Assignment 6 Solution (CEE 3804)

Problem 1:

Task 1)

BusCompany.m

```
%%%%%%%%%%%%%%%%%%%%Task 1/ Rroblem 1/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%%%%%
%% Import data from spreadsheet
% Script for importing data from the following spreadsheet:
%
%    Workbook: G:\My Drive\Semester 2\Computer Application in CEE- TA\Assignment 6\BusCompany_Data.xlsx
%    Worksheet: Bus Data
%
% Auto-generated by MATLAB on 21-Mar-2021 22:56:28

clc
clear
close all

%% Setup the Import Options and import the data
opts = spreadsheetImportOptions("NumVariables", 5);

% Specify sheet and range
opts.Sheet = "Bus Data";
opts.DataRange = "A2:E742";

% Specify column names and types
opts.VariableNames = ["City", "BusType", "Age", "Miles", "Routelength"];
opts.VariableTypes = ["categorical", "categorical", "double", "double", "double"];

% Specify variable properties
opts = setvaropts(opts, ["City", "BusType"], "EmptyFieldRule", "auto");

% Import the data
BusCompanyData = readtable("G:\My Drive\Semester 2\Computer Application in CEE- TA\Assignment 6\BusCompany_Data.xlsx", opts,


%% Clear temporary variables
clear opts

%%Difene the headers of the inpute table as variable to work on.
city= BusCompanyData.City;
bustype= BusCompanyData.BusType;
age= BusCompanyData.Age;
milage= BusCompanyData.Miles;
routelength= BusCompanyData.Routelength;
```

Editor - G:\My Drive\Semester 2\Computer Application in CEE- TA\Assignment 6\BusCompany.m

BusCompany.m

```
%% Clear temporary variables
clear opts

%%Difene the headers of the inpute table as variable to work on.
city= BusCompanyData.City;
bustype= BusCompanyData.BusType;
age= BusCompanyData.Age;
milage= BusCompanyData.Miles;
routelength= BusCompanyData.Routelength;


%%%%%%%%%%%%%%%%%%Task 2/ Problem 1%%%%%%%%%%%%%%%%%%%%%%%%%
bus_city_seattle= find (city== 'Seattle'); %find 'seattle' among the cities in the inpute table.
number_of_bus_seattle= length (bus_city_seattle); %Count number of buses in seattle.

routelength_seattle= routelength(bus_city_seattle); % find the route length of corresponding city.
average_milage_seattle= mean(routelength_seattle); %calculate the average route length in seattle.


%%%%%%%%%%%%%%%%%%Task 3/ Problem 1%%%%%%%%%%%%%%%%%%%%%%%%%
bus_city_Atlanta= find (city== 'Atlanta'); %find 'Atlanta' among the cities in the inpute table.
routelength_Atlanta= routelength(bus_city_Atlanta); % find the route length of corresponding city.
histogram(routelength_Atlanta)% draw histogram diagram
title('Route Length Buses in Atlanta')
xlabel('Route Length (miles)')
ylabel('Number of Buses')


%%%%%%%%%%%%%%%%%%Task 4/ Problem 1%%%%%%%%%%%%%%%%%%%%%%%%%
bus_newflyer = find (bustype == 'New Flyer XDE40'); %find 'New Flyer XDE40' among the bus types in the inpute table.
age_newflyer= age(bus_newflyer); %find the age of corresponding bus type.
average_age_newflyer = mean(age_newflyer); %calculate the average age of 'New Flyer XDE40'.


%%%%%%%%%%%%%%%%%%Task 5/ Problem 1%%%%%%%%%%%%%%%%%%%%%%%%%
bus_city_SaltLakeCity = find (city == 'Salt Lake City');  %find 'Salt Lake City' among the cities in the inpute table.
age_SaltLakeCity = age(bus_city_SaltLakeCity); %find the age of corresponding city.
milage_SaltLakeCity = milage(bus_city_SaltLakeCity); % find the milage of corresponding city.
dlmwrite('Bus Selected Characteristics in Salt Lake City.txt',[age_SaltLakeCity,milage_SaltLakeCity], 'precision', '%.0f', '
```

Task 2 and 4)

Application in CEE- TA ▸ Assignment 6

Editor - G:\My Drive\Semester 2\Computer Application in CEE- TA\Assignment 6\BusCompany.m

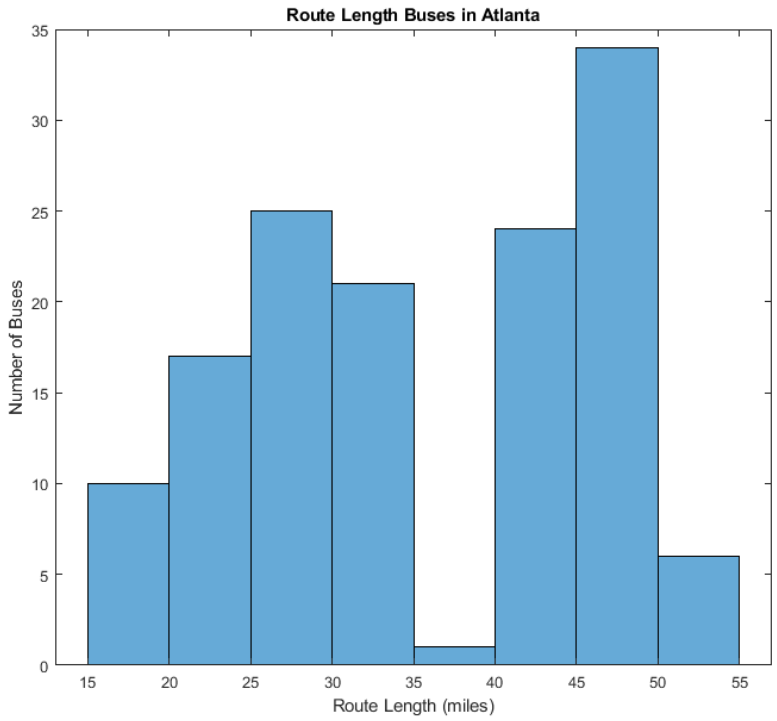
BusCompany.m

```
%%%%%%%%%%%%%%%%%Task 2/ Problem 1%%%%%%%%%%%%%%%%%%%%%%%%
bus_city_seattle= find (city== 'Seattle'); %find 'seattle' among the cities in the inpute table.
number_of_bus_seattle= length (bus_city_seattle); %Count number of buses in seattle.

routelength_seattle= routelength(bus_city_seattle); % find the route length of corresponding city.
average_milage_seattle= mean(routelength_seattle); %calculate the average route length in seattle.
```

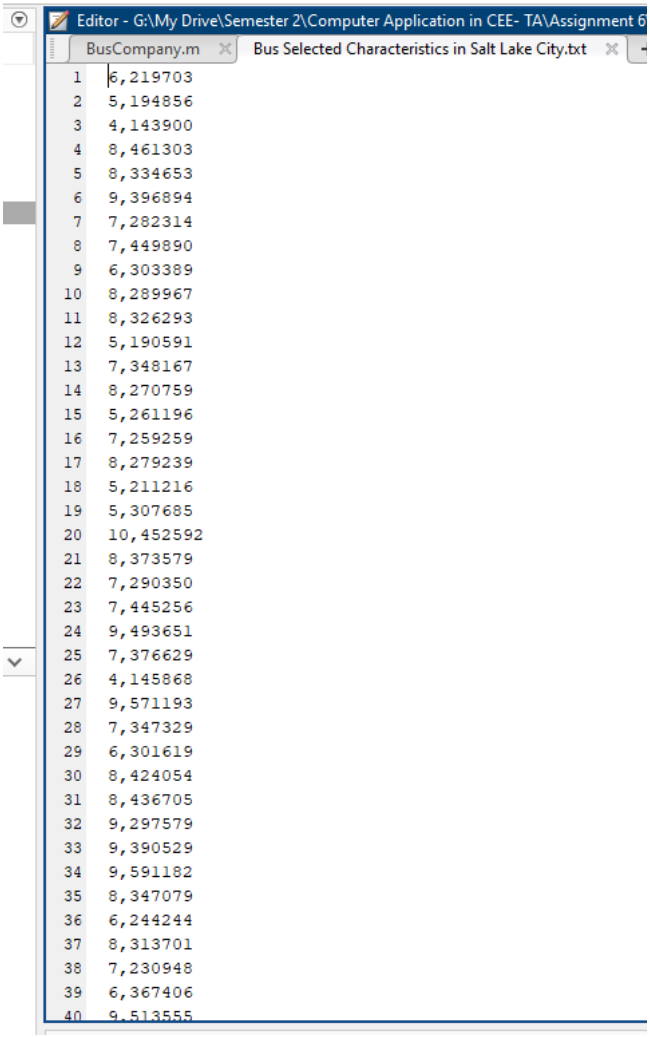
Command Window

```
>> number_of_bus_seattle

number_of_bus_seattle =

   189

>> average_milage_seattle

average_milage_seattle =

   35.8210

>> average_age_newflyer

average_age_newflyer =

    7.2045

>>
```

Task 3)



Task 5)


Editor - G:\My Drive\Semester 2\Computer Application in CEE- TA\Assignment 6
BusCompany.m
Bus Selected Characteristics in Salt Lake City.txt
6,219703
5,194856
4,143900
8,461303
8,334653
9,396894
7,282314
7,449890
6,303389
8,289967
8,326293
5,190591
7,348167
8,270759
5,261196
7,259259
8,279239
5,211216
5,307685
10,452592
8,373579
7,290350
7,445256
9,493651
7,376629
4,145868
9,571193
7,347329
6,301619
8,424054
8,436705
9,297579
9,390529
9,591182
8,347079
6,244244
8,313701
7,230948
6,367406
9,513555

Problem 2:

Task 1)

Editor - G:\My Drive\Semester 2\Computer Application in CEE- TA\Assignment 6\Train_Leg.m

Train_Leg.m

```
%%%%%%%%%%%%%%%%%%%%Task 1 and 2/ problem 2/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%%
% script calculates the noise generated by a train
clc
clear
close all

% formula to estimate the noise generated by a train is found to be:
% Leq = SELref + 10 log(Ncars) + 20 log(S/50) + 10 log (V) - 31.6
% where:
% Leq = equivalent noise level (decibels - dBA)
% SEL ref = reference sound exposure level (decibels - dBA)
% Ncars = number of cars in the train
% S = train speed (mph)
% V = hourly average train volume (trains per hour)
% log = natural log of the number

%Define inpute parameters
SELref = 55;
Ncars = 10;
S = (10:1:60);
V = 25;
%Calculate noise generated by the train
Leq = SELref + 10 * log(Ncars) + 20 * log(S/50) + 10 * log(V) - 31.6;


%%%%%%%%%%%%%%%%%%%%Task 3/ problem 2/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%%%%%%%
%find Leq values that are less than 60 dBL
leg_less_60_index = find(Leq < 60);
leg_less_60 = Leq(leg_less_60_index);


%%%%%%%%%%%%%%%%%%%%Task 4/ problem 2/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%%%%%%%
%find the speed of train correspomding to maximum Leg that is less that 60
%dBL
max_Leg_less_60 = max(leg_less_60);
max_Leg_less_60_index= find(Leq == max_Leg_less_60 );
Max_S = S(max_Leg_less_60_index);

```

Task 2, 3, and 4)

Command Window

```
>> Leq

Leq =

  Columns 1 through 13

   46.4259   48.3321   50.0723   51.6731   53.1553   54.5352   55.8259   57.0384   58.1816   59.2629   60.2888   61.2646   62.1950

  Columns 14 through 26

   63.0840   63.9352   64.7517   65.5361   66.2909   67.0182   67.7201   68.3981   69.0539   69.6889   70.3043   70.9014   71.4811

  Columns 27 through 39

   72.0445   72.5925   73.1259   73.6454   74.1517   74.6456   75.1275   75.5982   76.0579   76.5074   76.9470   77.3771   77.7982

  Columns 40 through 51

   78.2106   78.6146   79.0107   79.3990   79.7800   80.1538   80.5208   80.8812   81.2352   81.5830   81.9249   82.2610

>> leg_less_60

leg_less_60 =

   46.4259   48.3321   50.0723   51.6731   53.1553   54.5352   55.8259   57.0384   58.1816   59.2629

>> Max_S

Max_S =

    19

fx >>
```

Problem 3:

Task 1)

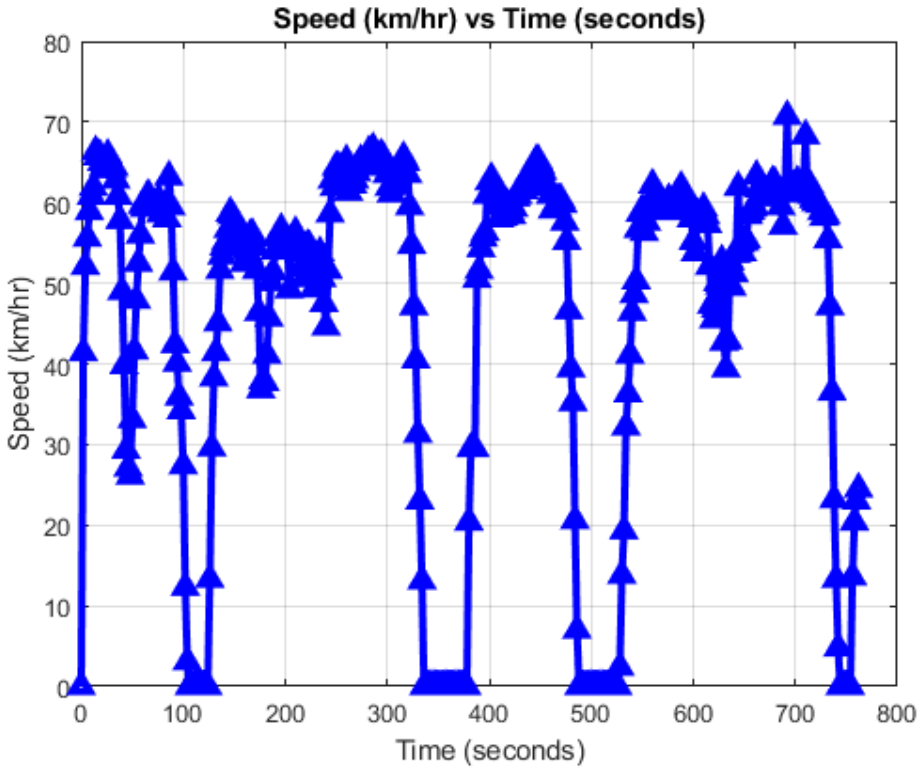
```
%%%%%%%%%%%%%%%%%%%%Task 1/ problem 3/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%%
% script to read GPS car data collected in rural roads in Arizona
clc
clear
close all

% load the GPS data file to WorkSpace.
load ('GPS_Data.m')

% columns of the GPS data file
% Column 1 = Time of observation (seconds)
% Column 2 = Distance traveled (m)
% Column 3 = Speed (km/hr)
% Column 4 = Acceleration (m/s-s)


%%%%%%%%%%%%%%%%%%%%Task 2/ problem 3/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%%
% define and obtain the paramenter named speed and time in GPS data file.
time = GPS_Data(:,1);
speed = GPS_Data(:,3);
% Plot the speed of the car (in y-axis) vs time (x- axis).
figure
plot(time,speed, '^-b','LineWidth',3)
title('Speed (km/hr) vs Time (seconds)')
xlabel('Time (seconds)')
ylabel('Speed (km/hr)')
grid

hold on
%%%%%%%%%%%%%%%%%%%%Task 3/ problem 3/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%%
% convert km/hr to m/s
speed_meter_second = speed .* (1000/3600);
% calculate the acceleration rate of car in m/s2
acceleration = gradient(speed_meter_second,time);

% Plot the acceleration of the car (in y-axis) vs time (x- axis).
figure
plot(time,acceleration, 'o--r')
title('Acceleration m/s2) vs Time (seconds)')
xlabel('Time (seconds)')
ylabel('Acceleration (m/s2)')
grid
```

Editor - G:\My Drive\Semester 2\Computer Application in CEE- TA\Assignment 6\Car_GPS.m

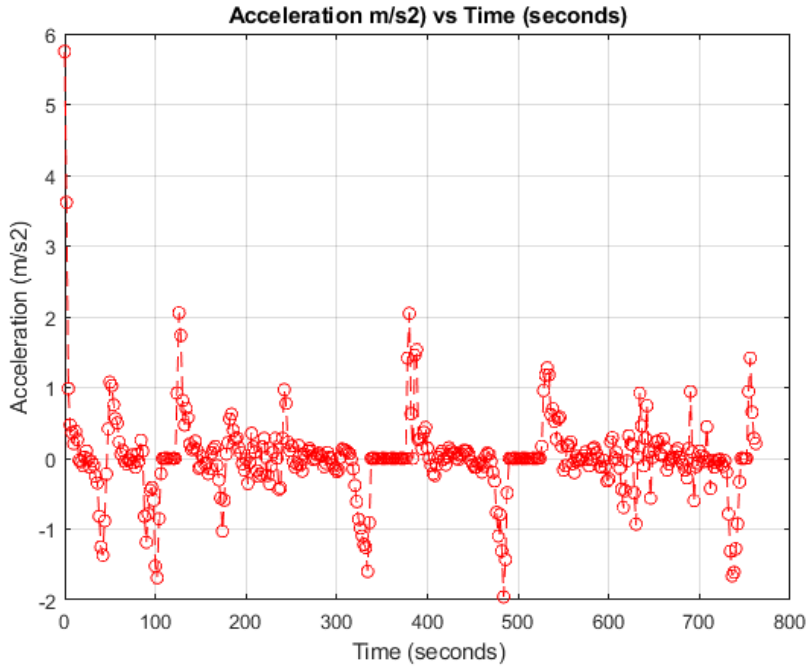
Car_GPS.m

```
% Plot the speed of the car (in y-axis) vs time (x- axis).
figure
plot(time,speed, '^-b','LineWidth',3)
title('Speed (km/hr) vs Time (seconds)')
xlabel('Time (seconds)')
ylabel('Speed (km/hr)')
grid

hold on
%%%%%%%%%%%%%%%%%%%%Task 3/ problem 3/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%%
% convert km/hr to m/s
speed_meter_second = speed .* (1000/3600);
% calculate the acceleration rate of car in m/s2
acceleration = gradient(speed_meter_second,time);

% Plot the acceleration of the car (in y-axis) vs time (x- axis).
figure
plot(time,acceleration, 'o--r')
title('Acceleration m/s2) vs Time (seconds)')
xlabel('Time (seconds)')
ylabel('Acceleration (m/s2)')
grid


%%%%%%%%%%%%%%%%%%%%Task 4/ problem 3/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%%
min_acceleration = min(acceleration); %find the maximum deceleration that is equal to minimum acceleration in acceleration v
min_Acceleration_index = find(acceleration == min_acceleration ); %find the index of minimum acceleration.
min_acceleration_time = time(min_Acceleration_index); %find the time at which, vehicle has the maximum deceleration.


%%%%%%%%%%%%%%%%%%%%Task 5/ problem 3/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%%
%Find the average speed of the car for the complete profile.
speed_average= mean(speed);


%%%%%%%%%%%%%%%%%%%%Task 6/ problem 3/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%%
%find the number of seconds the car is stopped during the recorded data.
%Time interval between successive observations in data is 2 seconds.
stop_time_index = find(speed == 0);
stop_time_duration= length(stop_time_index)*2;
```

Task 2)


Speed (km/hr) vs Time (seconds)
Speed (km/hr)
Time (seconds)
0
10
20
30
40
50
60
70
80
0
100
200
300
400
500
600
700
800

Task 3)


Acceleration m/s2) vs Time (seconds)
Acceleration (m/s2)
Time (seconds)
-2
-1
0
1
2
3
4
5
6
0
100
200
300
400
500
600
700
800

Task 4, 5, and 6)

Editor - G:\My Drive\Semester 2\Computer Application in CEE- TA\Assignment 6\

Car_GPS.m

```
38 -    plot(time,acceleration, 'o--r')
39 -    title('Acceleration m/s2) vs Time (seconds)')
40 -    xlabel('Time (seconds)')
41 -    ylabel('Acceleration (m/s2)')
42 -    grid
```

Command Window

```
>> min_acceleration

min_acceleration =

   -1.9583

>> min_acceleration_time

min_acceleration_time =

   484

>> speed_average

speed_average =

   45.5246

>> stop_time_duration

stop_time_duration =

   118

fx >>
```

Problem 4:

Task 1)

Editor - G:\My Drive\Semester 2\Computer Application in CEE- TA\Assignment 6\Cruise_ships.m

Cruise_ships.m

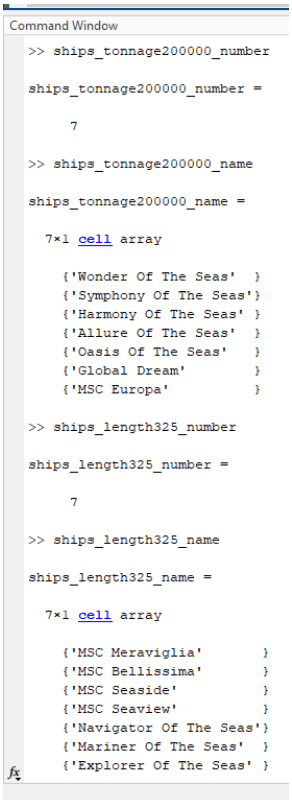
```
%%%%%%%%%%%%%%%%%%%Task 1/ problem 4/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%
% script to read Cruise_ships data.
clc
clear
close all
[num,txt,raw] = xlsread('Cruise_ships.xlsx');

%Define the name and variavle for the parameters in the Cruise_ships data
number_of_ships= length(raw);
ship_name = raw(2:number_of_ships,1);
ship_tonnage = num( :,1);
ship_length = num( :,2);
ship_width = num( :,3);
ship_passengers = num( :,4);
ship_cabins = num( :,5);

%Find number of ships with tonnage greater than 200,000 tons.
ships_tonnage200000_number = length(find(ship_tonnage > 200000));
%Find the names of the ships with tonnage greater than 200,000 tons.
ships_tonnage200000_name = ship_name(find(ship_tonnage > 200000));


%%%%%%%%%%%%%%%%%%%Task 2/ problem 4/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%
%find the number of the cruise ships with total length below 325 meters.
ships_length325_number = length(find(ship_length < 325));
%find the index of shipt with length below 325 meters.
ships_length325_index= find(ship_length < 325);
%Find the names of the ships with total length below 325 meters.
ships_length325_name = ship_name(ships_length325_index);


%%%%%%%%%%%%%%%%%%%Task 3/ problem 4/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%
%Find the average width of the ships in the database.
ship_width_average = mean(ship_width);


%%%%%%%%%%%%%%%%%%%Task 4/ problem 4/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%
%find the cruise ships with a passenger to cabin ratio above 2.38.
ships_ratio= ship_passengers./ship_cabins;
ships_ratio_index = find(ships_ratio > 2.38);
ships_ratio_name = ship_name(ships_ratio_index);
```

Editor - G:\My Drive\Semester 2\Computer Application in CEE- TA\Assignment 6\Cruise_ships.m

Cruise_ships.m

```
%%%%%%%%%%%%%%%%%%%Task 2/ problem 4/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%
%find the number of the cruise ships with total length below 325 meters.
ships_length325_number = length(find(ship_length < 325));
%find the index of shipt with length below 325 meters.
ships_length325_index= find(ship_length < 325);
%Find the names of the ships with total length below 325 meters.
ships_length325_name = ship_name(ships_length325_index);


%%%%%%%%%%%%%%%%%%%Task 3/ problem 4/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%
%Find the average width of the ships in the database.
ship_width_average = mean(ship_width);


%%%%%%%%%%%%%%%%%%%Task 4/ problem 4/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%
%find the cruise ships with a passenger to cabin ratio above 2.38.
ships_ratio= ship_passengers./ship_cabins;
ships_ratio_index = find(ships_ratio > 2.38);
ships_ratio_name = ship_name(ships_ratio_index);


%%%%%%%%%%%%%%%%%%%Task 5/ problem 4/Assignemnt 6/CEE 3804%%%%%%%%%%%%%%
%retrieve the tonnage and width of ships with a passenger to cabin ratio above 2.38.
ships_ratio_tonnage = ship_tonnage(ships_ratio_index);
ships_ratio_width = ship_width(ships_ratio_index);

%write name, tonnage, and width of the ships with a passenger to cabin ratio above 2.38 in a txt file using fprintf command.
fid = fopen ('ships with a passenger to cabin ratio above 2.38.txt','a');
fprintf(fid,'%s,%s,%s\n','Ship Name','Tonnage','Width(meter)');

for i=1: length(ships_ratio_index)

   fprintf(fid,'%s,%.0f,%.0f\n',ships_ratio_name{i},ships_ratio_tonnage(i),ships_ratio_width(i));

end

fclose(fid);
```

Task 2, 3 and4)



```
Command Window
>> ships_tonnage200000_number

ships_tonnage200000_number =

     7

>> ships_tonnage200000_name

ships_tonnage200000_name =

  7×1 cell array

    {'Wonder Of The Seas'  }
    {'Symphony Of The Seas'}
    {'Harmony Of The Seas' }
    {'Allure Of The Seas'  }
    {'Oasis Of The Seas'   }
    {'Global Dream'        }
    {'MSC Europa'          }

>> ships_length325_number

ships_length325_number =

     7

>> ships_length325_name

ships_length325_name =

  7×1 cell array

    {'MSC Meraviglia'       }
    {'MSC Bellissima'       }
    {'MSC Seaside'          }
    {'MSC Seaview'          }
    {'Navigator Of The Seas'}
    {'Mariner Of The Seas'  }
    {'Explorer Of The Seas' }
```

```
Command Window

>> ship_width_average

ship_width_average =

   44.9818

>> ships_ratio_name

ships_ratio_name =

  43×1 cell array

    {'MSC Europa'              }
    {'Arvia'                   }
    {'Iona'                    }
    {'AIDAcosma'               }
    {'AIDAnova'                }
    {'Costa Smeralda'          }
    {'Costa Toscana'           }
    {'Carnival Celebration'    }
    {'Carnival Mardi Gras'     }
    {'MSC Grandiosa'           }
    {'MSC Virtuosa'            }
    {'MSC Meraviglia'          }
    {'MSC Bellissima'          }
    {'MSC Seashore'            }
    {'Odyssey Of The Seas'     }
    {'Norwegian Bliss'         }
    {'Norwegian Encore'        }
    {'Norwegian Joy'           }
    {'Norwegian Escape'        }
    {'Norwegian Epic'          }
    {'Freedom Of The Seas'     }
    {'Independence Of The Seas'}
    {'Liberty Of The Seas'     }
    {'MSC Seaside'             }
    {'MSC Seaview'             }
    {'Queen Mary 2'            }
    {'Norwegian Getaway'       }
```

```
Command Window
    {'Costa Toscana'            }
    {'Carnival Celebration'     }
    {'Carnival Mardi Gras'      }
    {'MSC Grandiosa'            }
    {'MSC Virtuosa'             }
    {'MSC Meraviglia'           }
    {'MSC Bellissima'           }
    {'MSC Seashore'             }
    {'Odyssey Of The Seas'      }
    {'Norwegian Bliss'          }
    {'Norwegian Encore'         }
    {'Norwegian Joy'            }
    {'Norwegian Escape'         }
    {'Norwegian Epic'           }
    {'Freedom Of The Seas'      }
    {'Independence Of The Seas'}
    {'Liberty Of The Seas'      }
    {'MSC Seaside'              }
    {'MSC Seaview'              }
    {'Queen Mary 2'             }
    {'Norwegian Getaway'        }
    {'Norwegian Breakaway'      }
    {'Disney Wish'              }
    {'Britannia'                }
    {'Discovery Princess'       }
    {'Enchanted Princess'       }
    {'Sky Princess'             }
    {'Majestic Princess'        }
    {'Regal Princess'           }
    {'Royal Princess'           }
    {'Navigator Of The Seas'    }
    {'MSC Divina'               }
    {'MSC Preziosa '            }
    {'Mariner Of The Seas'      }
    {'MSC Fantasia'             }
    {'MSC Splendida'            }
    {'Explorer Of The Seas'     }
```

Task 5)