Assignment 7 Solution (CEE 3804)

Problem 1:

Task 1)

Dams_UnitedStates.m

```
%% Import data from spreadsheet
% Script for importing data from the following spreadsheet:
%
%    Workbook: G:\My Drive\Semester 2\Computer Application in CEE- TA\Assignment 7\US_dams_2021.xlsx
%    Worksheet: damData
%
% Auto-generated by MATLAB on 31-Mar-2021 11:19:19

clc;
clear;
close all;

%% Setup the Import Options and import the data%%%%%%%%%%%%%%%Task 1%%%%%%%%%%%%%%%%
opts = spreadsheetImportOptions("NumVariables", 12);

% Specify sheet and range
opts.Sheet = "damData";
opts.DataRange = "A2:L8121";

% Specify column names and types
opts.VariableNames = ["Name", "Longitude", "Latitude", "County", "Height", "MaxStorgae", "NormalStorage", "SurfaceArea", "D
opts.VariableTypes = ["string", "string", "string", "string", "string", "string", "string", "string", "string", "string", "

% Specify variable properties
opts = setvaropts(opts, ["Name", "Longitude", "Latitude", "County", "Height", "MaxStorgae", "NormalStorage", "SurfaceArea",
opts = setvaropts(opts, ["Name", "Longitude", "Latitude", "County", "Height", "MaxStorgae", "NormalStorage", "SurfaceArea",

% Import the data
USdams2021 = readtable("G:\My Drive\Semester 2\Computer Application in CEE- TA\Assignment 7\US_dams_2021.xlsx", opts, "UseE

% Convert to output type
USdams2021 = table2cell(USdams2021);
numIdx = cellfun(@(x) ~isnan(str2double(x)), USdams2021);
USdams2021(numIdx) = cellfun(@(x) {str2double(x)}, USdams2021(numIdx));

clear opts
```

Dams_UnitedStates.m

```
%Define the name of variabls based on the headers in excel file
dam_name= USdams2021( :,1);
dam_longitude= USdams2021( :,2);
dam_latitude= USdams2021( :,3);
dam_county= USdams2021( :,4);
dam_height= USdams2021( :,5);
dam_maxstorage= USdams2021( :,6);
dam_normalStorage= USdams2021( :,7);
dam_surfacearea= USdams2021( :,8);
dam_drainarea= USdams2021( :,9);
dam_hazard= USdams2021( :,10);
dam_state= USdams2021( :,11);
dam_year= USdams2021( :,12);

%%Fine the name of dams with high hazard (H), then display the name of the first 20 hazardous dams%%%%%%%%%%Task 2%%%%%%%%%
%Find the index of the high hazrad dams
high_hazard_index = find([dam_hazard{:}] == 'H')';
%Find the name of the high hazrad dams
high_hazard_name = dam_name(high_hazard_index);
%Find average surface area of the high hazrad dams
high_hazard_surfacearea= dam_surfacearea(high_hazard_index);
high_hazard_surfacearea_average = mean(cell2mat(high_hazard_surfacearea));
high_hazard_surfacearea_average_rounded = round(high_hazard_surfacearea_average,2);
%Display the "high_hazard_surfacearea_average" and the name of the first 20 hazardous dams
disp(['Average Surface Area of High Hazard Dams is ', num2str(high_hazard_surfacearea_average_rounded), ' m2']);
disp('Name of the First 20 Hazardous Dams are:');
disp(string(high_hazard_name(1:20,1)));

%%Find name of dams built before the year 1900 and count the number of such dams,
%%then find the average height of these dams. In the end, display names of
%%the first 10 dams found.%%%%Task 3%%%%%
dams_year1900_index= find(cell2mat(dam_year)<1900);
dams_year1900_name = dam_name(dams_year1900_index);
dams_year1900_count= length(dams_year1900_index);
dams_year1900_average_height= mean(cell2mat(dam_height(dams_year1900_index)));
dams_year1900_average_height_rounded= round(dams_year1900_average_height,2);
disp('Name of the First 10 Dams built before the year 1900 are:');
disp(string(dams_year1900_name(1:10,1)));
```

Editor - G:\My Drive\Semester 2\Computer Application in CEE- TA\Assignment 7\Dams_UnitedStates.m

Dams_UnitedStates.m

```
%Find the name of the high hazrad dams
high_hazard_name = dam_name(high_hazard_index);
%Find average surface area of the high hazrad dams
high_hazard_surfacearea= dam_surfacearea(high_hazard_index);
high_hazard_surfacearea_average = mean(cell2mat(high_hazard_surfacearea));
high_hazard_surfacearea_average_rounded = round(high_hazard_surfacearea_average,2);
%Display the "high_hazard_surfacearea_average" and the name of the first 20 hazardous dams
disp(['Average Surface Area of High Hazard Dams is ', num2str(high_hazard_surfacearea_average_rounded), ' m2']);
disp('Name of the First 20 Hazardous Dams are:');
disp(string(high_hazard_name(1:20,1)));

%%Find name of dams built before the year 1900 and count the number of such dams,
%%then find the average height of these dams. In the end, display names of
%%the first 10 dams found.%%%%Task 3%%%%%
dams_year1900_index= find(cell2mat(dam_year)<1900);
dams_year1900_name = dam_name(dams_year1900_index);
dams_year1900_count= length(dams_year1900_index);
dams_year1900_average_height= mean(cell2mat(dam_height(dams_year1900_index)));
dams_year1900_average_height_rounded= round(dams_year1900_average_height,2);
disp('Name of the First 10 Dams built before the year 1900 are:');
disp(string(dams_year1900_name(1:10,1)));

%%Plot 1) a histogram of the maximum storage of the US dams and 2) a regular scattered plot with the dam height in the x ax
dam_maxstorage= string(dam_maxstorage);
dam_maxstorage(strcmp('',dam_maxstorage))= []; %Exclude emplty cell array in the data set.
dam_height = string(dam_height);
dam_height(strcmp('',dam_height))= []; %Exclude emplty cell array in the data set.


figure
histogram(double(dam_maxstorage),3);
title('Number of Maximum Storage of Dams in the US');
xlabel('Max Storage');
ylabel('Count of Dams');

figure
plot(str2double(dam_height),str2double(dam_maxstorage),'*r');
title('Maximum Storage vs Height for the US Dams');
xlabel('Height');
ylabel('Max Storage');
grid

```

Task 2)

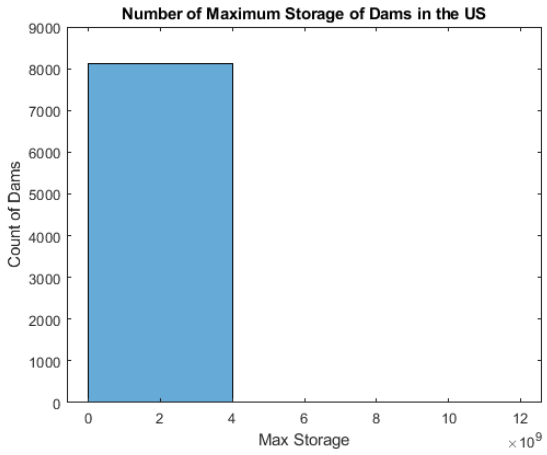
Command Window

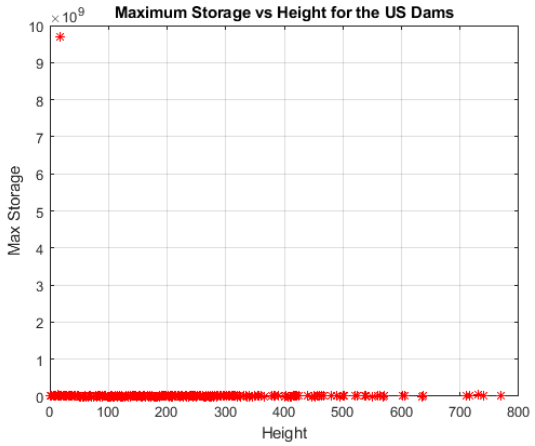
```
Average Surface Area of High Hazard Dams is 8119.39 m2
Name of the First 20 Hazardous Dams are:
    "COAMO"
    "PATILLAS"
    "LOCO"
    "ANA MARIA 5"
    "PORTUGUES"
    "CARITE"
    "ANTONIO LUCCHETTI"
    "GUAYABAL"
    "TOA VACA DAM"
    "GARZAS"
    "GUINEO"
    "PRIETO"
    "CIDRA"
    "ADJUNTAS"
    "PELLEJAS"
    "MATRULLAS"
    "GUAYO"
    "YAHUECAS"
    "VIVI"
    "COMERIO DAM 2"
```

Task 3)

```
>> dams_year1900_count

dams_year1900_count =

   223

>> dams_year1900_average_height_rounded

dams_year1900_average_height_rounded =

   44.5100

>> disp('Name of the First 10 Dams built before the year 1900 are:');
disp(string(dams_year1900_name(1:10,1)));
Name of the First 10 Dams built before the year 1900 are:
    "KAPALAALAEA RESERVOIR"
    "FORT PULASKI NM HISTORIC DIKE"
    "SWEETWATER MAIN"
    "CUYAMACA"
    "HEMET, LAKE"
    "RIVER RESERVOIR #3"
    "WALNUT CANYON"
    "BUENA VISTA"
    "PAN"
    "FERN LAKE DAM"
```

Task 4)





Problem 2:

Task 1)

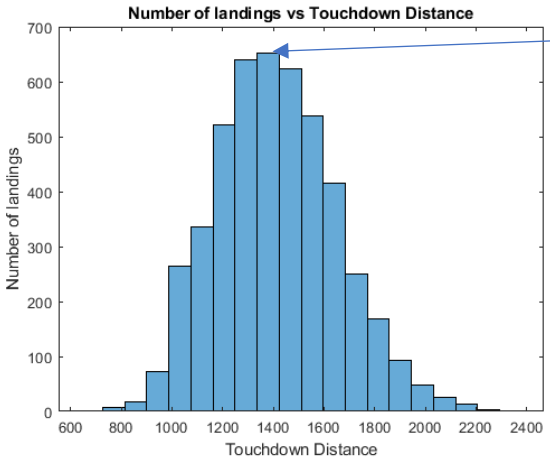
Landing_flight.m

```
%% Import data from spreadsheet
% Script for importing data from the following spreadsheet:
%
%    Workbook: G:\My Drive\Semester 2\Computer Application in CEE- TA\Assignment 7\LGA22_ROT_data.xlsx
%    Worksheet: LGA22_allTD_data
%
% Auto-generated by MATLAB on 31-Mar-2021 14:31:13

%% Setup the Import Options and import the data

close all
clear
clc

opts = spreadsheetImportOptions("NumVariables", 8);

% Specify sheet and range
opts.Sheet = "LGA22_allTD_data";
opts.DataRange = "A2:H48765";

% Specify column names and types
opts.VariableNames = ["Airport", "FlightID", "Aircraft", "TouchdownDistanceft", "ROTFuselages", "ExitDistanceft", "Threshol
opts.VariableTypes = ["string", "string", "string", "string", "string", "string", "string", "string"];

% Specify variable properties
opts = setvaropts(opts, ["Airport", "FlightID", "Aircraft", "TouchdownDistanceft", "ROTFuselages", "ExitDistanceft", "Thres
opts = setvaropts(opts, ["Airport", "FlightID", "Aircraft", "TouchdownDistanceft", "ROTFuselages", "ExitDistanceft", "Thres

% Import the data
LGA22ROTdata = readtable("G:\My Drive\Semester 2\Computer Application in CEE- TA\Assignment 7\LGA22_ROT_data.xlsx", opts, "

%% Convert to output type
LGA22ROTdata = table2cell(LGA22ROTdata);
numIdx = cellfun(@(x) ~isnan(str2double(x)), LGA22ROTdata);
LGA22ROTdata(numIdx) = cellfun(@(x) {str2double(x)}, LGA22ROTdata(numIdx));

%% Clear temporary variables
clear opts
```

Landing_flight.m

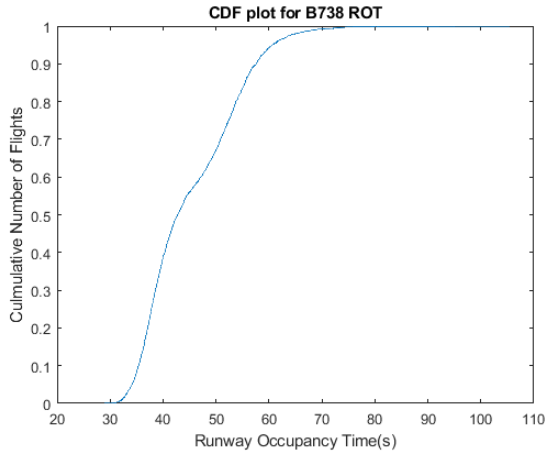
```
%%Define the name of variabls based on the headers in excel file.%%%%%Task 1%%%%%
airport_name = LGA22ROTdata( :,1);
flight_id = LGA22ROTdata( :,2);
aircraft_name = LGA22ROTdata( :,3);
touchdown_distance = LGA22ROTdata( :,4);
ROT_fuselage = LGA22ROTdata( :,5);
exit_distance = LGA22ROTdata( :,6);
threshold_speed = LGA22ROTdata( :,7);
exit_speed = LGA22ROTdata( :,8);

%%Plot histogram for touchdown distance for B738%%%Task 2%%%%%%
B738_index = find([aircraft_name{:}] == 'B738')';
touchdown_distance_B738 = touchdown_distance(B738_index);

figure
histogram(cell2mat(touchdown_distance_B738),20);
title('Number of landings vs Touchdown Distance');
xlabel('Touchdown Distance');
ylabel('Number of landings');

%%scatter plot with the exit distance (x-axis) versus ROT (y-axis) for all aircraft in the data.
figure
createfigure(cell2mat(exit_distance),cell2mat(ROT_fuselage)) %call createfigure function to create desired scatter plot

%%Plot a CDF plot for B738
figure
ROT_fuselage_B738 = ROT_fuselage(B738_index);
cdfplot(cell2mat(ROT_fuselage_B738));
title('CDF plot for B738 ROT');
xlabel('Runway Occupancy Time(s)');
ylabel('Culmulative Number of Flights');
grid


%%Estimate the percent of landings for aircraft of type A320 with runway threshold crossing speeds below 125 knots.%%%Task
A320_index = find([aircraft_name{:}] == 'A320')';
A320_number = length(A320_index);
number_A320_Speed125 = length(find(cell2mat(threshold_speed(A320_index)) < 125));
percentage_A320_speed125 = round((number_A320_Speed125/A320_number)*100,2);
```

Task 2)

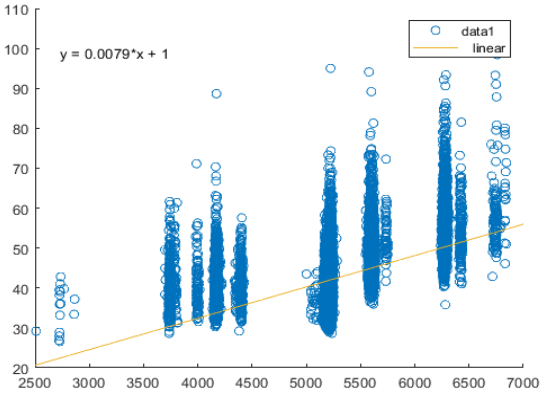


Most Repeated

Task 3)



Task 4)



Note: This scatter plot has been created using script generator feature in MATLAB. Also, the codes to create this plot is available on page 4.

Task 5)

```
Landing_flight.m
55 -  histogram(cell2mat(touchdown_distance_B738),20);
56 -  title('Number of landings vs Touchdown Distance');
57 -  xlabel('Touchdown Distance');
58 -  ylabel('Number of landings');
59
60    %%scatter plot with the exit distance (x-axis) versus ROT (y-axis) for all aircraft in the data.
61 -  figure
62 -  createfigure(cell2mat(exit_distance),cell2mat(ROT_fuselage)) %call createfigure function to create desired scatter plot
63
64    %%Plot a CDF plot for B738
65 -  figure
66 -  ROT_fuselage_B738 = ROT_fuselage(B738_index);
67 -  cdfplot(cell2mat(ROT_fuselage_B738));
68 -  title('CDF plot for B738 ROT');
69 -  xlabel('Runway Occupancy Time(s)');
70 -  ylabel('Culmulative Number of Flights');
71 -  grid
72
73
74    %%Estimate the percent of landings for aircraft of type A320 with runway threshold crossing speeds below 125 knots.%%%Task
75 -  A320_index = find([aircraft_name{:}] == 'A320')';
76 -  A320_number = length(A320_index);
77 -  number_A320_Speed125 = length(find(cell2mat(threshold_speed(A320_index)) < 125));
78 -  percentage_A320_speed125 = round((number_A320_Speed125/A320_number)*100,2);
79
80
```

```
Command Window
>> percentage_A320_speed125

percentage_A320_speed125 =

   18.2600

fx >>
```

Problem 3:

Task 1)

```
Amtrak_Stations.m
7     % Auto-generated by MATLAB on 31-Mar-2021 16:19:08
8
9     %% Setup the Import Options and import the data
10
11 -  close all
12 -  clear
13 -  clc
14
15 -  opts = spreadsheetImportOptions("NumVariables", 6);
16
17    % Specify sheet and range
18 -  opts.Sheet = "Sheet1";
19 -  opts.DataRange = "A2:F880";
20
21    % Specify column names and types
22 -  opts.VariableNames = ["Longitude_deg", "Latitude_deg", "Station_Code", "County", "State", "Station_Type"];
23 -  opts.VariableTypes = ["string", "string", "string", "string", "string", "string"];
24
25    % Specify variable properties
26 -  opts = setvaropts(opts, ["Longitude_deg", "Latitude_deg", "Station_Code", "County", "State", "Station_Type"], "WhitespaceRu
27 -  opts = setvaropts(opts, ["Longitude_deg", "Latitude_deg", "Station_Code", "County", "State", "Station_Type"], "EmptyFieldRu
28
29    % Import the data
30 -  Amtrakstations = readtable("G:\My Drive\Semester 2\Computer Application in CEE- TA\Assignment 7\Amtrak_stations.xlsx", opts
31
32    %% Convert to output type
33 -  Amtrakstations = table2cell(Amtrakstations);
34 -  numIdx = cellfun(@(x) ~isnan(str2double(x)), Amtrakstations);
35 -  Amtrakstations(numIdx) = cellfun(@(x) {str2double(x)}, Amtrakstations(numIdx));
36
37    %% Clear temporary variables
38 -  clear opts
39
40    %%Define the name of variabls based on the headers in excel file.%%%%%Task 1%%%%%
41 -  longitude = Amtrakstations( :,1);
42 -  latitude = Amtrakstations( :,2);
43 -  station_code = Amtrakstations( :,3);
44 -  county = Amtrakstations( :,4);
45 -  state = Amtrakstations( :,5);
46 -  station_type = Amtrakstations( :,6);
47
```

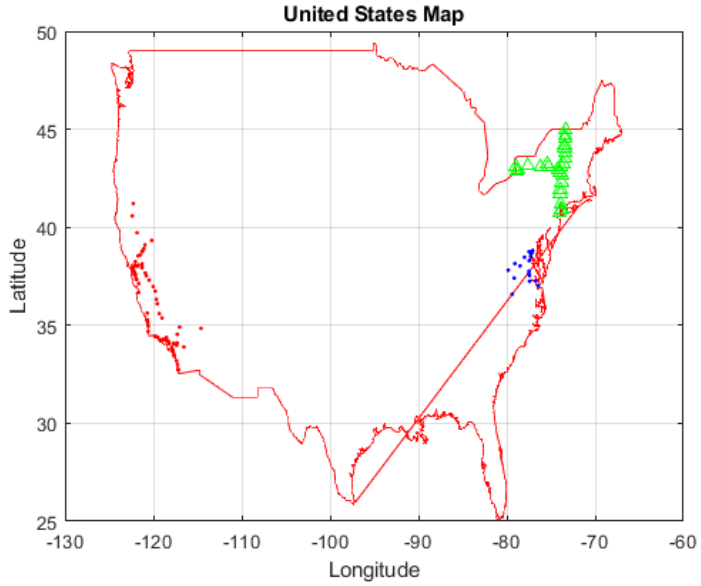
Amtrak_Stations.m

```
%%%%%%%%%Task 2%%%%%%%%%%
%Retrieve data for the US map
[num,txt,raw] = xlsread('US_coastline.xlsx');
% plot the US outline
plot(num(:,2), num(:,1), '-r');
grid
title('United States Map');
xlabel('Longitude');
ylabel('Latitude');
hold on


railstations_index = find([station_type{:}] == 'RAIL')';   %find all rail stations
state_railstations = state(railstations_index); %detect the name state.

%Find the lat/lon of stations in CA and VA
railstation_lon = longitude(railstations_index);
railstation_lat = latitude(railstations_index);
california = find([state_railstations{:}] == 'CA')';
virginia = find([state_railstations{:}] == 'VA')';

california_lon = railstation_lon(california);
california_lat = railstation_lat(california);
virginia_lon = railstation_lon(virginia);
virginia_lat = railstation_lat(virginia);

% plots California rail stations
plot(cell2mat(california_lon), cell2mat(california_lat), '.r');
%plot virginia rail stations
plot(cell2mat(virginia_lon),cell2mat(virginia_lat),'.b');


%%%%%%%%%Task 3%%%%%%%%%%
%Find the lat/lon of stations at New York, then plot them in green.
newyork =  find([state_railstations{:}] == 'NY')';
newyork_lon = railstation_lon(newyork);
newyork_lat = railstation_lat(newyork);
plot(cell2mat(newyork_lon), cell2mat(newyork_lat),'^g');

```

Amtrak_Stations.m

```
california = find([state_railstations{:}] == 'CA')';
virginia = find([state_railstations{:}] == 'VA')';

california_lon = railstation_lon(california);
california_lat = railstation_lat(california);
virginia_lon = railstation_lon(virginia);
virginia_lat = railstation_lat(virginia);

% plots California rail stations
plot(cell2mat(california_lon), cell2mat(california_lat), '.r');
%plot virginia rail stations
plot(cell2mat(virginia_lon),cell2mat(virginia_lat),'.b');


%%%%%%%%%Task 3%%%%%%%%%%
%Find the lat/lon of stations at New York, then plot them in green.
newyork =  find([state_railstations{:}] == 'NY')';
newyork_lon = railstation_lon(newyork);
newyork_lat = railstation_lat(newyork);
plot(cell2mat(newyork_lon), cell2mat(newyork_lat),'^g');

%%%%%%%%%Task 4%%%%%%%%%%
busstation_index = find([station_type{:}] == 'BUS')';
state_busstations = state(busstation_index);
number_of_stations = length(state_busstations);
%Count the number of distinct states with bus system
states_with_bus = unique(string(state_busstations));

```

Task 2 and 3)



Task 4)

```
Command Window
>> number_of_stations

number_of_stations =

   336

>> states_with_bus

states_with_bus =

  33×1 string array

    "AL"
    "AZ"
    "BC"
    "CA"
    "CO"
    "CT"
    "DE"
    "FL"
    "IA"
    "ID"
    "IL"
    "IN"
    "KY"
    "LA"
    "MA"
    "MD"
    "ME"
    "MI"
    "MN"
    "NC"
    "NH"
    "NM"
    "NV"
    "NY"
    "OK"
    "OR"
    "TX"
    "UT"
    "VA"
    "VT"
    "WA"
    "WI"
```

Problem 4:

Task 1)

Train_noise.m | Train.m

```
%%Estimate the noise generated by a train
%parameters and inputs:
%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)

%Leq = SELref + 10 log(Ncars) + 20 log(S/50) + 10 log (V) - 31.6
close all
clear
clc


%Detemine the input values
Ncars = 6;
V = 25;
SELref = 55;
S = 20:1:65;
%Call the function named "Train_noise". The calculated noises are returend to main script as variable "Leq".
[Leq] = (Train_noise(SELref, Ncars, S, V))';

%Plot Leq vs Speed
plot(S,Leq,'.r')
title('Noise generated by a train (dBL) vs Speed (mph)');
xlabel('Speed (mph)');
ylabel('Noise generated by a train (dBL)');
grid

```

Editor - G:\My Drive\Semester 2\Computer Application in CEE- TA\Assignment 7\Train_noise.m

Train_noise.m | Train.m

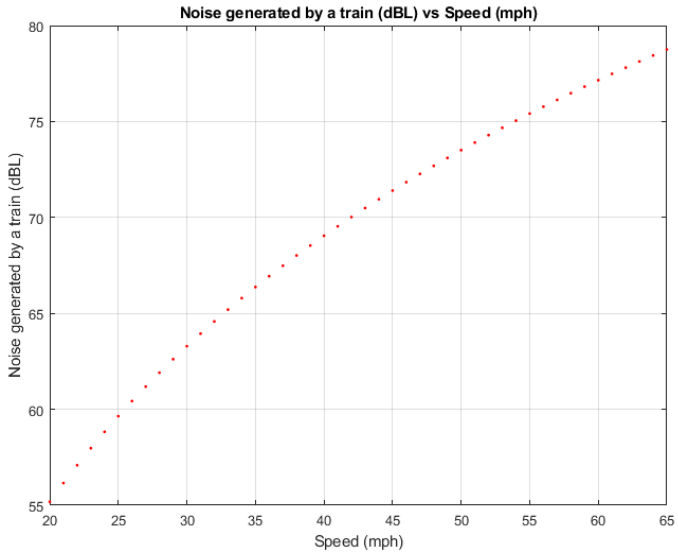
```
function [Leq] = Train_noise(SELref, Ncars, S, V)


Leq = SELref + 10 * log(Ncars) + 20 * log(S/50) + 10 * log(V) -31.6;



end

```

Task 2)

Command Window

```
>> Leq

Leq =

   55.1805
   56.1563
   57.0867
   57.9758
   58.8270
   59.6434
   60.4278
   61.1826
   61.9100
   62.6118
   63.2898
   63.9456
   64.5806
   65.1960
   65.7931
   66.3729
   66.9363
   67.4843
   68.0176
   68.5371
   69.0435
   69.5373
   70.0193
   70.4899
   70.9497
   71.3991
   71.8387
   72.2688
   72.6899
   73.1023
   73.5064
   73.9024
   74.2908
   74.6717
   75.0456
   75.4126
   75.7729
   76.1269
   76.4748
```

Task 3)


Noise generated by a train (dBL) vs Speed (mph)
Noise generated by a train (dBL)
Speed (mph)
80
75
70
65
60
55
20
25
30
35
40
45
50
55
60
65