ASS 1

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1. Sampling

1.1 Sampled time

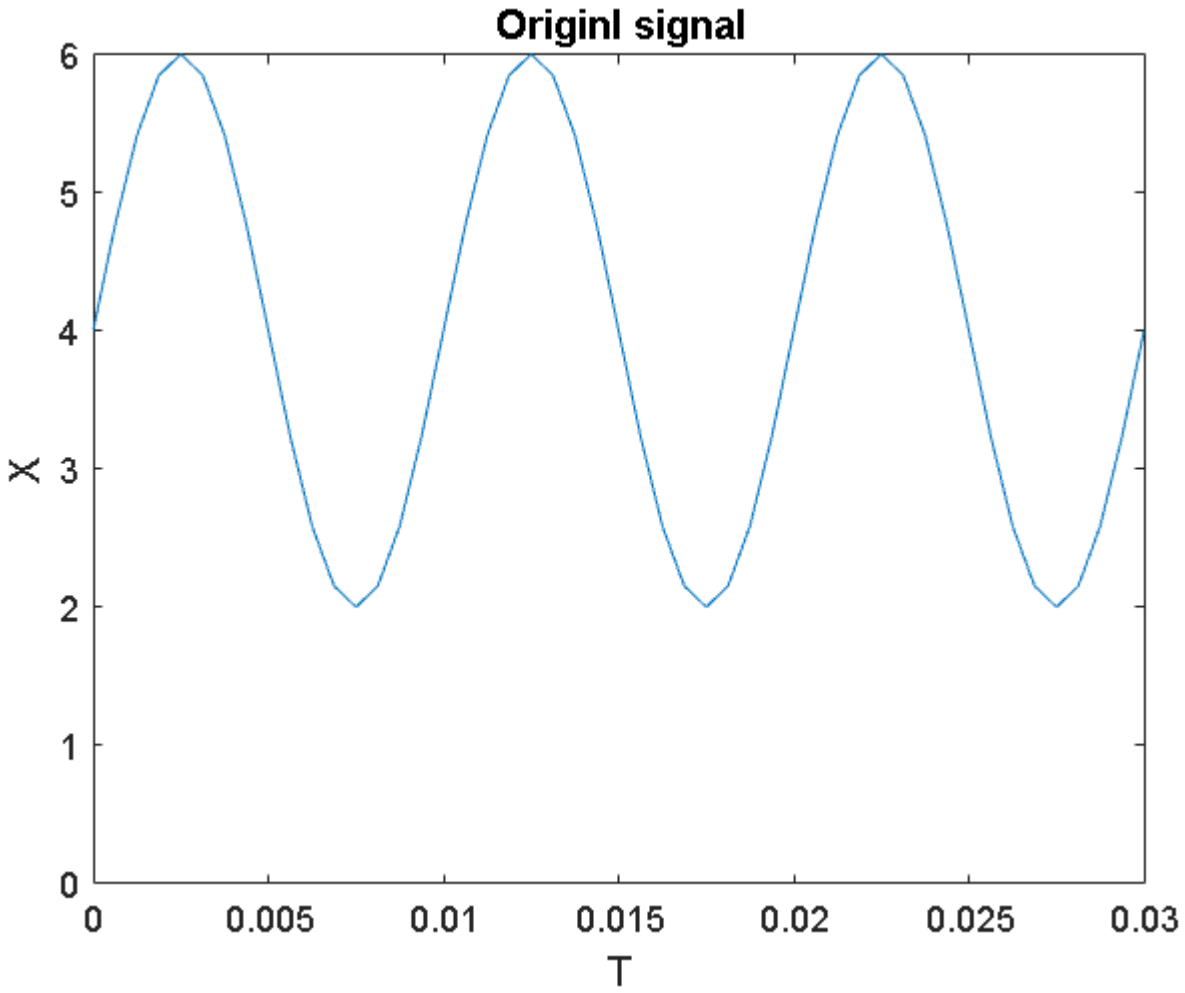
```
t = 0:1/1600:2;
```

What is the maximum frequency which can be present in a continuous signal such that the original signal can be reconstructed again from the sampled signal?

Using the formula $f_{sampled} \leq 2f$ we can determine that the maximum frequency of the function is 800Hz

1.2 Sampled signal

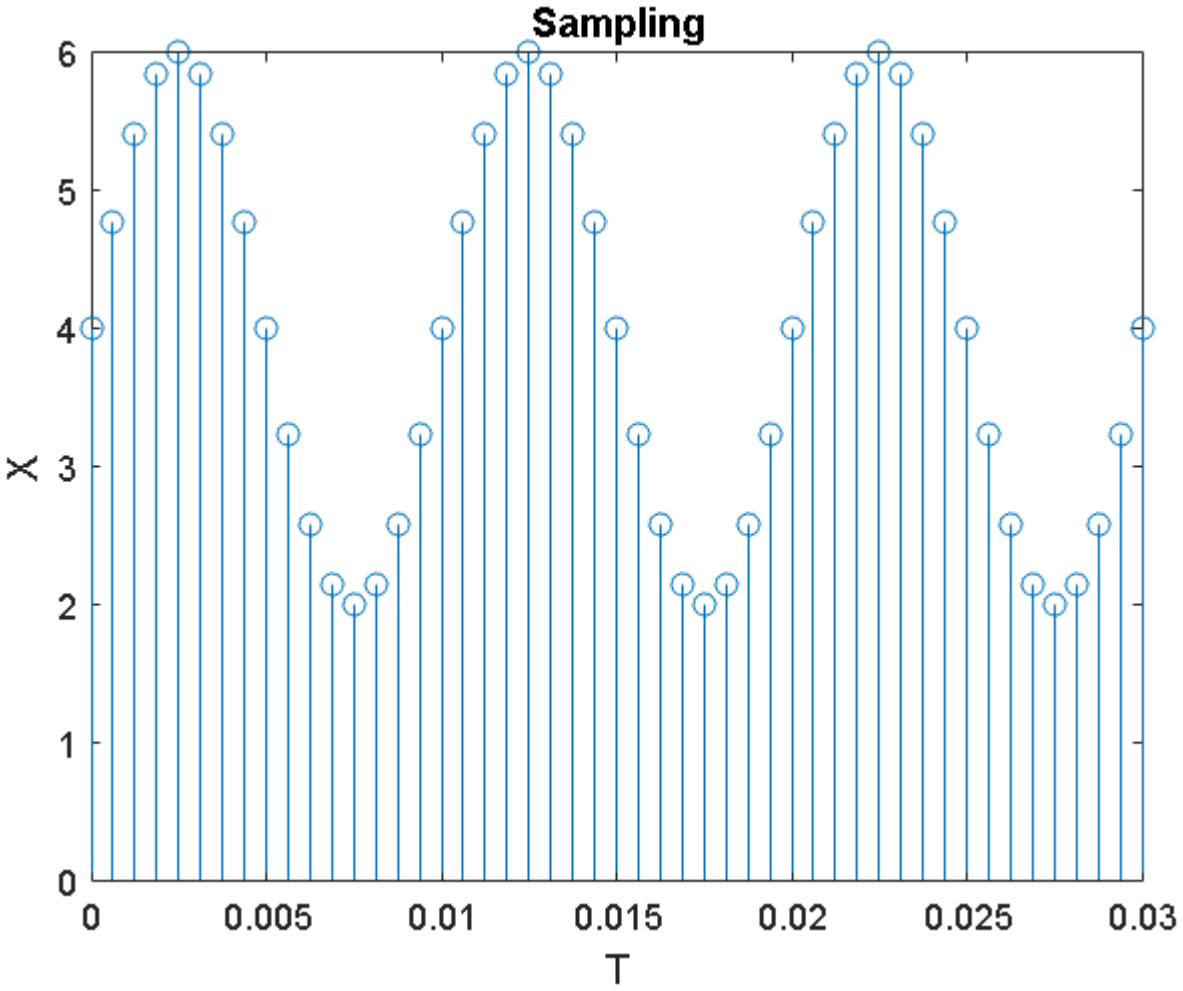
```
y = 4 + 2*sin(2*pi*100*t);

plot(t,y)
title("Originl signal")
ylabel("X")
xlabel("T")
axis ([0 0.03 0 6])
```




```
figure
```

1.3 Plot the sampled signal

```
stem(t,y)
title("Sampling")
ylabel("X")
xlabel("T")
axis ([0 0.03 0 6])
```

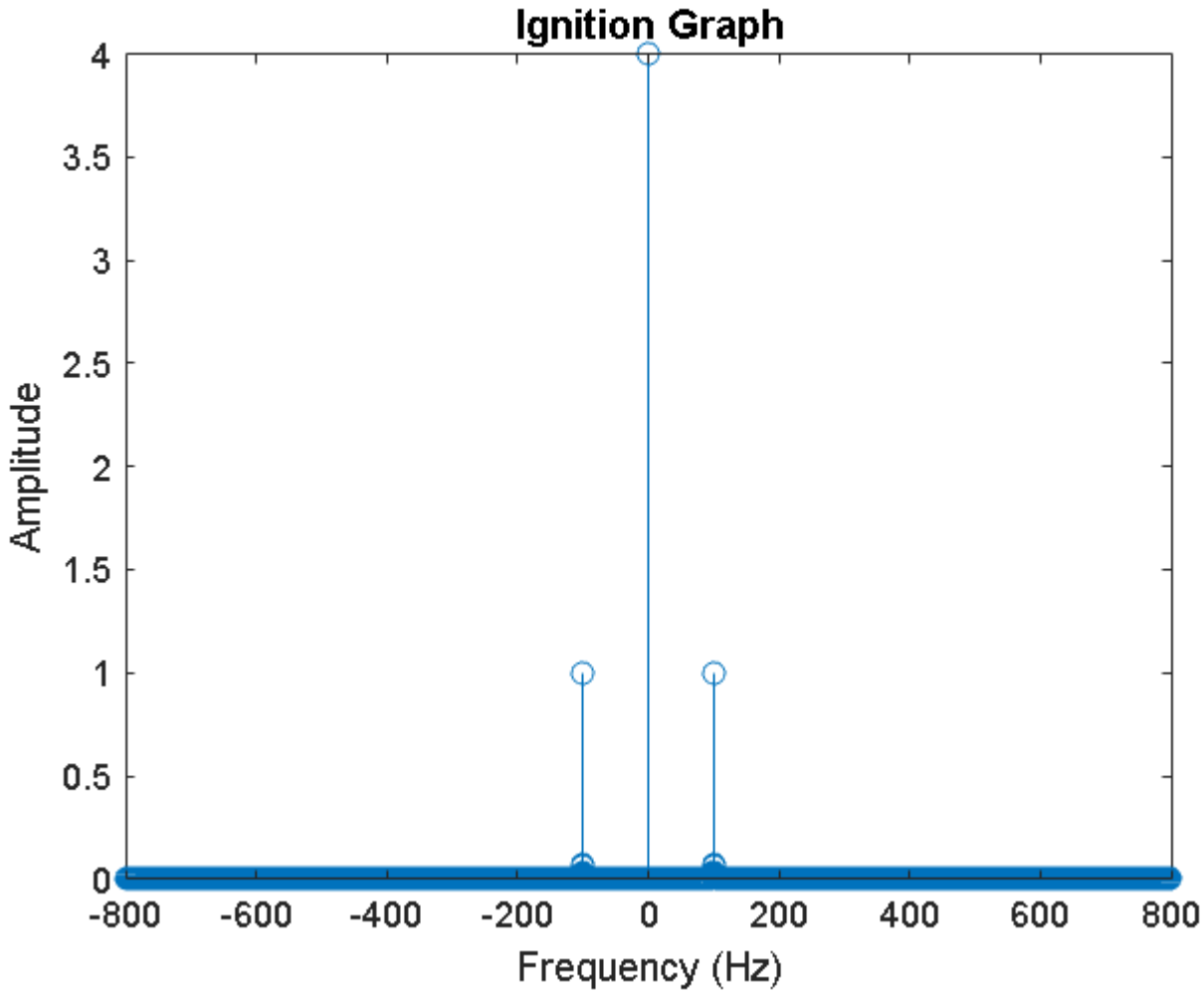



```
figure
```

2. Frequency Spectrum

2.1 Ignition

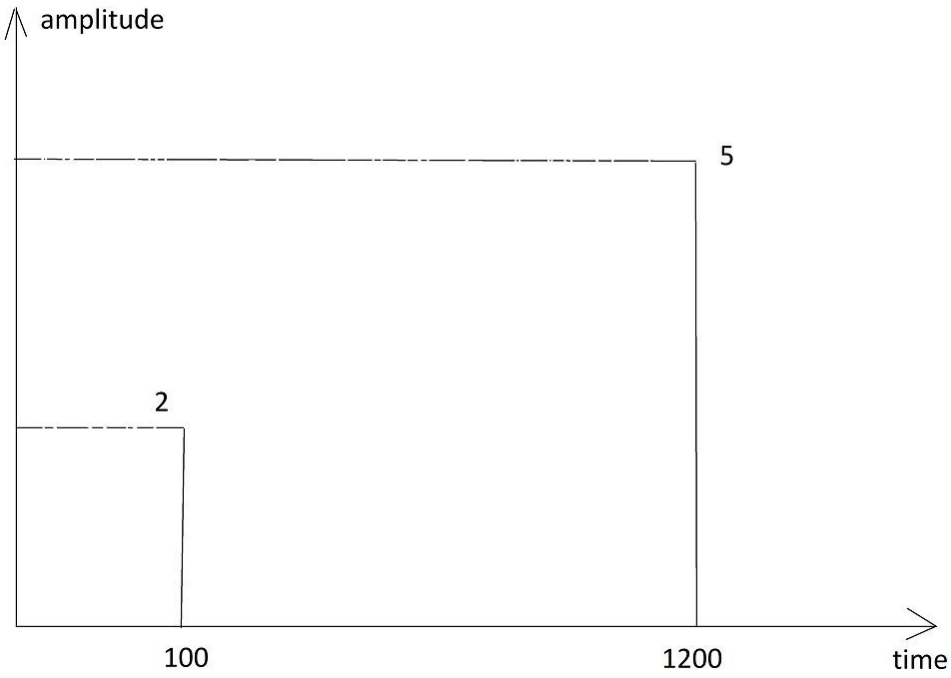
```
clear
t = 0:1/1600:2;

y = 4 + 2*sin(2*pi*100*t);
ypp = fftshift(fft(y) / length(y));
yp = (1600 / length(y)) * (-length(y)/2:length(y)/2 - 1);

stem(yp,abs(ypp))
title("Ignition Graph")
ylabel("Amplitude")
xlabel("Frequency (Hz)")
```



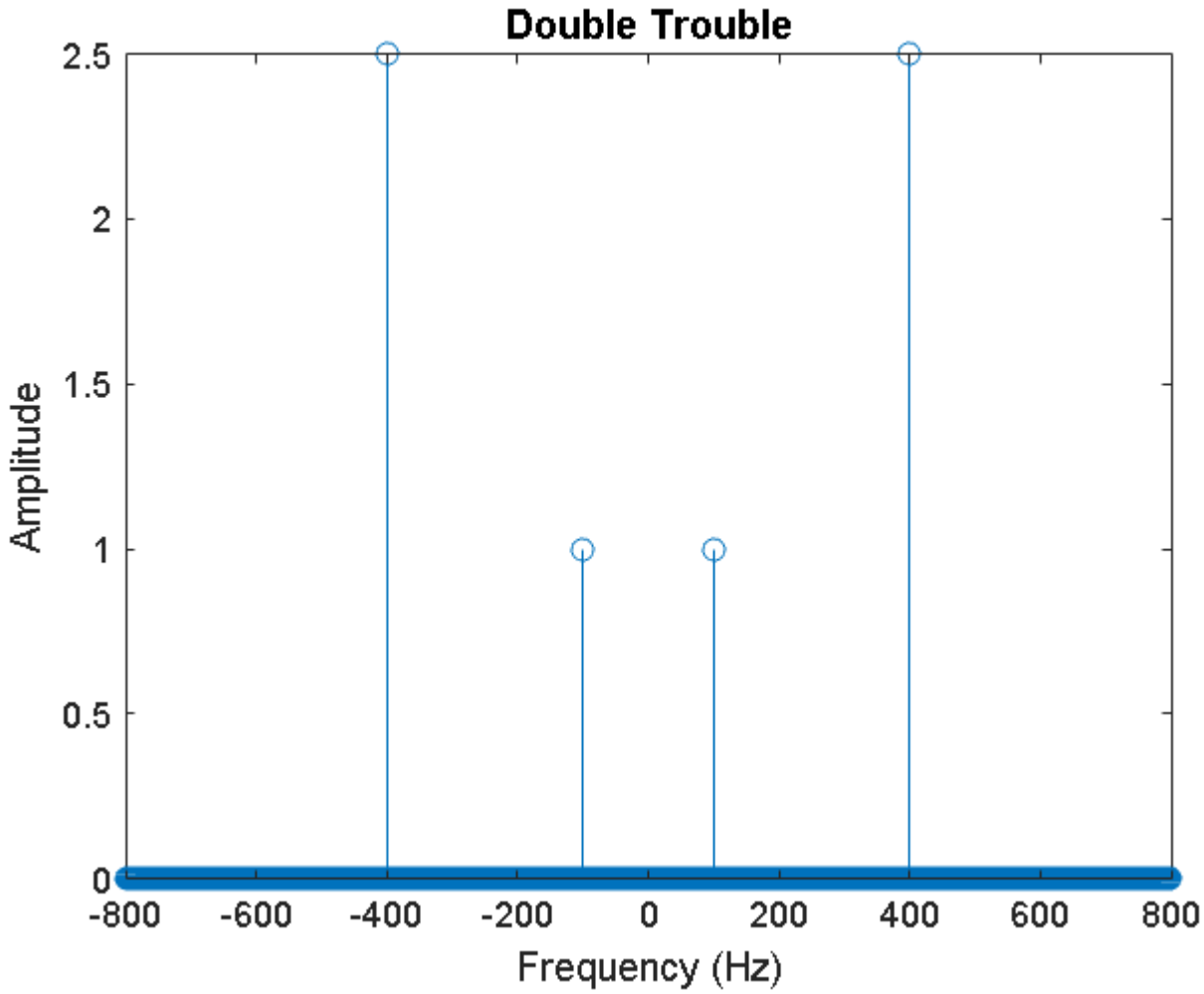

```
figure
```

2.2 Double trouble

2.2 Sketch



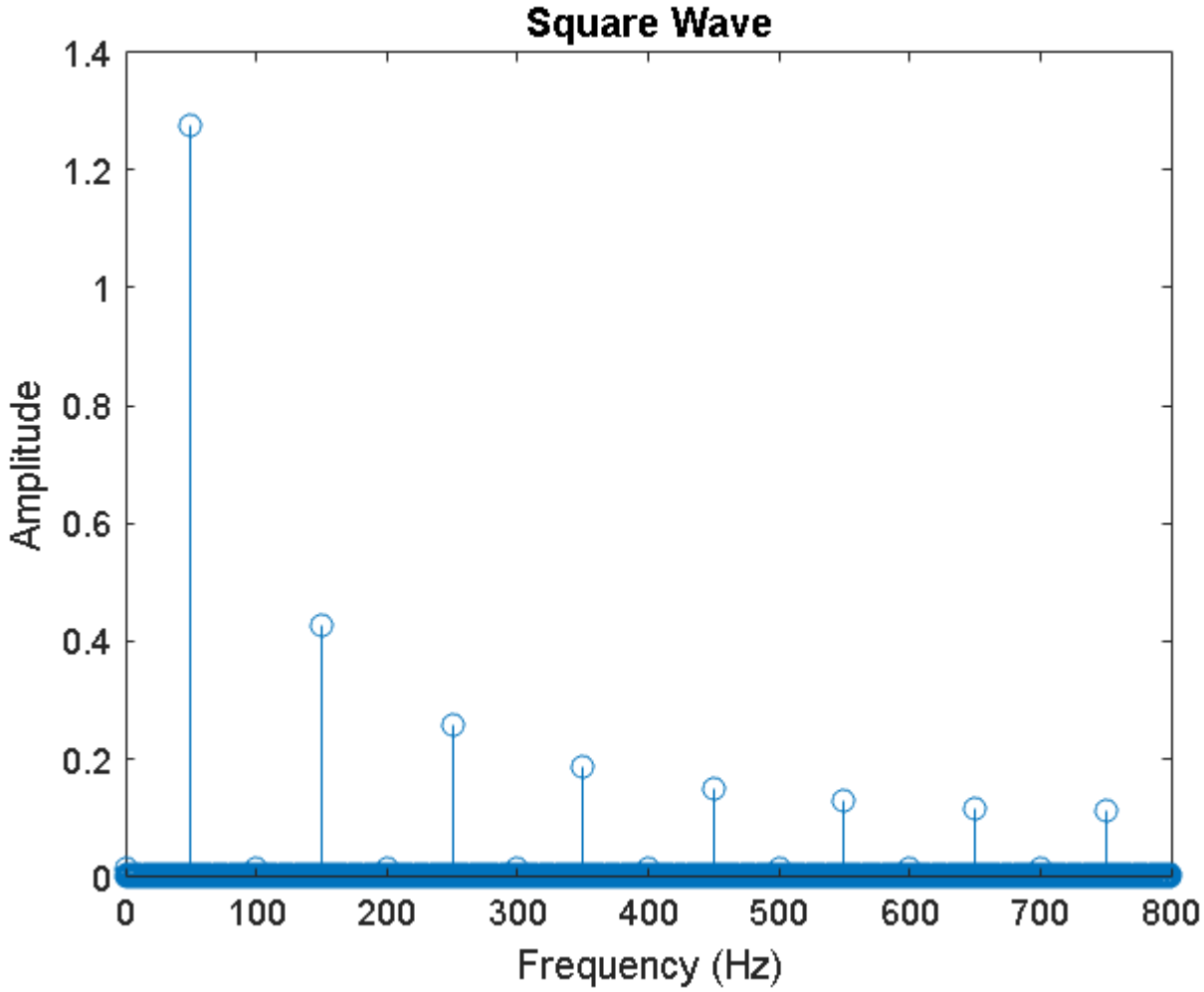

```
clear
t = 0:1/1600:2 - 1/1600;
y = + 2.*sin(2.*pi.*100.*t) + 5.*cos(2.*pi.*1200.*t);

ypp = fftshift(fft(y) / length(y));
yp = (1600 / length(y)) * (-length(y)/2:length(y)/2 - 1);

stem(yp,abs(ypp))
title("Double Trouble")
ylabel("Amplitude")
xlabel("Frequency (Hz)")
```




```
figure
```

2.3 Square wave

```
t = 0:1/1600:10 - 1/1600;

y = 2.*square(2.*pi.*50.*t);
ypp = abs(fftshift(fft(y) / length(y)));
yp = (1600 / length(y)) * (-length(y)/2:length(y)/2 - 1);

stem(yp,ypp)
title("Square Wave")
ylabel("Amplitude")
xlabel("Frequency (Hz)")
xlim([0 800])
```




```
figure
```

the reason why we chose a sampling frequency of 1/100 is because the value should be $\frac{1}{2f}$ when frequency is 50Hz

we observe that the square wave has odd harmonics and the predominant frequency .