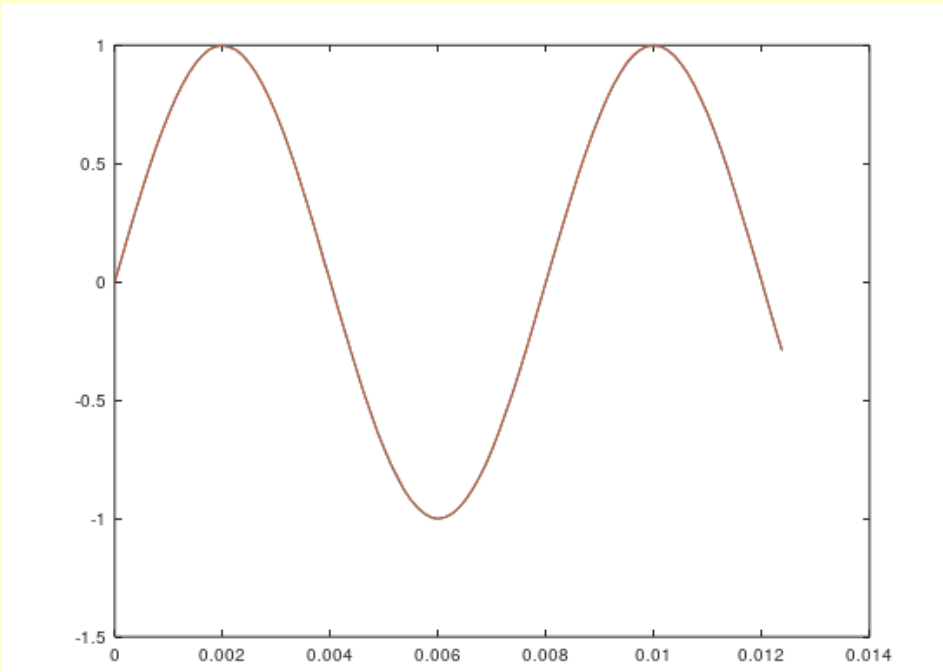
TX00CQ31 –Digital Signal Processing

Study 3: Signal Spectrum	Name(s): Arsi Arola	ID(s): 1706768	Deadline: Exercise 4

Read these instructions first!

Number	Write your answer in this column	Question
Q1	Write the commands! SSS = 768; A = 1; Fs = 8000; F = Fs / 2^(mod(SSS, 5) + 3); SNR = 50; tt = 0:(1/Fs):1/Fs * (2^12-1); ss = sin(2*pi*F*tt); ss = ss * A; % set amplitude sound(ss,Fs); var(ss) nvar = var(ss) / 10^(SNR/10); nn = randn(size(ss))*sqrt(nvar); var(nn) mean(nn) ssn = ss + nn; plot(tt(1:100), ss(1:100)); hold on; plot(tt(1:100), ssn(1:100)); hold off; % becuase the SNR is so high we cant even detect the noise from the image just by looking	Generate wave sar • A • S fr 8 % • S ra • S le s Signal to level +5

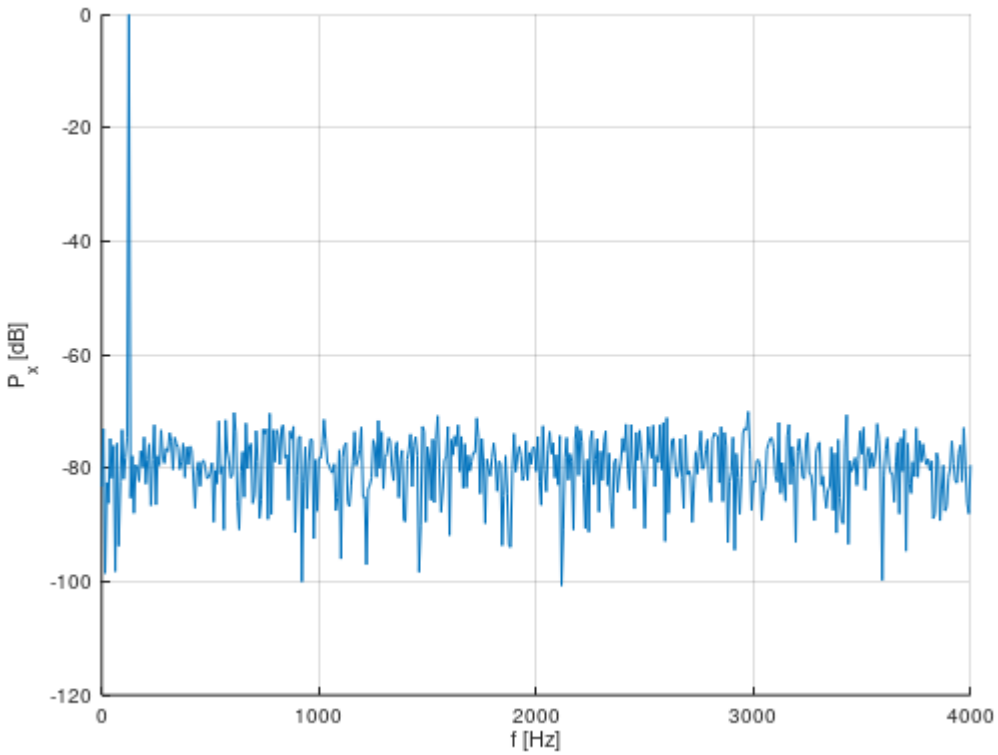


sound(ssn, Fs)
sound(nn, Fs)

Q2

Insert the figure here!

```
hold on;
spk(ssn, Fs);
hold off;
```



Use Four
Transfor
generate
spectrum
previous

- U
  fr
  F
  h
  a

Use desi
vertical a

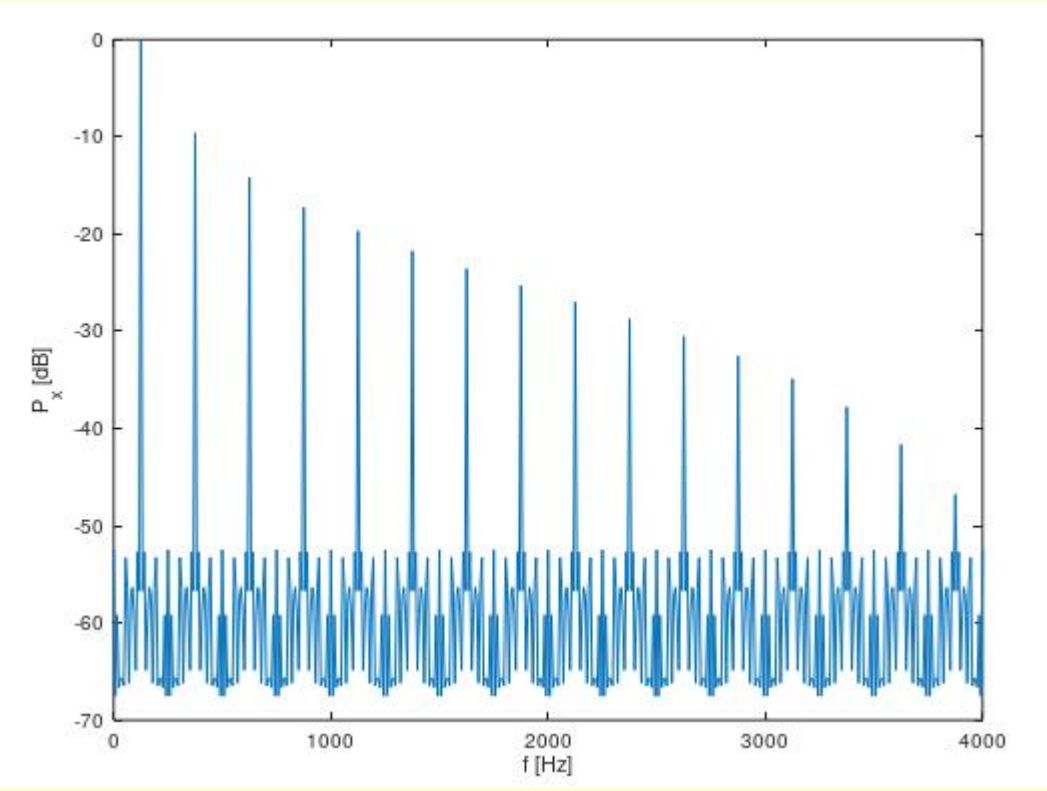
Explain why the signal level in spectrum seems higher than approx. 83 dB compared to the noise level.
It is because of spectral leakage. This make the amplitude increasing. Bin effect also affects the noise

Q3

Write the commands!

```
SS = 68;

Gain = SS + 2;

ssnGain = ssn * Gain;

ssnGain( ssnGain > 1 )  = 1;

ssnGain( ssnGain < -1 ) = -1;

spk(ssnGain,Fs);

grid; hold off
```

Insert the figure here!



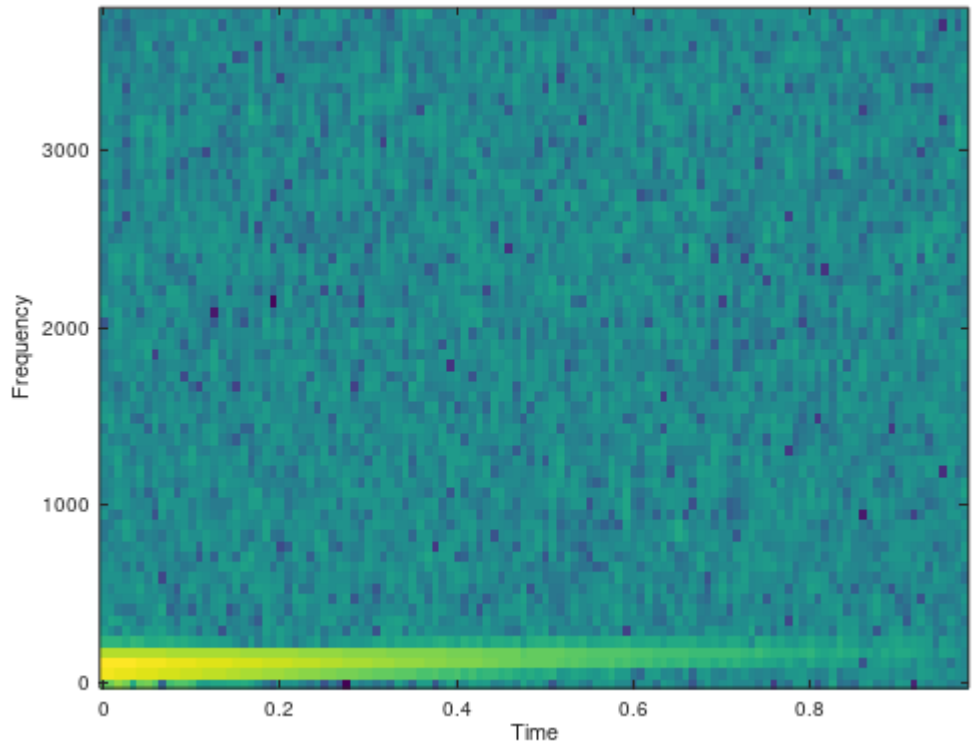
Explain the main differences of the power spectra in this and previous case.
Since power is gained the steps between audio differences is biggers so the power differences are quite jarring and also a lot of the random variance dissapears.

Simulate
distorion
sinusoid
Q1 to pr
saturated

- C
- D
  a
  le

Generate
spectrum
sample a
it with th
in Q2.

Q4	Write the commands! ``` SSS = 768; Fs = SSS * 10; tt = 0:1/Fs:1-1/Fs; F = chirp(tt, 100, 1, 200) A = exp(-tt/0.2); S = A .* F .+ (randn(size(tt)) .* 0.02); ```	Produce second lo sample v • si fr in li ti 1 2 s • si a d e w c 0 • m a 1 • a n s d 0 sampling SSS*10
Q5	Insert the figure here!	Generate spectrog previous Use freq as your v and time as your h axis.

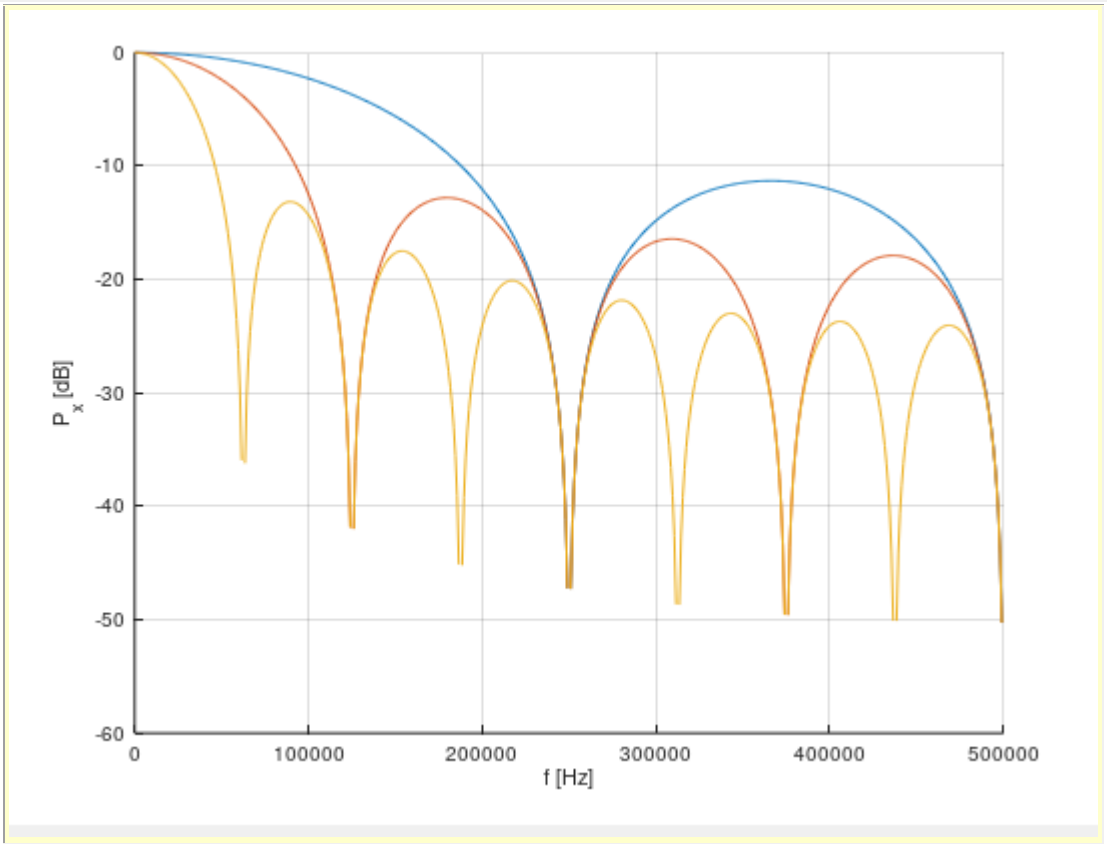


Q6

Insert the figure here!

```
fs = 1e6; % 1Mhz
n = 0:2^12;
u4  = (n >= 0) - (n >= 4);
u8  = (n >= 0) - (n >= 8);
u16 = (n >= 0) - (n >= 16);

hold on;
spk(u4, fs);
spk(u8, fs);
spk(u16, fs);
hold off;

% When the pulse width doubles the spectral content of the pulse
halves.
```

Generate
pulses of
4μs, 8μs
when the
frequenc
Then eva
spectrum
pulses in
How the
and its sp
content a


0
-10
-20
-30
-40
-50
-60
P x [dB]
0
100000
200000
300000
400000
500000
f [Hz]