REPORT 1

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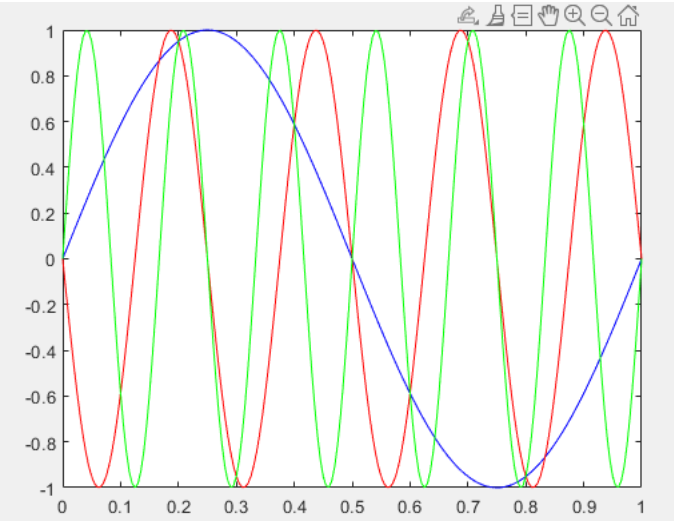
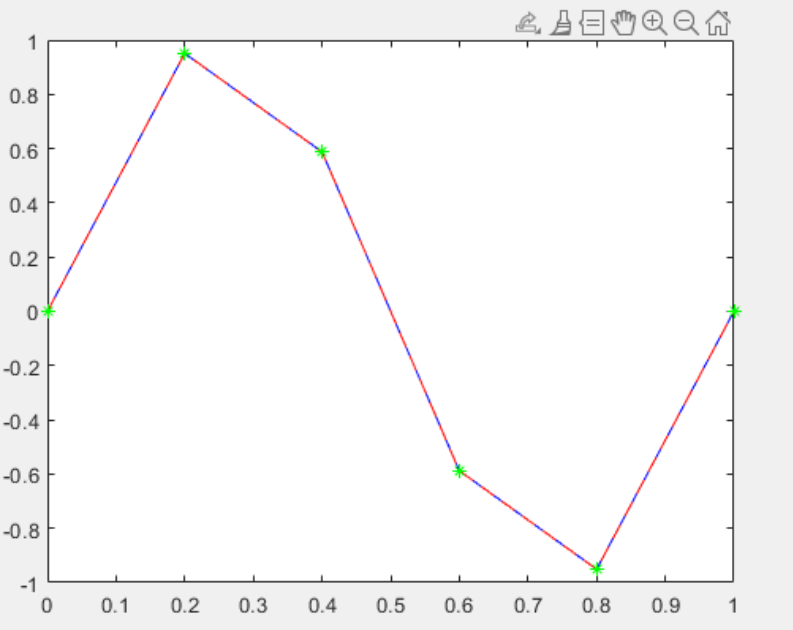
Task 1

```
%%

%for 200 hz
fs = 200; % sampling frequency [Hz]
dt = 1/fs; % time step [s]
t = 0:dt:1; % time vector
f1 = 1; % frequency equal to 1 Hz
y1=sin(2*pi*f1*t+0)
% time vector ‘t’
f2 = 4;
y2=sin(2*pi*f2*t+pi)
% time vector ‘t’
f3 = 6;
y3=sin(2*pi*f3*t+0)
% time vector ‘t’
plot(t,y1,'b-')
hold on;
plot(t,y2,'r-')
hold on;
plot(t,y3,'g-')
hold on;
```



This 3 sine waves are generated with frequencies of 1,4 and 6 Hz. This waves plotted against time. The wave with frequency 6 has more cycles compared to the others in time.

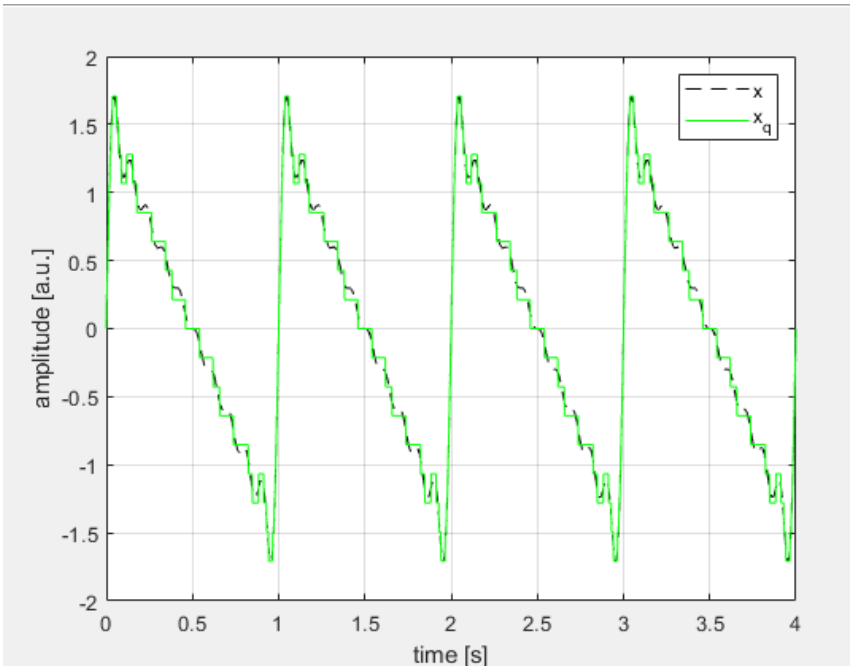
```
%%
%for 5 hz
fs = 5; % sampling frequency [Hz]
dt = 1/fs; % time step [s]
t = 0:dt:1; % time vector
f1 = 1; % frequency equal to 1 Hz
y1=sin(2*pi*f1*t+0) % sinusoidal signal defined for frequency ‘f’ and
% time vector ‘t’
f2 = 4;
y2=sin(2*pi*f2*t+pi)
% time vector ‘t’
f3 = 6;
y3=sin(2*pi*f3*t+0) % sinusoidal signal defined for frequency ‘f’ and
% time vector ‘t’
plot(t,y1,'b-')
hold on;
plot(t,y2,'r--')
hold on;
plot(t,y3,'g*')
hold on;
```



Overall observation, due to difference of frequency, t will differ between 2 plots. For 5 Hz plot, will have fewer data point compared to 200 Hz plot.

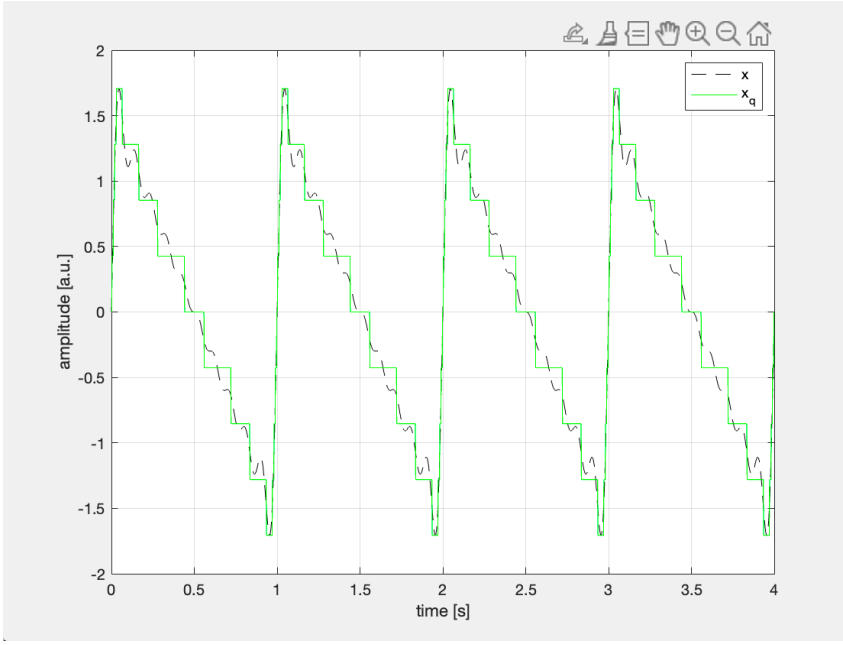
TASK2

```
dt = 1/500;
t = 0:dt:4;
x = zeros(size(t));
for i = 1:10
    sum = (1/i)*sin(2*pi*i*t);
    x = sum + x;
end
A = max(x);
dx = A/8;

xq = dx * round(x/dx);
figure(2);
plot(t, x, '--k', t, xq, 'g'); %
grid on;
legend('x', 'x_q');
xlabel('time [s]');
ylabel('amplitude [a.u.]');
```



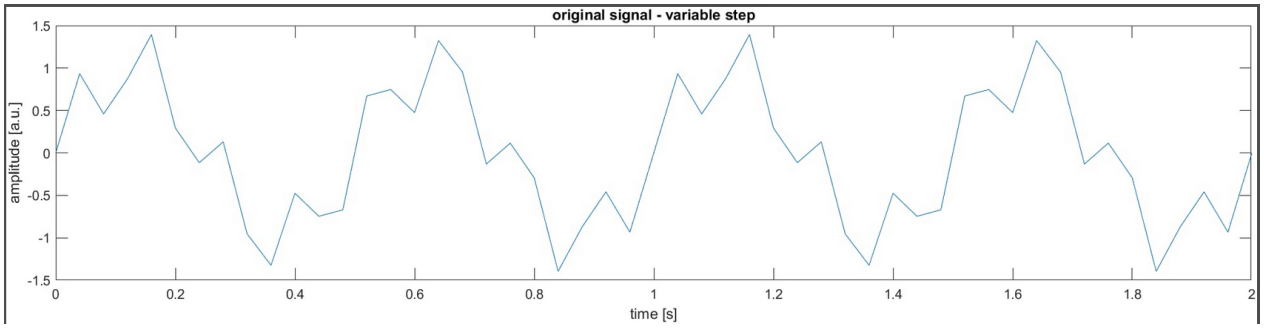
%2bit

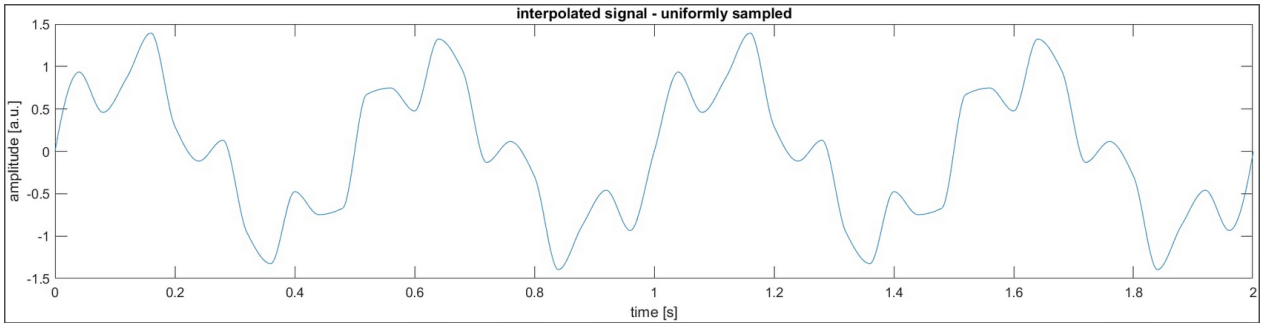
```
dt = 1/500;

t = 0:dt:4;
x = zeros(size(t));
for i = 1:10
    sum = (1/i) * sin(2*pi*i*t);
    x = sum + x;
end

% Quantization parameters
bits = 2;
levels = 2^bits;
A = max(x);
dx = A / levels;
xq = dx * round(x/dx);

% Plotting
figure;
plot(t, x, '--k', t, xq, 'g');
grid on;
legend('x', 'x_q');
xlabel('time [s]');
ylabel('amplitude [a.u.]');

%%
```



TASK 3 CASE

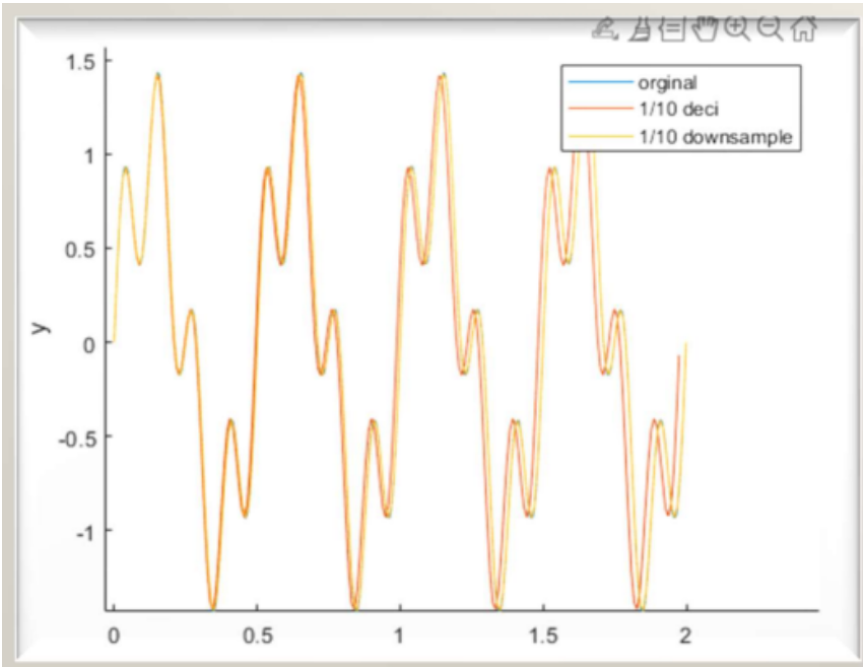
```
1 dt = 0.001;

out = sim('isil.slx');

% simulate the model

x=out.isil; t=out.tout;

t_uni=min(t):dt:max(t);

x_uni = interp1(t,x,t_uni,'pchip');

 % interpolate the signal

 % plot the results

figure(4), subplot(2,1,1);

plot(t,x), hold on, hold off;

xlabel('time [s]');

ylabel('amplitude [a.u.]'), title('original signal - variable step')

subplot(2,1,2);

plot(t_uni,x_uni), hold on, hold off;

xlabel('time [s]'); ylabel('amplitude [a.u.]'), title('interpolated signal - uniformly sampled')

% figure(3), plot(t,x);

% xlabel('time [s]');

% ylabel('amplitude [a.u.]');

% hold off;

% %Interpolated Signal

% figure(4), plot(t_uni,x_uni)

% xlabel('time [s]');

% ylabel('amplitude [a.u.]');

% title('interpolated signal - uniformly sampled');
```

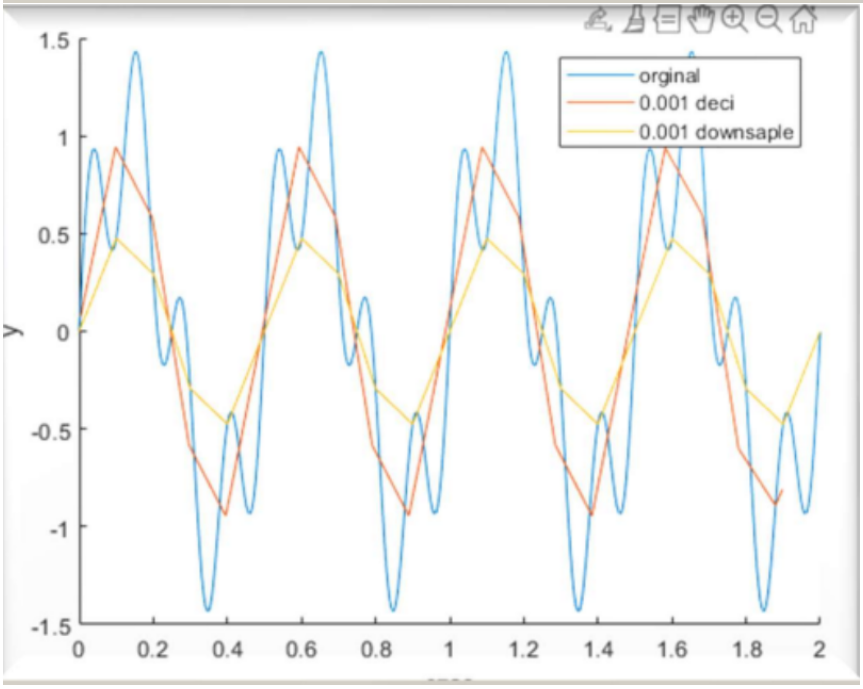





```
dt=0.001;
out=sim('Task32.slx'); % simulate the model
x=out.isilout;
t=out.tout;
% Reducing sample rate by 10
rate=10;
xd=downsample(x,rate);
td=downsample(t,rate);
% Reducing sample rate by 100
```

```
rate=100;
xd2=downsample(x,rate);
td2=downsample(t,rate);
% plot results
figure(3)
plot(t,x);
xlabel('time [s]');
ylabel('amplitude [a.u.]');
hold off;
figure(4),
subplot(2,1,1), plot(td,xd); xlabel('time [s]'),
stem(td,xd);
ylabel('amplitude [a.u.]'); title('signal sampled at 1 kHz')
subplot(2,1,2), plot(td2,xd2); xlabel('time [s]'),
stem(xd2,td2);
ylabel('amplitude [a.u.]'); title('signal sampled at 10 mHz')
%compare obtained signals
figure(5), plot(t,x,'r',td,xd,'k--',td2,xd2,'b--');
xlabel('time [s]'), ylabel('amplitude [a.u.]');
legend('original signal','decimated signal','downsampled signal');
```


orginal
1/10 deci
1/10 downsample
y
1.5
1
0.5
0
-0.5
-1
0
0.5
1
1.5
2


orginal
0.001 deci
0.001 downsaple
y
1.5
1
0.5
0
-0.5
-1
-1.5
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2

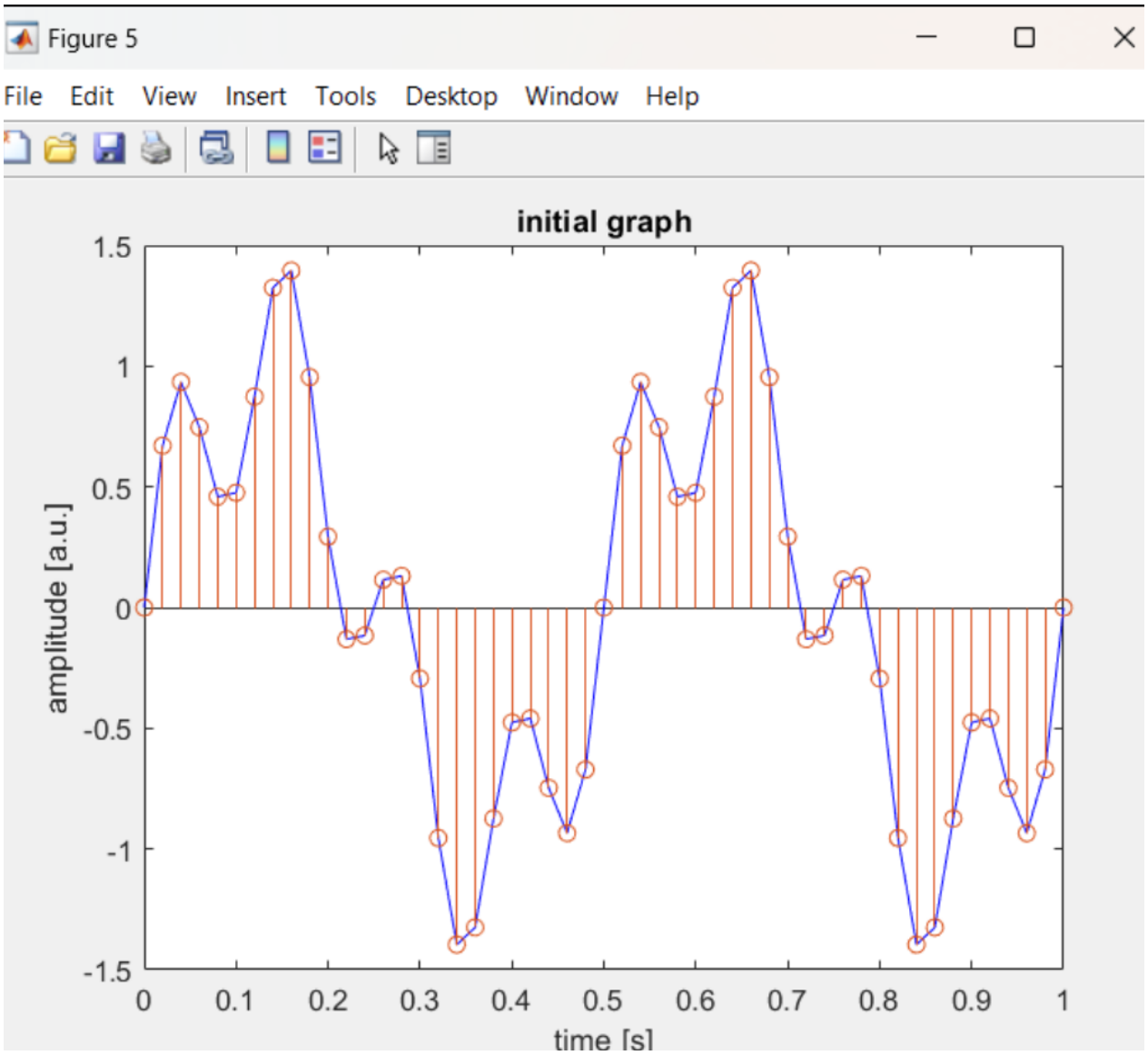


Figure 5
File Edit View Insert Tools Desktop Window Help
initial graph
amplitude [a.u.]
time [s]
1.5
1
0.5
0
-0.5
-1
-1.5
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

```
dt=0.001;
out=sim('isil.slx'); % simulate the model
x=out.simout;
t=out.tout;
t_uni=min(t):dt:max(t);
x_uni = interp1(t,x,t_uni,'pchip'); % interpolate the signal
% downsample the signal to obtain digital signal
rate=1;
xd=downsample(x,rate);
td=downsample(t,rate);
figure(3)
subplot(2,2,1)
plot(t_uni,x_uni);
xlabel('time [s]');
ylabel('amplitude [a.u.]');
title('continuous signal');
subplot(2,2,2)
plot(td,xd);
stem(td,xd);
xlabel('time [s]');
ylabel('amplitude [a.u.]');
title('digital signal');
subplot(2,2,3)
plot(t_uni,x_uni)
hold on;
plot(td,xd);
stem(td,xd);
xlabel('time [s]'), ylabel('amplitude [a.u.]');
```

legend('continous signal', 'digital signal');

title('continuous signal vs digital signal');