CEE 3804 Exam 2 Solution

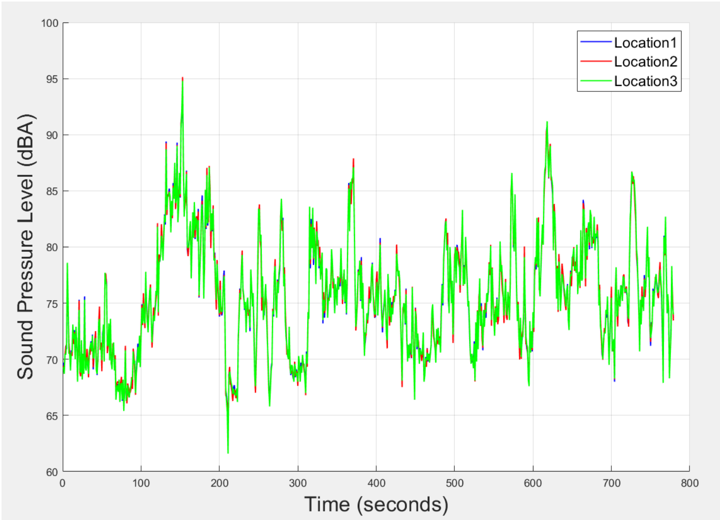
Problem 1

a)

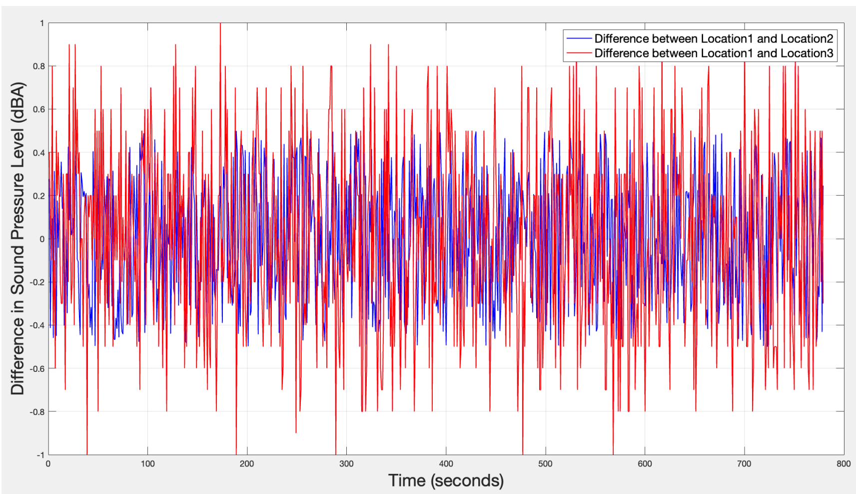
```
%% Problem 1 a)
warning('off')
% read the data for every sheet
Noisedata_location1=readtable('C:\CEE 3804\Exam 2\noiseData_Quiz2.xlsx','Sheet','Set1');
Noisedata_location2=readtable('C:\CEE 3804\Exam 2\noiseData_Quiz2.xlsx','Sheet','Set2');
Noisedata_location3=readtable('C:\CEE 3804\Exam 2\noiseData_Quiz2.xlsx','Sheet','Set3');
% Define variablename with units
Noisedata_location1.Properties.VariableNames = ["Time_sec","SPL_dBA"];
Noisedata_location2.Properties.VariableNames = ["Time_sec","SPL_dBA"];
Noisedata_location3.Properties.VariableNames = ["Time_sec","SPL_dBA"];
```

b)

```
%% Problem 1 b)

% Plot the data with color-coding
figure(1)
grid on
hold on
h1=plot(Noisedata_location1.Time_sec,Noisedata_location1.SPL_dBA);
h1.Color='b';
h1.LineWidth=1;

h2=plot(Noisedata_location2.Time_sec,Noisedata_location2.SPL_dBA);
h2.Color='r';
h2.LineWidth=1;

h3=plot(Noisedata_location3.Time_sec,Noisedata_location3.SPL_dBA);
h3.Color='g';
h3.LineWidth=1;

legend([h1 h2 h3],'Location1','Location2','Location3',FontSize=14)
xlabel('Time (seconds)',FontSize=20)
ylabel('Sound Pressure Level (dBA)',FontSize=20)
```



c)




```
%% Problem 1 c)
Difference_between_l1_l2=(Noisedata_location1.SPL_dBA-Noisedata_location2.SPL_dBA);
Difference_between_l1_l3=(Noisedata_location1.SPL_dBA-Noisedata_location3.SPL_dBA);

figure(2)
h4=plot(Noisedata_location1.Time_sec,Difference_between_l1_l2);
h4.Color='b';
h4.LineWidth=1;
hold on
grid on
h5=plot(Noisedata_location1.Time_sec,Difference_between_l1_l3);
h5.Color='r';
h5.LineWidth=1;
legend([h4 h5],'Difference between Location1 and Location2','Difference between Location1 and Location3',FontSize=14)
xlabel('Time (seconds)',FontSize=20)
ylabel('Sound Pressure Level (dBA)',FontSize=20)

Mean_Diff_l1_l2=mean(abs(Difference_between_l1_l2));
Mean_Diff_l1_l3=mean(abs(Difference_between_l1_l3));
disp(['The mean difference between Set1 and Set2 is ',num2str(Mean_Diff_l1_l2)])
disp(['The mean difference between Set1 and Set3 is ',num2str(Mean_Diff_l1_l3)])
```

The absolute mean difference between Set1 and Set2 is 0.26 dBA.

The absolute mean difference between Set1 and Set3 is 0.35 dBA.

d)

The number of times that SPL exceeded 65dBA in Set 1 is 778.

The number of times that SPL exceeded 65dBA in Set 2 is 778.

The number of times that SPL exceeded 65dBA in Set 3 is 778.

```
%% Problem 1 d)
Num_times_location1=length(find(Noisedata_location1.SPL_dBA>65));
Num_times_location2=length(find(Noisedata_location2.SPL_dBA>65));
Num_times_location3=length(find(Noisedata_location3.SPL_dBA>65));
disp(['The number of times that SPL exceeded 65dBA in Set 1 is ',num2str(Num_times_location1)])
disp(['The number of times that SPL exceeded 65dBA in Set 2 is ',num2str(Num_times_location2)])
disp(['The number of times that SPL exceeded 65dBA in Set 3 is ',num2str(Num_times_location3)])
```

e)

The value of L_{eq} in Set 1 is 79.0183.

The value of L_{eq} in Set 2 is 79.0407.

The value of L_{eq} in Set 3 is 79.0365.

```
%% Problem 1 e)
locaton1_Leq=10*log10(sum(10.^(Noisedata_location1.SPL_dBA/10))/length(Noisedata_location1.Time_sec));
locaton2_Leq=10*log10(sum(10.^(Noisedata_location2.SPL_dBA/10))/length(Noisedata_location2.Time_sec));
locaton3_Leq=10*log10(sum(10.^(Noisedata_location3.SPL_dBA/10))/length(Noisedata_location3.Time_sec));

disp(['The value of L_eq in Set 1 is ',num2str(locaton1_Leq)])
disp(['The value of L_eq in Set 2 is ',num2str(locaton2_Leq)])
disp(['The value of L_eq in Set 3 is ',num2str(locaton3_Leq)])
```

f) The plot in part b shows three approximately overlapping data trends, indicating similar SPL values. In part c, the plot and calculation shows that the difference between Set1 and Set2 is less than that between Set1 and Set3. In part e, the equivalent noise levels for each dataset are nearly the same. So, the three datasets are very similar with minor differences.

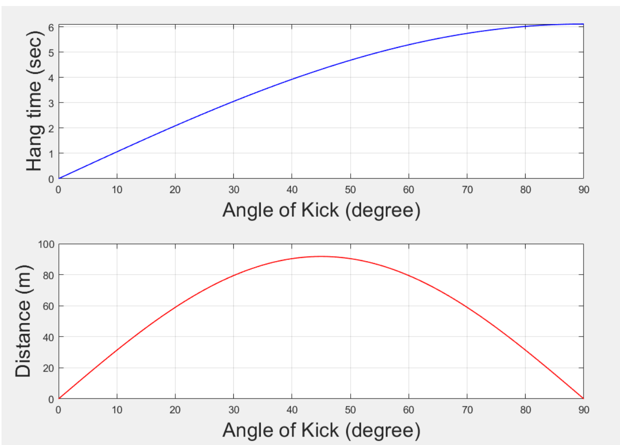
Problem 2

a)

```
function [hangtime, Distance]=Kicker(initialspeed_m_s,angleofkick_degree)
% Estimates the hang time and the distance traveled by the ball
% Uses simple equations learned in Physics
g=9.81; % acceleration of gravity (m/s-s)
vx0=initialspeed_m_s*cos(angleofkick_degree*pi/180); % initial horizontal velocity (m/s)
vy0=initialspeed_m_s*sin(angleofkick_degree*pi/180); % initial vertical velocity (m/s)
hangtime=2*vy0/g;
Distance=hangtime.*vx0;
end
```

b) and c)

```
%% Problem 1 b) and c)
angleofkick_degree=0:1:90;
initialspeed_m_s=30;
[hangtime, Distance]=Kicker(initialspeed_m_s,angleofkick_degree);

figure(1)

subplot(2,1,1)

h1=plot(angleofkick_degree,hangtime);
grid on
h1.Color='b';
h1.LineWidth=1;
xlabel('Angle of Kick (degree)',FontSize=20)
ylabel('Hang time (sec)',FontSize=20)

subplot(2,1,2)

h2=plot(angleofkick_degree,Distance);
grid on
h2.Color='r';
h2.LineWidth=1;
xlabel('Angle of Kick (degree)',FontSize=20)
ylabel('Distance (m)',FontSize=20)
```



d) The code in MATLAB is vectorized to generate the output.

In VBA, we used a loop to do the same thing.

The calculation speed in MATLAB is faster compared to VBA using vector operations.

Problem 3

a)

Z-156*x1-185x2=0

4.1*x1+x2+x3=10200

-1.3*x1+x2+x4=1500

3.5*x1+x2+x5=9200

x1+x6=2000

x1, x2, x3, x4, x5, x6 >=0

b)

	A	B	C	D	E	F	G	H	I	J
1	BV	Z	X1	X2	X3	X4	X5	X6	RHS	Row Operations
2	Z	1	-156	-185					0	
3	X3		4.1	1	1				10200	
4	X4		-1.3	1		1			1500	
5	X5		3.5	1			1		9200	
6	X6		1					1	2000	
7										
8	BV	Z	X1	X2	X3	X4	X5	X6	RHS	
9	Z	1	-396.5	0		185			277500	Row Z+185*pivot row
10	X3		5.4	0	1	-1			8700	Row X3-pivot row
11	X2		-1.3	1		1			1500	pivot row
12	X5		4.8	0		-1	1		7700	Row X5-pivot row
13	X6		1					1	2000	
14										
15	BV	Z	X1	X2	X3	X4	X5	X6	RHS	
16	Z	1	0	0		102.3958	82.60417		913552.2	Row Z+396.5*pivot row
17	X3		0	0	1	0.125	-1.125		37.4982	Row X3-5.4*pivot row
18	X2		0	1		0.729167	0.270833		3585.417	Row X2+1.3*pivot row
19	X1		1	0		-0.20833	0.208333		1604.167	pivot row/4.8
20	X6		0			0.208333	-0.20833	1	395.833	Row X6-pivot row

First tableau: BV: X3 X4 X5 X6 NBV: X1 =0 , X2 =0

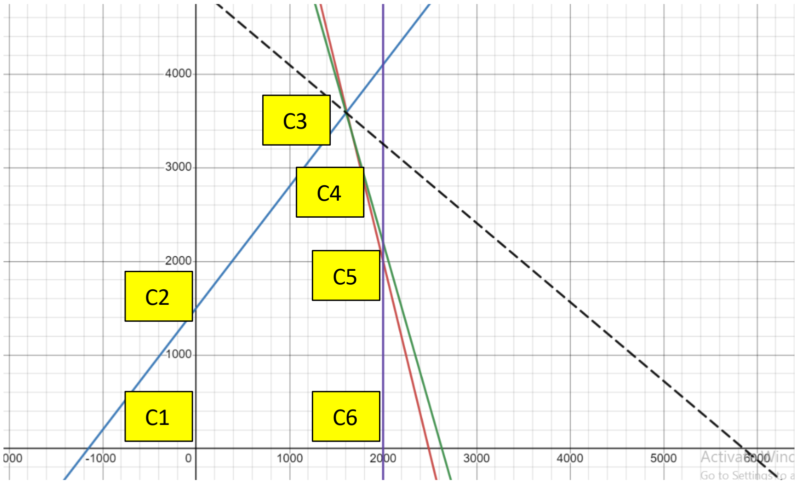
Second tableau: X4 leaves the BV set. New Basic Variable is X2

Third tableau: X5 leaves BV New BV: X1

c)

Optimization Problem			
Decision Variables			
x1		1604.167	steel doubler
x2		3585.417	titanium doubler
Objective Function			
156* x1 + 185* x2		913552.0833	
Constraint Equations			
	Formula		
4.1* x1 + x2 < = 10200		10162.500 <=	10200
(-1.3)* x1 + x2 < = 1500		1500.000 <=	1500
3.5*x1 + x2 <= 9200		9200.000 <=	9200
x1 <= 2000		1604.167 <=	2000

d) Graphical solution to the LP problem.



Corner Point	x1	x2	Z
C1	0	0	0
C2	0	1500	277500
C3	1604.17	3585.42	913552.08
C4	1666.67	3366.67	882833.45
C5	2000	2000	682000
C6	2000	0	312000