DIGITAL SIGNAL PROCESSING

TASK 3

Submitted by:

Anupam Kshetri
33471

Submitted to:

Prof. Vivien Glönkler

TASK 2

The task was done to calculate the **Discrete Fourier Transform (DFT)** of the input signal using the sum of two discrete, periodic signals as the input signal for the DFT.

QUESTIONS

I work part time in a RIGGS Kitchen. There are big chimneys in this restaurant. These chimneys are cleaned regularly, however the times they are cleaned varies depending upon the schedule. On a free day, it is cleaned less as compared.

Calculate Discrete Fourier Transform (DFT) of the input signal with given conditions:
1. Use sampling frequency (fs) 150.
2. Calculate the DFT using the FFT function and all the requitred parts such as the imaginary, real part and magnitude.
3. Plot all the signals including imaginary part, real part , phase, magnitude and the windowed output.

✧ **SUBTASK**
You can do simple task such as building subplots using DFT functions to know how to create the whole program.

HINTS

1. The input signals are:
    a) x1 = |sin(2pi * (fb/fs) * n)|
    b) x2 = |cos(2pi * (fss/fs) * n)|
2. The maximum amount of wast collected on a busy day is 4 kg and on a free day is 2 kg.

SAMPLE CODE

```
%%PORTFOLIO 3
%Calculation of the Discrete Fourier Transform (DFT)

clear;
fs = 150; %sampling frequency
ts = 1 / fs  ; %sampling time

fb = 2 ;
fss = 0.5 ;

n  = 0 : (fs-1);
f  = 0 : 1 : (fs-1);

x1 = abs( 4 * sin(2*pi * (fb/fs) * n));
x2 = abs( 2 * cos(2*pi * (fss/fs) * n));

y  = x1 + x2;

%% First Window
DFT = fft(y); %discrete fourior transformation
m1 = abs(DFT); %magnitude of DFTed signal
p1 = angle(DFT); % phase of DFTed signal
r1 = real(DFT); %real part
i1 = imag(DFT);
%% Second Window
w1 = blackman(fs)'; % Black window
y2 = y.* w1;
%% Input signals
figure();
subplot(2,2,1);
plot(n,x1, 'r');
grid('minor');
grid on;
title('Change in the weight of waste collected On busy
days');
xlabel('Number of days (samples)');
ylabel('Weight');
axis([0, fs, 0, 5]);

subplot(2,2,2);
plot(n, x2, 'b');
grid('minor');
grid on;
title('Change in the weight of waste collected On free
days');
xlabel('Number of days (samples)');
```

```
ylabel('Weight');
axis([0, fs, 0, 5]);

subplot(2,1,2);
plot(n, abs(y), 'k');
grid('minor');
grid on;
title('Superimposed signal');
xlabel('Number of days (samples)');
ylabel('Weight');
axis([0, fs, 0, 8]);
%% No window Calculation
figure();
subplot(2,2,1);
plot(f, m1, 'b');
grid on;
xlabel('frequency');
ylabel('magnitude');

subplot(2,2,2);
plot(f, p1*180/pi, 'r');
grid on;
xlabel('frequency');
ylabel('Phase');

subplot(2,2,3);
plot(f, r1, 'g');
grid on;
xlabel('frequency');
ylabel('real');

subplot(2,2,4);
plot(f, i1, 'm');
grid on;
xlabel('frequency');
ylabel('imaginary');
%% Triangular window calculations
figure();
subplot(2,1,1)
plot(n, DFT, 'r');
grid on;
xlabel("Sample");
ylabel("Frequency");
title('Non Windowed');
axis([0, fs, 0, 10]);
subplot(2,1,2)
plot(n, y2, 'r');
grid on;
title('Blackman Windowed signal');
axis([0, fs, 0, 10]);
```

GRAPHS

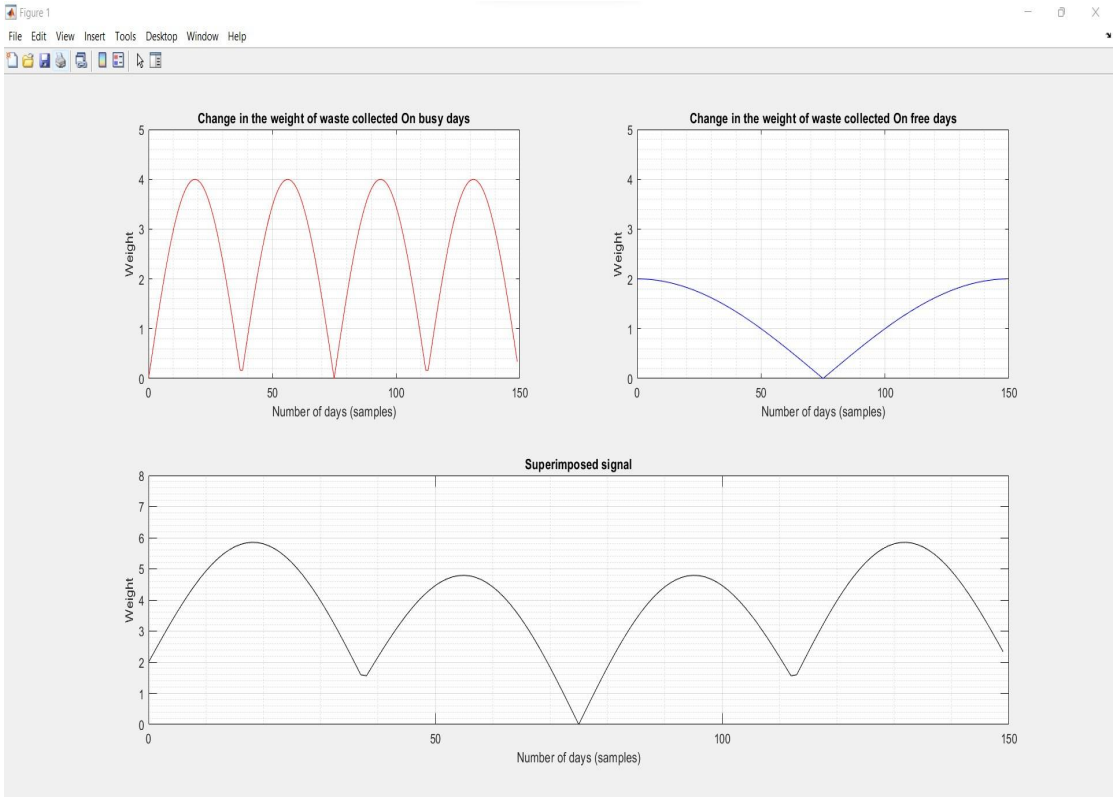


Figure 1
File Edit View Insert Tools Desktop Window Help
Change in the weight of waste collected On busy days
Weight
Number of days (samples)
Change in the weight of waste collected On free days
Weight
Number of days (samples)
Superimposed signal
Weight
Number of days (samples)

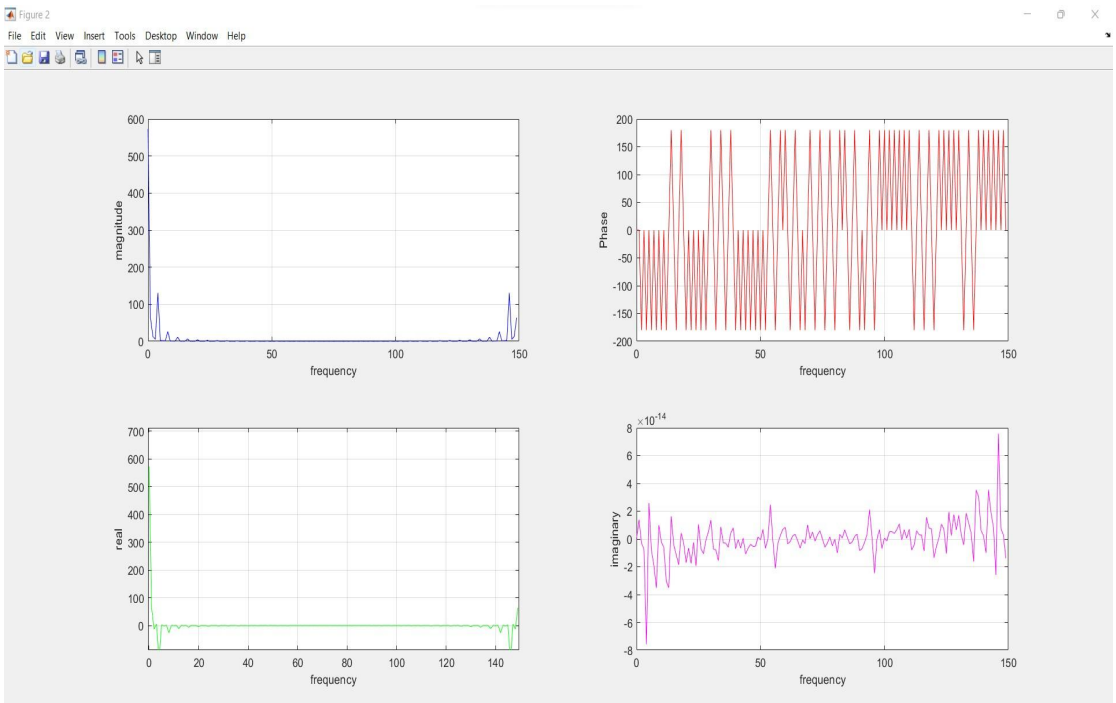
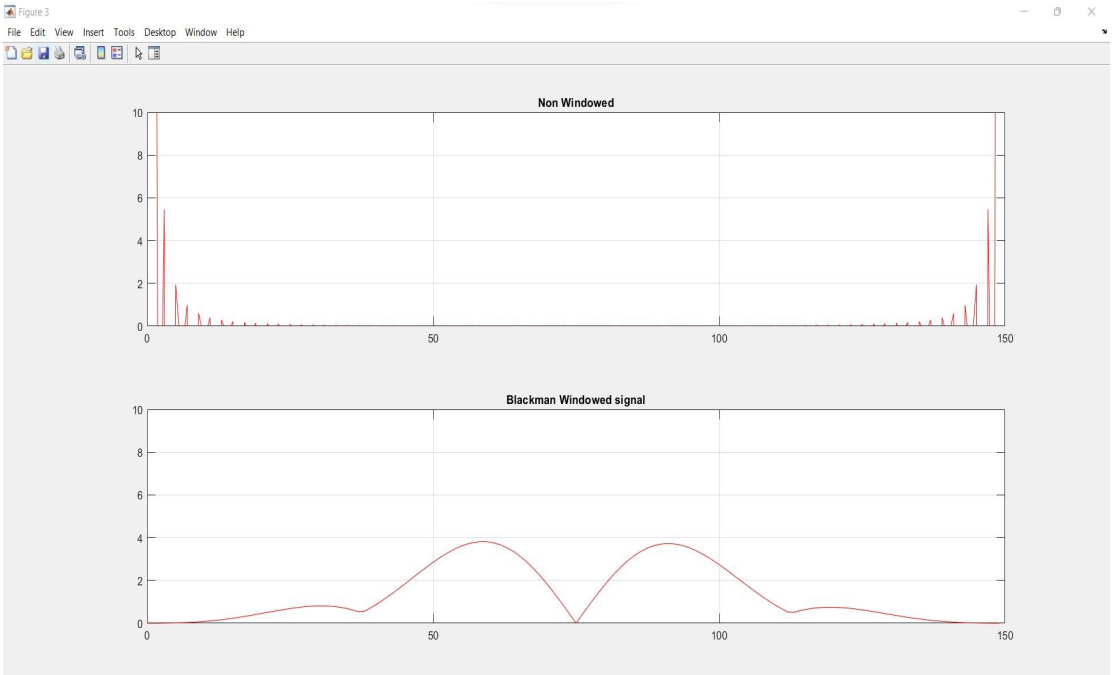


Figure 2
File Edit View Insert Tools Desktop Window Help
magnitude
frequency
Phase
frequency
real
frequency
imaginary
frequency



The graph from the sample solution.

Reference:

[1] Window function - Wikipedia, the free encyclopedia
[2] Blackman Window - an overview | ScienceDirect Topics