DSP LAB ASSIGNMENT-3

CODE:

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clear;
Fs=3400; %%sampling frequency
Ts=1/Fs;
N=17000; %%signal length
A=10; %%Amplitude of the signal
freq=-(1*Fs)/2:Fs/N:(N-1)*Fs/(2*N); %%sampling frequency
%%
t=0:Ts:(N-1)*Ts; %%sampling the time till (N-1)*Ts=5sec
x=A*cos(2*pi*697*t)+A*cos(2*pi*1633*t); %%siganl:X(t)
y=fft(x); %%fft of the signal
y=fftshift(y); %%fftshift of the signal
%% For the frequency component:697Hz
h1 = zeros(1,N);
for i=1:N
h1(i)= (8/A)*cos(2*pi*Ts*697*(i-1)); %%defining the impulse response
end
hd1=conv(x,h1,'same'); %%convolving the impulse response with the main signal
y1=fft(hd1);
y1=fftshift(y1);
%% For the frequency component:770Hz
h2 = zeros(1,N);
for i=1:N
h2(i)= (8/A)*cos(2*pi*Ts*770*(i-1));
end
hd2=conv(x,h2,'same');
y2=fft(hd2);
y2=fftshift(y2);
%% For the frequency component:852Hz
h3 = zeros(1,N);
for i=1:N
h3(i)= (8/A)*cos(2*pi*Ts*852*(i-1));
end
hd3=conv(x,h3,'same');
y3=fft(hd3);
y3=fftshift(y3);
%% For the frequency component:941Hz
h4 = zeros(1,N);
for i=1:N
h4(i)= (8/A)*cos(2*pi*Ts*941*(i-1));
end
hd4=conv(x,h4,'same');
y4=fft(hd4);
y4=fftshift(y4);
%% For the frequency component:1209Hz
h5 = zeros(1,N);
for i=1:N
h5(i)= (8/A)*cos(2*pi*Ts*1209*(i-1));
end
hd5=conv(x,h5,'same');
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y5=fft(hd5);
y5=fftshift(y5);
%% For the frequency component:1336Hz
h6 = zeros(1,N);
for i=1:N
h6(i)= (8/A)*cos(2*pi*Ts*1336*(i-1));
end
hd6=conv(x,h6,'same');
y6=fft(hd6);
y6=fftshift(y6);
%% For the frequency component:1477Hz
h7 = zeros(1,N);
for i=1:N
h7(i)= (8/A)*cos(2*pi*Ts*1477*(i-1));
end
hd7=conv(x,h7,'same');
y7=fft(hd7);
y7=fftshift(y7);
%% For the frequency component:1633Hz
h8 = zeros(1,N);
for i=1:N
h8(i)= (8/A)*cos(2*pi*Ts*1633*(i-1));
end
hd8=conv(x,h8,'same');
y8=fft(hd8);
y8=fftshift(y8);
%% Plotting the signals:
figure(1)
stem(t(1:40),x(1:40)); %%considering the only first 20 points of the signal
xlabel('time in sec');
ylabel('Amplitude');
title('Signal:');
%% FFT of all the output functions:
figure(2)
subplot(331)
plot(freq,abs(y)/N);
xlabel('F in Hz');
ylabel('|X(f)|');
title('FFT of the signal:');
subplot(332)
plot(freq,abs(y1)/(N*N));
xlabel('F in Hz');
ylabel('|X(f)|');
title('Frequency component:697Hz');
subplot(333)
plot(freq,abs(y2)/(N*N));
xlabel('F in Hz');
ylabel('|X(f)|');
title('Frequency component:770Hz');
subplot(334)
plot(freq,abs(y3)/(N*N));
xlabel('F in Hz');
ylabel('|X(f)|');
title('Frequency component:852Hz');
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subplot(335)
plot(freq,abs(y4)/(N*N));
xlabel('F in Hz');
ylabel('|X(f)|');
title('Frequency component:941Hz');
subplot(336)
plot(freq,abs(y5)/(N*N));
xlabel('F in Hz');
ylabel('|X(f)|');
title('Frequency component:1209Hz');
subplot(337)
plot(freq,abs(y6)/(N*N));
xlabel('F in Hz');
ylabel('|X(f)|');
title('Frequency component:1336Hz');
subplot(338)
plot(freq,abs(y7)/(N*N));
xlabel('F in Hz');
ylabel('|X(f)|');
title('Frequency component:1477Hz');
subplot(339)
plot(freq,abs(y8)/(N*N));
xlabel('F in Hz');
ylabel('|X(f)|');
title('Frequency component:1633Hz');
%% Display Part
di=['1' '2' '3' 'A' ; '4' '5' '6' 'B' ; '7' '8' '9' 'C' ; '*' '0' '#' 'D']; %%defining the matrix
z1=abs(y1)/(N*N);
z2=abs(y2)/(N*N);
z3=abs(y3)/(N*N);
z4=abs(y4)/(N*N);
z5=abs(y5)/(N*N);
z6=abs(y6)/(N*N);
z7=abs(y7)/(N*N);
z8=abs(y8)/(N*N);
%% Assigning the corresponding values for row number(r) and coulmn number(c) for the given signal
for i=1:length(z1) %%iterate over fft of Y1 and ensure if it has that particular frequency component
if(z1(i)>=1)
r=1;
continue;
end
end
for i=1:length(z2)
if(z2(i)>=1)
r=2;
continue;
end
end
for i=1:length(z3)
if(z3(i)>=1)
r=3;
continue;
end
end
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```
for i=1:length(z4)
if(z4(i)>=1)
r=4;
continue;
end
end
for i=1:length(z5)
if(z5(i)>=1)
c=1;
continue;
end
end
for i=1:length(z6)
if(z6(i)>=1)
c=2;
continue;
end
end
for i=1:length(z7)
if(z7(i)>=1)
c=3;
continue;
end
end
for i=1:length(z8)
if(z8(i)>=1)
c=4;
continue;
end
end
disp("The dialled number is:");
disp(di(r,c)); %%Display at the output
```

RESULTS :-

Output at the command terminal :

The dialled number is:

A

Figure 1 :-

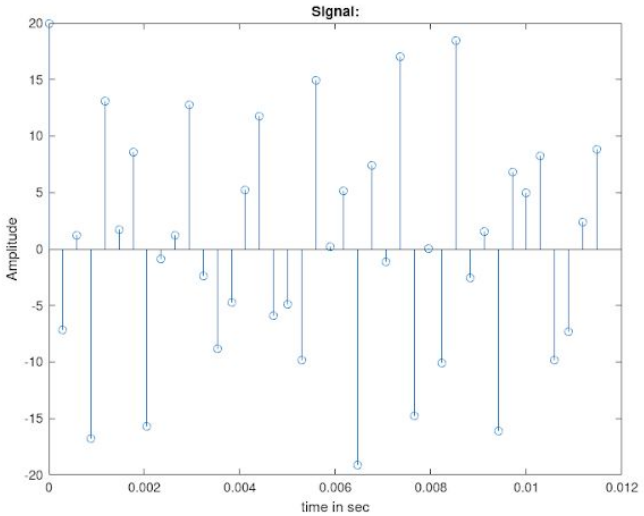
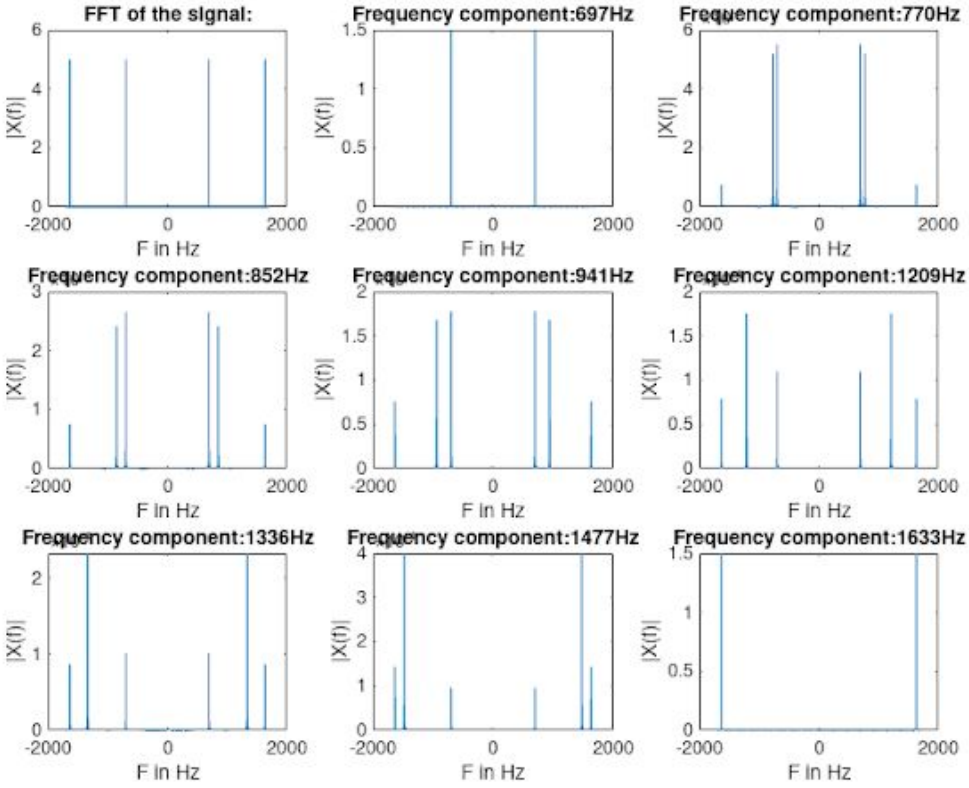


Figure 2 :-


FFT of the signal:
Frequency component:697Hz
Frequency component:770Hz
Frequency component:852Hz
Frequency component:941Hz
Frequency component:1209Hz
Frequency component:1336Hz
Frequency component:1477Hz
Frequency component:1633Hz
|X(f)|
F in Hz