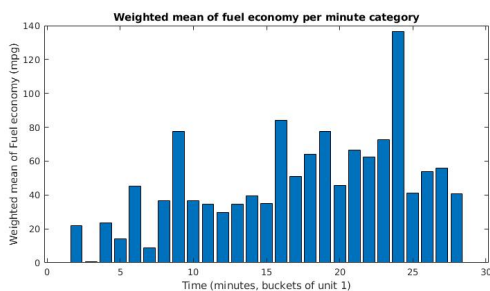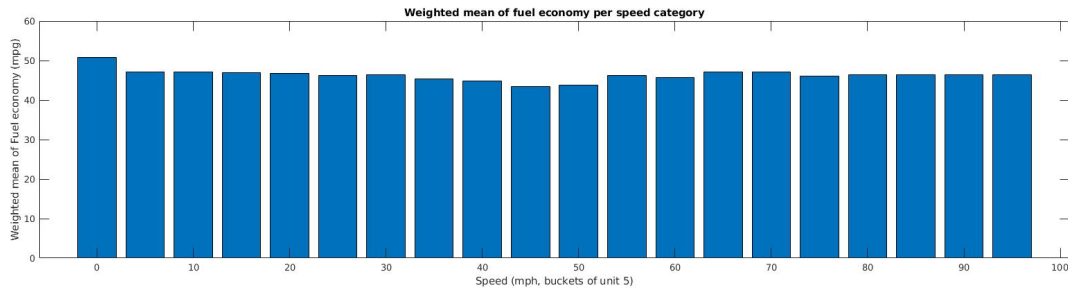
Author: Peter A. Dranishnikov
Lab number: 3
Course number, section: EEL4685C, 01
Due time, date, semester: February 12th, 17:20, Spring of 2019

```matlab
    bool_arr = (paramvals >= bupper) & (paramvals < blower);
    values(bool_arr) = [];
    weights(bool_arr) = [];

    result = sum(values .* weights)/sum(weights);
end
```

Part 4b:
```matlab
%Author: Peter A. Dranishnikov
%Lab number: 3
%Course number, section: EEL4685C, 01
%Due time, date, semester: February 12th, 17:20, Spring of 2019
%Function for per minute averaging
%Params: values (vector), weights (vector), timestamp (decimal time, in seconds,
%sorted vector)
%Returns a vector of the weighted averages for each minute
%!!!!!!!!!!!!!!!1
%NOTICE: if the input data does not have exact points that are evenly
%divisible by 60 or are floating point values, then the buckets may
%over or underextend by some amount of the error
function [result] = part4b(values, weights, timestamp)

    min_divs = mod(timestamp, 60.0) < mean(weights);
    time_vals = round(timestamp(min_divs));
    loc_min_divs = find(min_divs == 1);

    result = zeros(length(time_vals),1);
    for i = 2:length(time_vals)
        result(i-1) = sum(values(loc_min_divs(i-1):loc_min_divs(i)) .* weights(loc_min_divs(i-
1):loc_min_divs(i))) / sum(weights(loc_min_divs(i-1):loc_min_divs(i)));
    end


end
```

Part 4c:
```matlab
%Author: Peter A. Dranishnikov
%Lab number: 3
%Course number, section: EEL4685C, 01
%Due time, date, semester: February 12th, 17:20, Spring of 2019
%Function for per minute averaging with a filter
%Params: values (vector), weights (vector), timestamp (decimal time, in seconds,
%sorted vector), elim_factor (filter, vector)
%Returns a vector of the filtered weighted averages for each minute
%!!!!!!!!!!!!!!!1
%NOTICE: if the input data does not have exact points that are evenly
%divisible by 60 or are floating point values, then the buckets may
%over or underextend by some amount of the error
function [result] = part4c(values, weights, timestamp, elim_factor)
    values(elim_factor == 0) = [];
```

Author: Peter A. Dranishnikov
Lab number: 3
Course number, section: EEL4685C, 01
Due time, date, semester: February 12th, 17:20, Spring of 2019

```matlab
    weights(elim_factor == 0) = [];
    timestamp(elim_factor == 0) = [];

    min_divs = mod(timestamp, 60.0) < mean(weights);
    time_vals = round(timestamp(min_divs));
    loc_min_divs = find(min_divs == 1);

    result = zeros(length(time_vals),1);
    for i = 2:length(time_vals)
        result(i-1) = sum(values(loc_min_divs(i-1):loc_min_divs(i)) .* weights(loc_min_divs(i-
1):loc_min_divs(i))) / sum(weights(loc_min_divs(i-1):loc_min_divs(i)));
    end
end
```

Combined script:

```matlab
%Author: Peter A. Dranishnikov
%Lab number: 3
%Course number, section: EEL4685C, 01
%Due time, date, semester: February 12th, 17:20, Spring of 2019
%This script runs all parts of the lab assignment over all datalogs provided
for i = [1:7]
    %Part 1-3
    data = part1(sprintf('datalog%d.csv',i));
    part2(data(:,2), data(:,5));
    part3(data(:,2), data(:,5), data(:,8));
    %Part 4 start here
    %4a
    figure;
    subplot(2,1,1);
    gen_arr = [0:5:100];
    groups = zeros(length(gen_arr)-1,1);
    for i = 1:length(gen_arr)-1
        groups(i) = part4a(data(:,5), data(:,2), data(:,8), gen_arr(i), gen_arr(i+1));
    end
    gen_arr(gen_arr == 100) = [];%remove unused category (>=100 mph)
    bar(gen_arr, groups);
    title("Weighted mean of fuel economy per speed category");
    xlabel("Speed (mph, buckets of unit 5)");
    ylabel("Weighted mean of Fuel economy (mpg)");
    %4b
    subplot(2,2,3);
    minutes = part4b(data(:,5), data(:,2), data(:,1));
    bar(minutes);
    title("Weighted mean of fuel economy per minute category");
    xlabel("Time (minutes, buckets of unit 1)");
    ylabel("Weighted mean of Fuel economy (mpg)");
    %4c
    subplot(2,2,4); %assignment says lower left, but so does the previous part, so lower right is
what's left
    speeding = part4c(data(:,5), data(:,2), data(:,1), data(:,8));
    bar(speeding);
```

Author: Peter A. Dranishnikov
Lab number: 3
Course number, section: EEL4685C, 01
Due time, date, semester: February 12th, 17:20, Spring of 2019

```
    title("Weighted mean of fuel economy per minute category considering speed");
    xlabel("Time (minutes, buckets of unit 1)");
    ylabel("Weighted mean of Fuel economy (mpg)");
end
```