

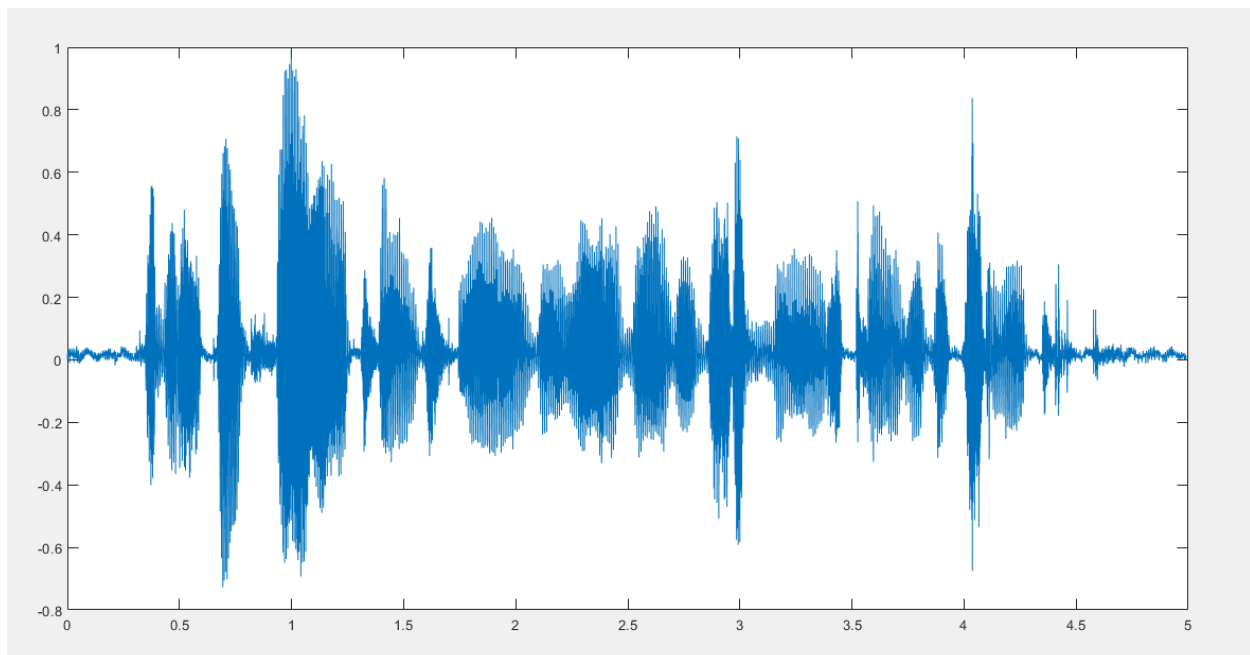
Machine Learning

Problem 1:

Matlab code:

Part a

```
clear; clc; close all;  
[x,sr]=audioread('D:\AsamMahmood\New Folder\dft.wav');  
%[x,sr]=audioread('sa1.wav');  
td=1/sr;  
%soundsc(x,sr)  
lx=length(x);  
t=[0:lx-1]*td;  
figure  
plot(t,x)
```



Part b

```
%[x, sr]=frame2im(x, 125, 0.9, sr);  
nof=size(x,2);  
lof=size(x,1);  
nfft_fr=2^11;  
fxm=fft(x,nfft_fr);  
  
afxm=abs(fxm(1:nfft_fr/2,:));
```

```
r=zeros(M,M);
dy=M/sr*1e3; %duration (ms) of a frame with M samples
V=zeros(M,M,nof);
D=zeros(M,nof);
VV=V;
Dv=D;
```

[illegible]

Part f

```
[v d]=eig(V);
```

```
V(:, :, k)=v;
```

```
RV=vym;
```

vym ✕				
110033x1 double				
	1	2	3	
1	0			
2	0			
3	0			
4	0			
5	0			
6	3.0518e-05			
7	-3.0518e-05			
8	6.1035e-05			
9	-9.1553e-05			
10	1.2207e-04			
11	-1.2207e-04			
12	1.2207e-04			
13	-1.2207e-04			
14	3.0518e-05			
15	9.1553e-05			
16	-4.8828e-04			
17	0.0082			
18	0.0144			
19	0.0138			
20	0.0151			

Part g

```
lambda=diag(d);
```

```
D(:,k)=lambda;
```

We take the inverse transform of the vym do that we can generate the ym and we add some weights to the as the eigon vectors to ym we get the same result because the inverse of the identity matrix is also a identity matrix.

[illegible]

Part h

```
vym=y;  
rv=vym; %acf estimate /nofy
```

[illegible]

Part i

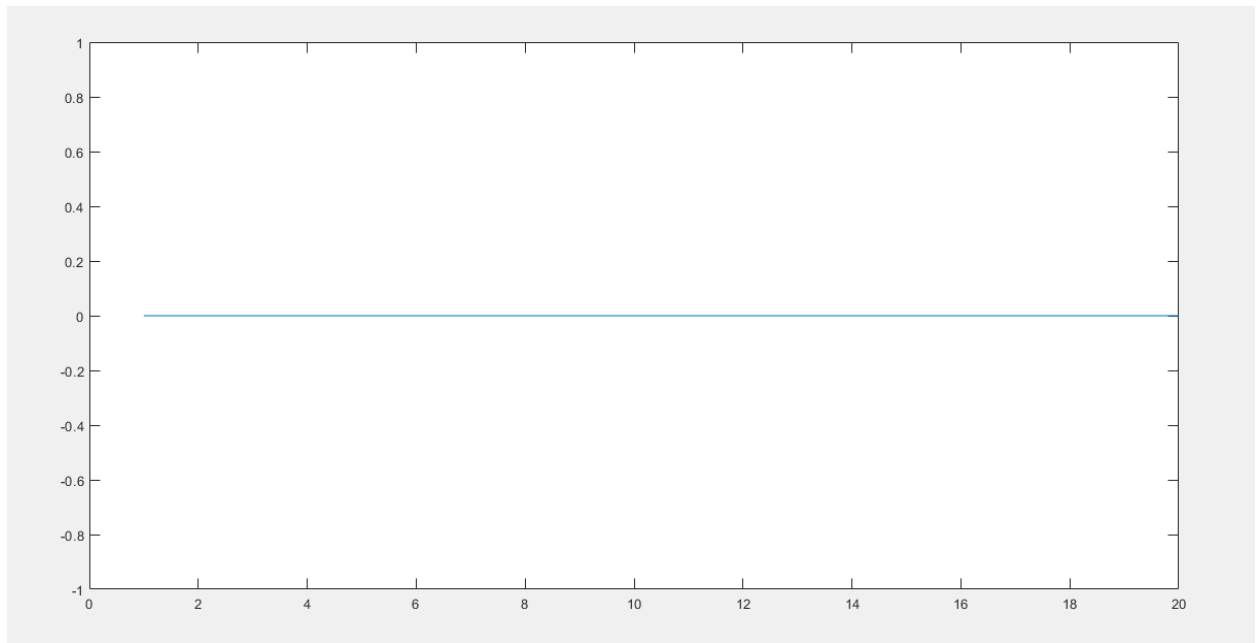
```
[vv dv]=eig(VV);
Vv(:, :, k)=vv;
```

	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0	0	0	0	0	0	0
3	0	0	1	0	0	0	0	0	0	0	0	0	0
4	0	0	0	1	0	0	0	0	0	0	0	0	0
5	0	0	0	0	1	0	0	0	0	0	0	0	0
6	0	0	0	0	0	1	0	0	0	0	0	0	0
7	0	0	0	0	0	0	1	0	0	0	0	0	0
8	0	0	0	0	0	0	0	1	0	0	0	0	0
9	0	0	0	0	0	0	0	0	1	0	0	0	0
10	0	0	0	0	0	0	0	0	0	1	0	0	0
11	0	0	0	0	0	0	0	0	0	0	1	0	0
12	0	0	0	0	0	0	0	0	0	0	0	1	0
13	0	0	0	0	0	0	0	0	0	0	0	0	1
14	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0

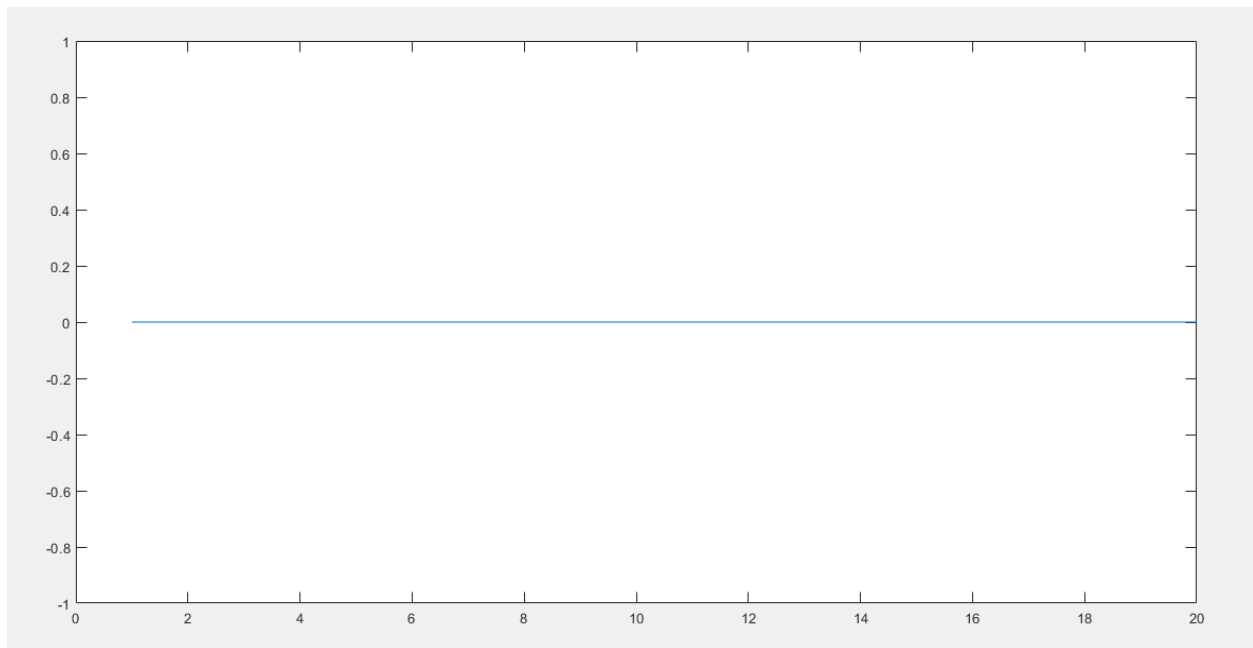
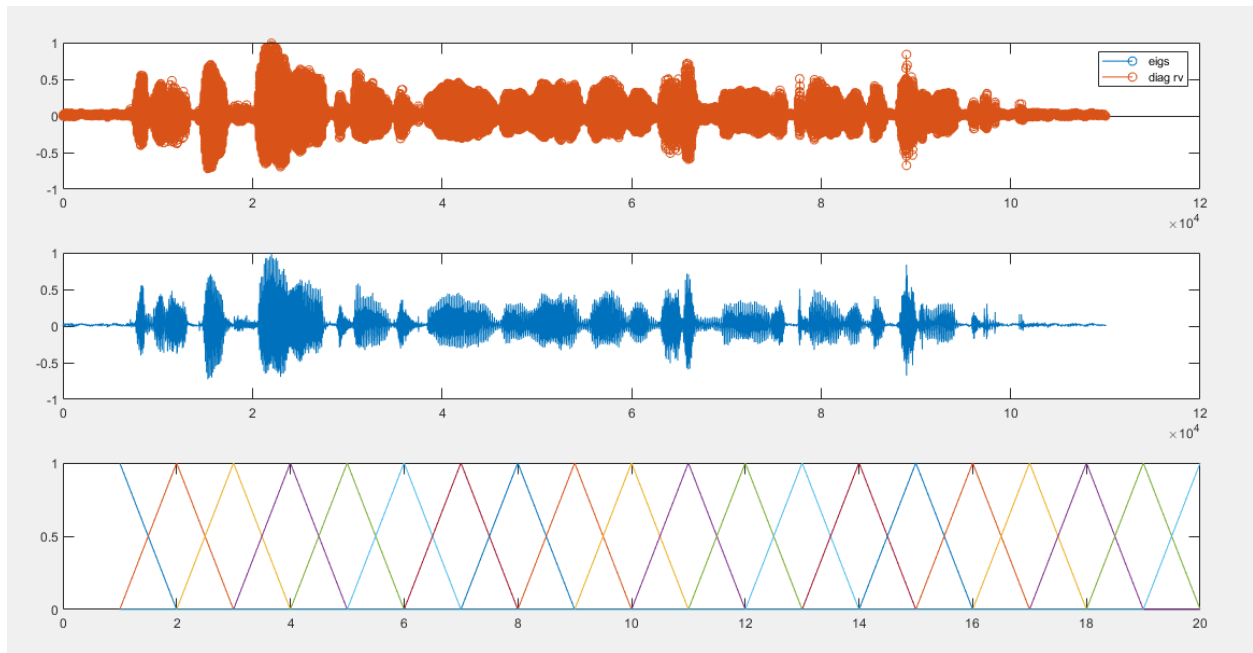
Part j

```
lambdav=v;
subplot(311),stem(lambda), hold, pause(0.3), stem((rv)), legend('eigs','diag
rv'), hold off
subplot(312), plot(y)
subplot(313), plot(v)

end
figure
plot(D)
```



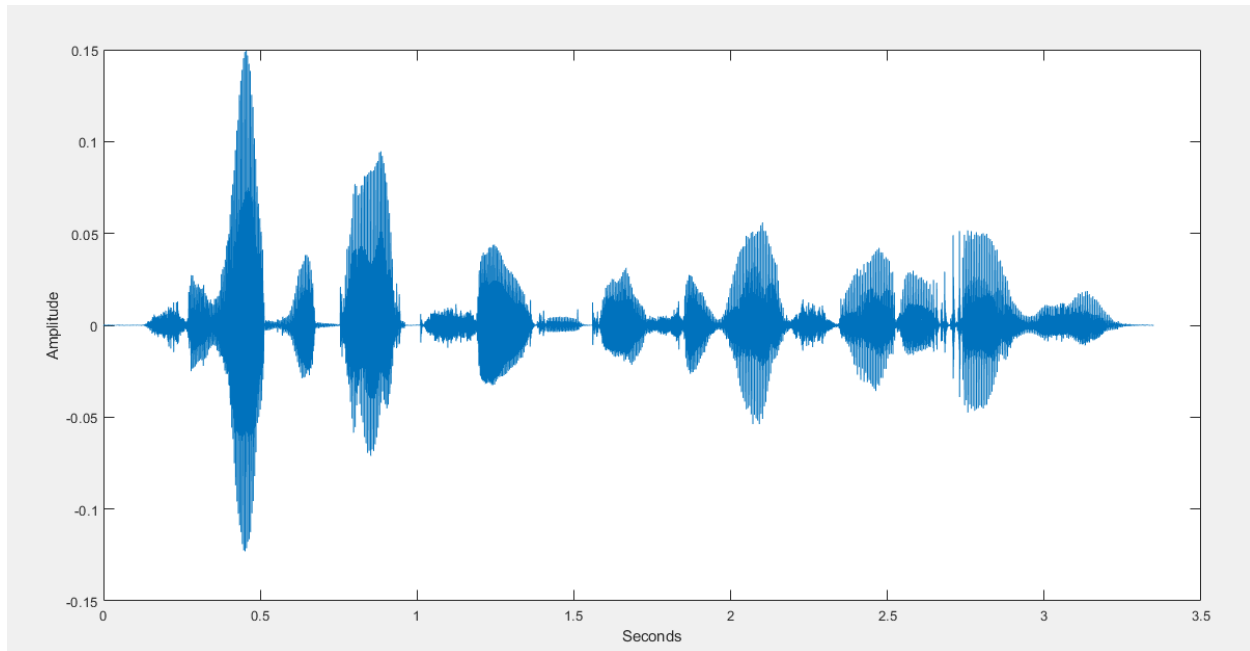
Part k



Part I

i. Matlab code

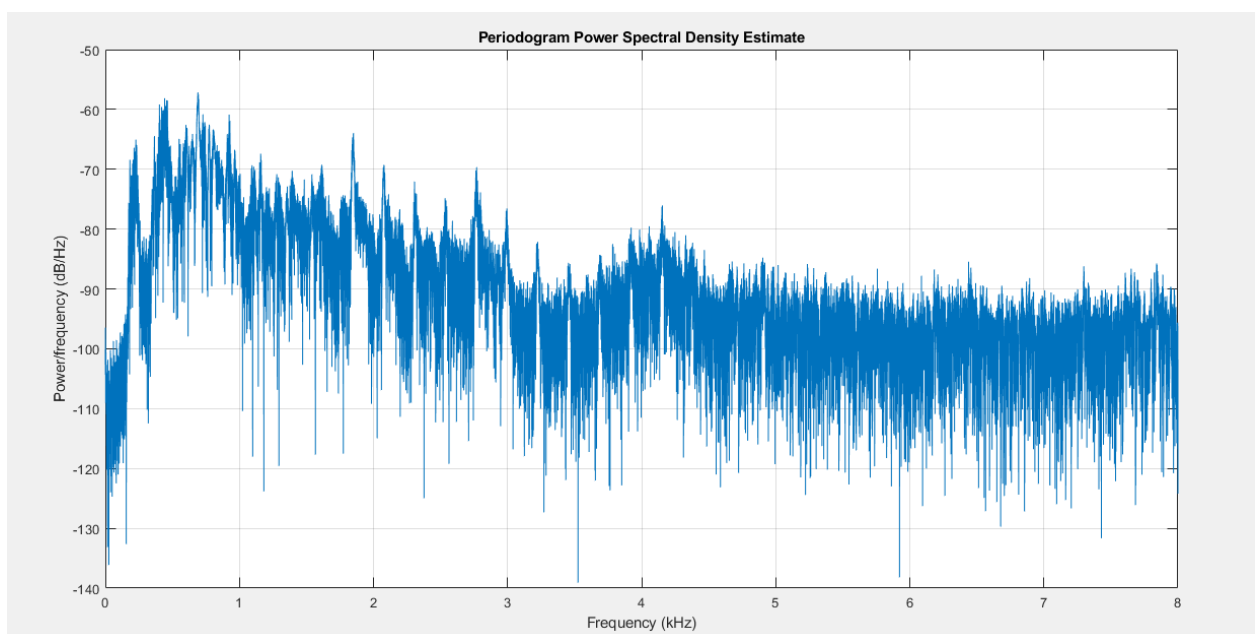

```
[y,fs]=audioread('D:\AsamMahmood\New Folder\s1.wav');
y = y(:,1);
dt = 1/fs;
t = 0:dt:(length(y)*dt)-dt;
plot(t,y); xlabel('Seconds'); ylabel('Amplitude');
```



ii. Matlab Code

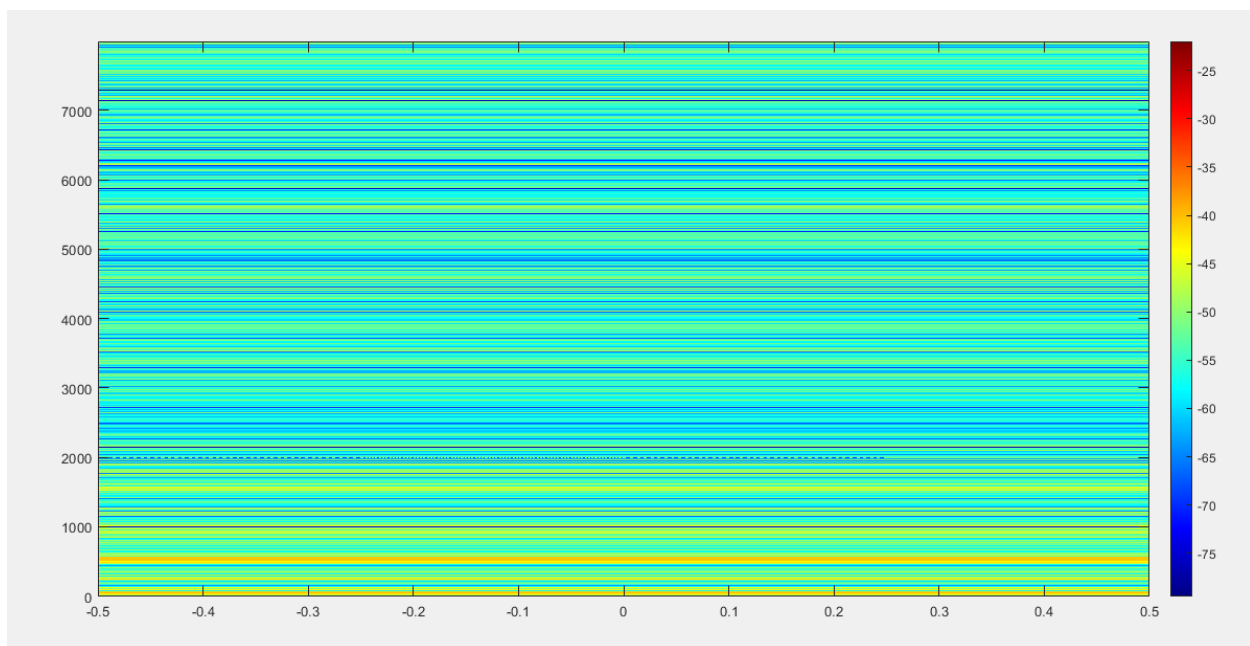
figure

```
plot(psd(spectrum.periodogram,y,'Fs',fs,'NFFT',length(y)));
```



iii. Matlab code

```
nof=size(y,2);  
lof=size(y,1);  
nfft_fr=2^11;  
fxm=fft(y,nfft_fr);  
  
afxm=abs(fxm(1:nfft_fr/2,:));  
t_fr=[0:nof-1]*sr;  
f=[0:nfft_fr/2-1]/nfft_fr*sr;  
figure  
imagesc(t_fr,f,20*log10(afxm)), axis xy, colormap(jet), colorbar
```



iv. Matlab code

```
M=20; %no of lags acf  
r=zeros(M,M);  
dy=M/sr*1e3; %duration (ms) of a frame with M samples  
V=zeros(M,M,nof);  
D=zeros(M,nof);  
VV=V;  
Dv=D;
```