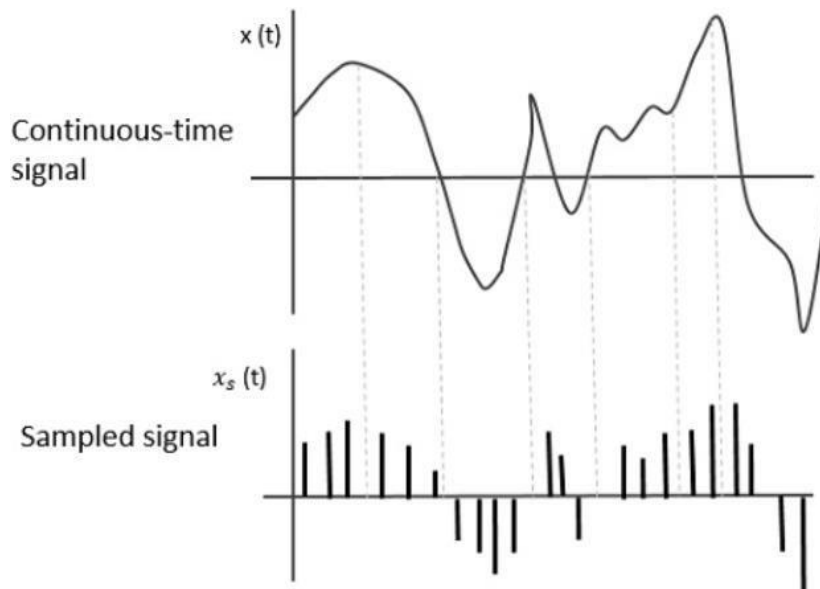


## SAMPLING

In signal processing, sampling is the reduction of a continuous-time signal to a discrete-time signal. A common example is the conversion of a sound wave (a continuous signal) to a sequence of samples (a discrete-time signal). A sample is a value or set of values at a point in time and/or space.



## BASE BAND SIGNAL

A baseband signal or lowpass signal is a signal that can include frequencies that are very near zero. A baseband signal can be transmitted over a pair of wires (like in a telephone), coaxial cables, or optical fibres.

## SAMPLING FREQUENCY

Sampling rate or sampling frequency defines the number of samples per second (or per another unit) taken from a continuous signal to make a discrete or digital signal.

## PROBLEM STATEMENT

- Write a script to sample a sinusoidal base band signal of 1000Hz frequency at a sampling frequency of 40KHz. Reduce the sampling frequency by half and then to  $1/4^{\text{th}}$ . Report if the sampling frequency would alter retrieving the baseband signal. Determine around what sampling frequency you start seeing the distortion?

## GIVEN:

- Frequency of base band signal =1000Hz
- Sampling Frequency =40000Hz

## MATLAB CODE

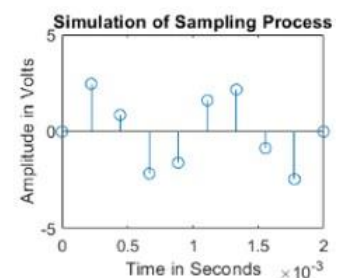
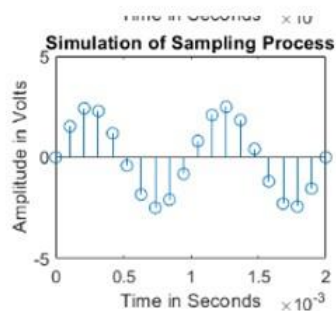
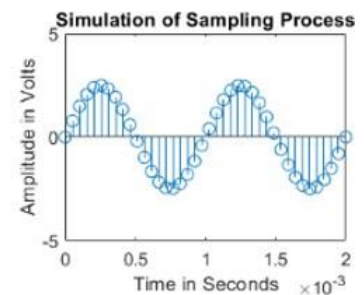
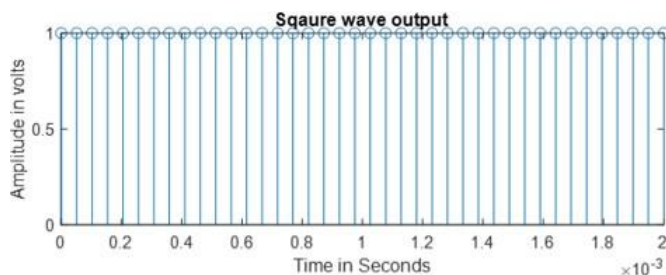
```
clear all;
clc; clf;
fb= 1000; % base band signal
tb= 1/fb;
fs1=40000;
Ns1 = fs1/fb; %Number of samples in one period of the baseband signal
t1=linspace(0,0.002,Ns1);
sq1=(1+t1.^2)/2;
asb1=5*sin(2*pi*fb*t1).*sq1;
subplot(221)
plot(t1,sq1);
axis([0 0.002 0 1]);
xlabel('Time in Seconds');
ylabel('Amplitude in Volts')
title('Square Wave Output');
subplot (222)
stem(t1,asb1);
axis([0 0.002 -5 5]);
xlabel('Time in Seconds');
ylabel('Amplitude in Volts')
title('Simulation of Sampling Process')

fs2=40000/2;
Ns2 = fs2/fb; %Number of samples in one period of the baseband signal
t2=linspace(0,0.002,Ns2);
sq2=(1+t2.^2)/2;
asb2=5*sin(2*pi*fb*t2).*sq2;
subplot (223)
stem(t2,asb2);
axis([0 0.002 -5 5]);
xlabel('Time in Seconds');
ylabel('Amplitude in Volts')
```

```
title('Simulation of Sampling Process')
```

```
fs3=40000/4;
Ns3 = fs3/fb; %Number of samples in one period of the baseband signal
t3=linspace(0,0.002,Ns3);
sq3=(1+t3.^2)/2;
asb3=5*sin(2*pi*fb*t3).*sq3;
subplot (224)
stem(t3,asb3);
axis([0 0.002 -5 5]);
xlabel('Time in Seconds');
ylabel('Amplitude in Volts')
title('Simulation of Sampling Process')
```

## MATLAB OUTPUT



Distortion can be seen mainly when the sampling frequency is reduced to 1/4