DSP LAB TEST 3 report:

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Experiment 6

Part 1: DFT and IDFT Functions

Aim: to write the functions DFTsum and IDFTsum that calculate the DFT and IDFT of the signal and its frequency response respectively

Matlab code: `N=10;`

```
n=0:1:N-1;
x1=ones(N);
tic;X1=DFTsum(x1);sumtime=toc;
x2=exp(-((n-5).^2)/4);
X2=DFTsum(x2);
figure;
stem(n,abs(X1));
title("DFTsum of given constant signal");
xlabel('ω');
ylabel('|X(e^{jω})|');
figure;
stem(n,abs(X2));
title("DFTsum of given exponential signal");
xlabel('ω');
ylabel('|X(e^{jω})|');
IX1=IDFTsum(X1);
IX2=IDFTsum(X2);
figure;
subplot(1,2,1);
stem(n,x1);
title("given constant signal");
xlabel('n');
ylabel('x1');
subplot(1,2,2);
stem(n,abs(IX1));
title("IDFTsum of DFTsum of given constant signal");
xlabel('n');
ylabel('IX1');

figure;
subplot(1,2,1);
stem(n,x2);
title("given exponential signal");
xlabel('n');
ylabel('x2');
subplot(1,2,2);
stem(n,abs(IX2));
title("IDFTsum of DFTsum of given exponential signal");
xlabel('n');
ylabel('IX2');
```

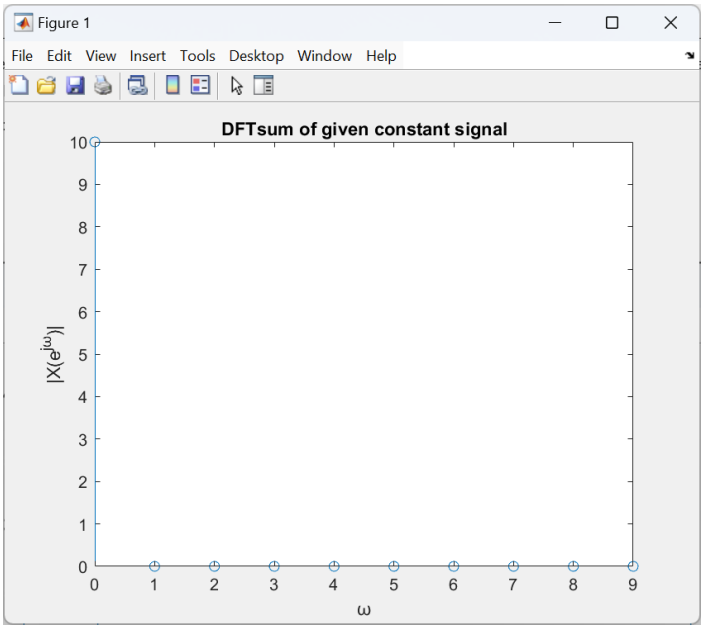


Figure 1
File Edit View Insert Tools Desktop Window Help
DFTsum of given constant signal
|X(e^jω)|
ω

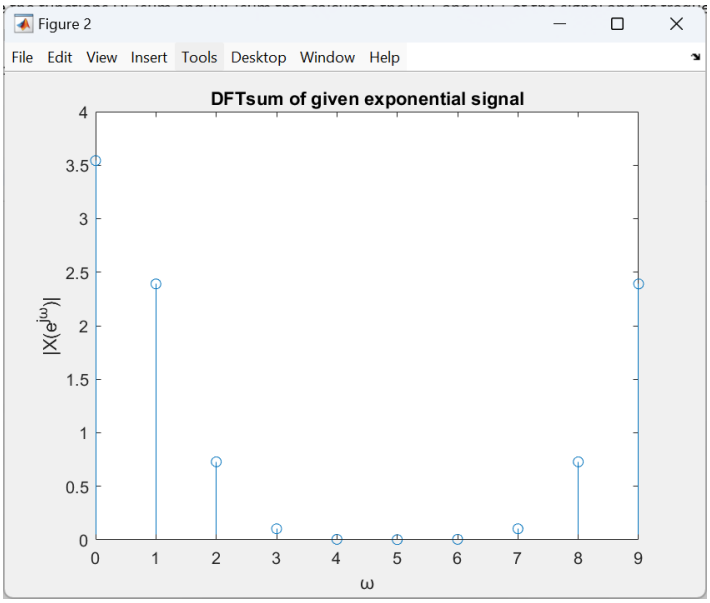


Figure 2
File Edit View Insert Tools Desktop Window Help
DFTsum of given exponential signal
|X(e^jω)|
ω

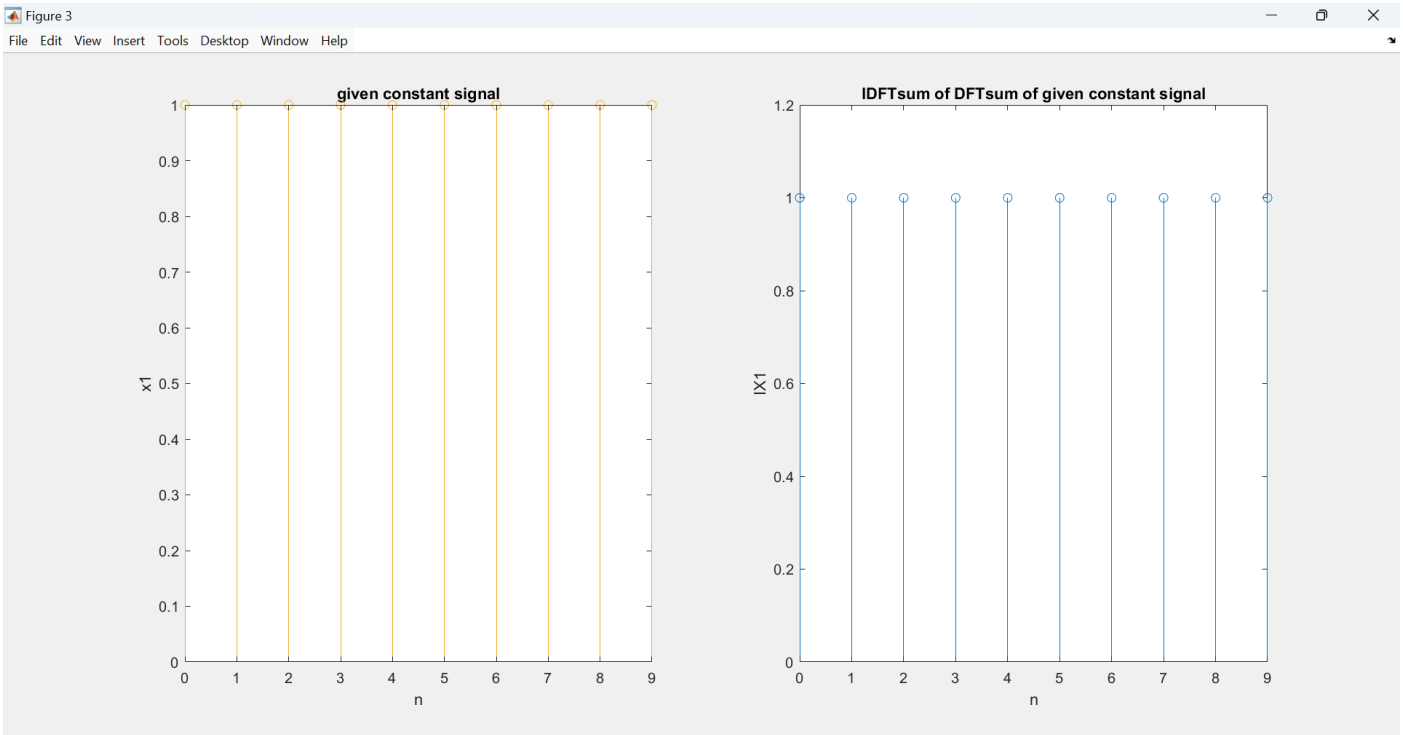
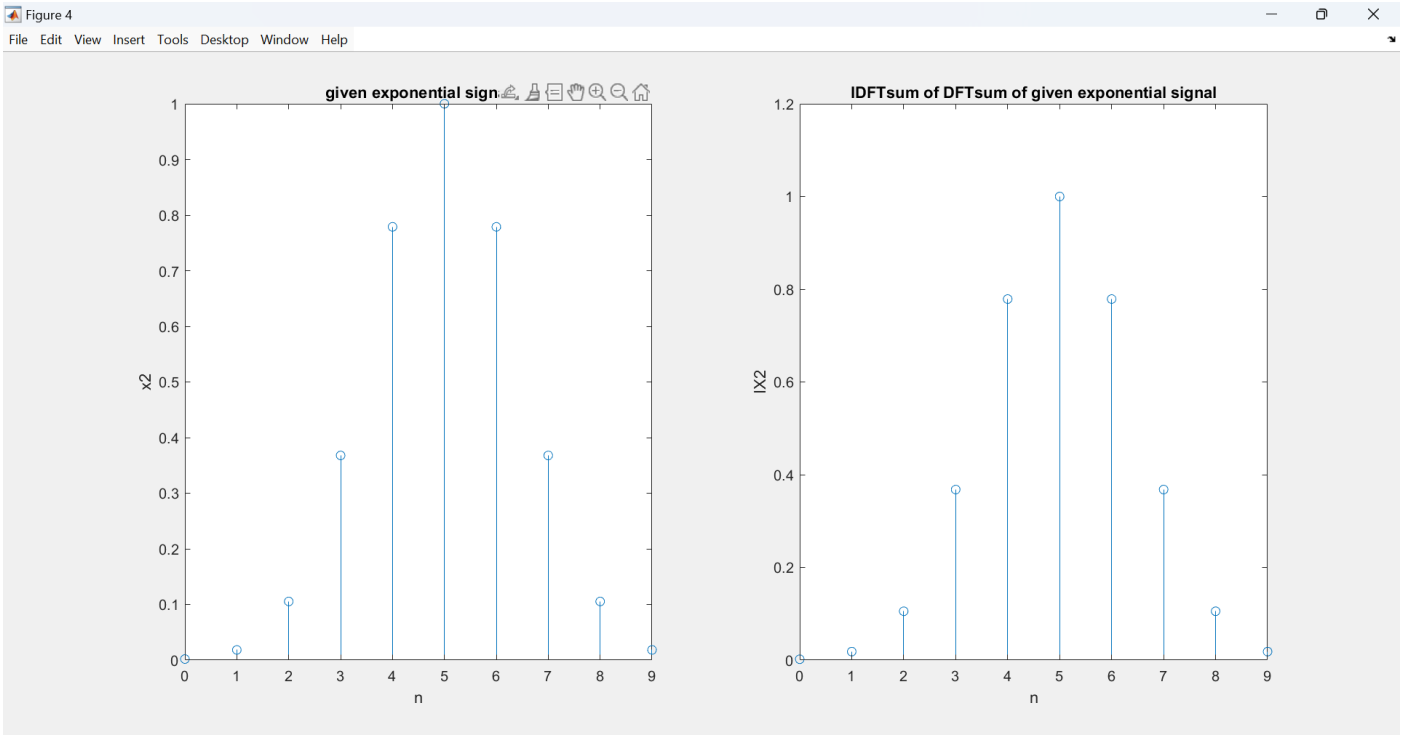


Figure 3
File Edit View Insert Tools Desktop Window Help
given constant signal
x1
n
IDFTsum of DFTsum of given constant signal
|X1
n



Observation:

We can see that the IDFTsum of the DFTsum gives us back the original signal just like we wanted.

Part 2: DFT Matrix Function and Signal Computation

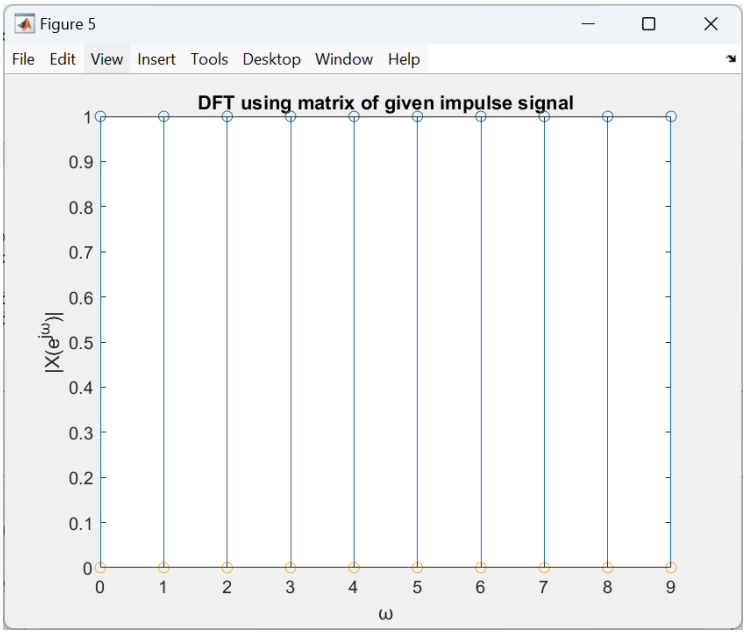
Aim: to write the function DFTmatrix and compare the computation time for the two different methods

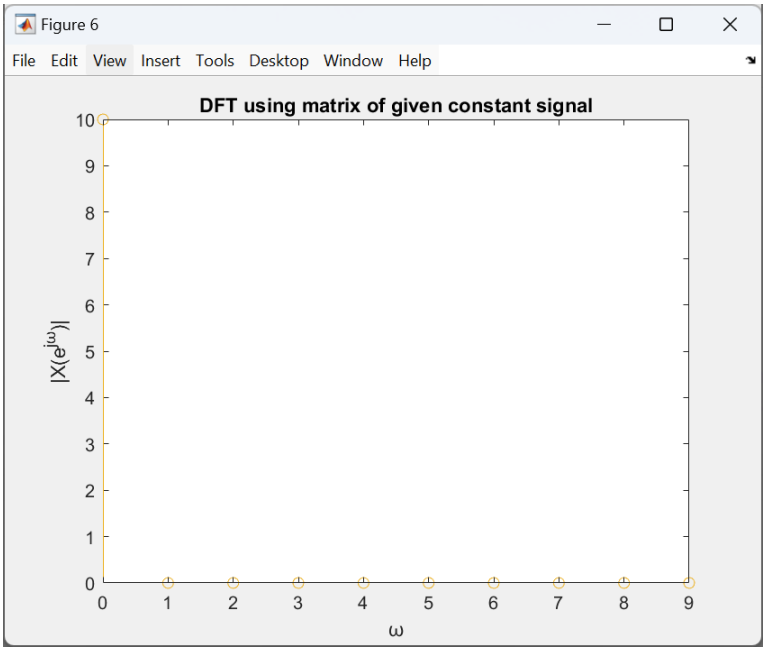
Matlab code:

```
x3=zeros(N);
x4=ones(N);
x3(1)=1;
A=DFTmatrix(N);
X3=A * x3;
tic;
X4=A*x4;
matime=toc;
figure;
stem(n,abs(X3));
title("DFT using matrix of given impulse signal");
xlabel('ω');
ylabel('|X(e^{jω})|');
figure;
stem(n,abs(X4));
title("DFT using matrix of given constant signal");
xlabel('ω');
ylabel('|X(e^{jω})|');
fprintf('Time taken by DFTsum for contant signal: %f seconds\n', sumtime);
fprintf('Time taken by Matrix-multiplicationfor constant signal: %f seconds\n', matime);
n5=0:1:511;
A5=DFTmatrix(512);
x5=zeros(512,1);
for n = 1:512
    x5(n,1)=cos((pi/5)*n);
end
x6=cos(((pi/5).*n5));
tic;
X5=A5 *x5;
matime2=toc;
tic;
```

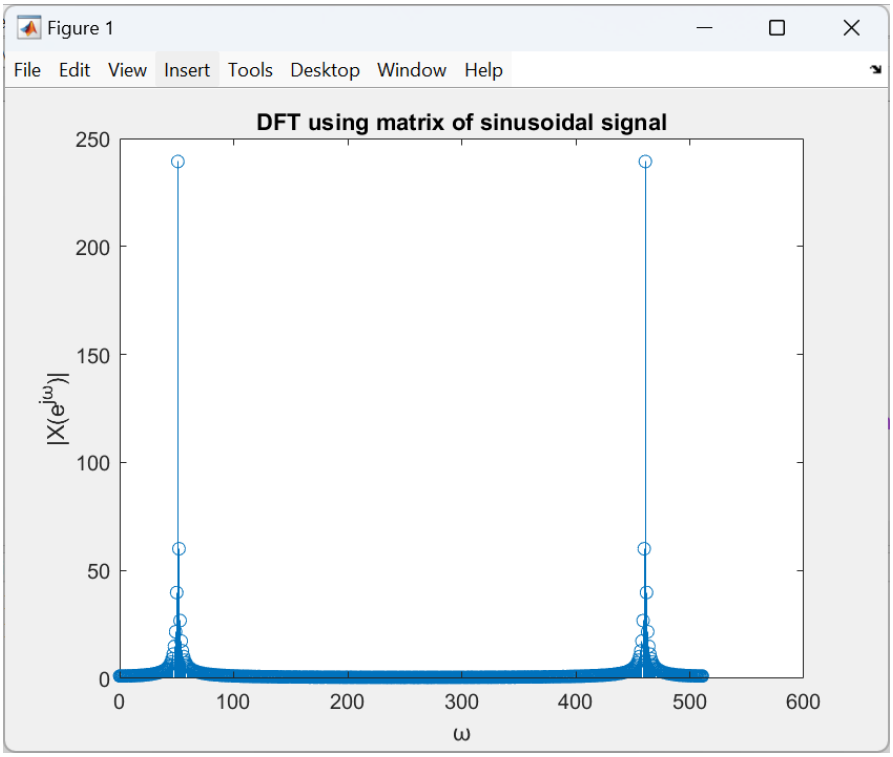
```
X6=DFTsum(x6);
sumtime2=toc;

fprintf('Time taken by DFTsum: %f seconds\n', sumtime2);
fprintf('Time taken by Matrix-multiplication: %f seconds\n', matime2);
```






```
Command Window
  Time taken by DFTsum for contant signal: 0.000170 seconds
  Time taken by Matrix-multiplicationfor constant signal: 0.000033 seconds
fx >>
```




```
Command Window
  Time taken by DFTsum: 0.025900 seconds
  Time taken by Matrix-multiplication: 0.000477 seconds
fx >>
```

Here w can see that the results are the same for both DFTmatrix and DFTsum methods but the time taken is different

Matrix method takes much lesser time buit it also takes a lot of space