hw02

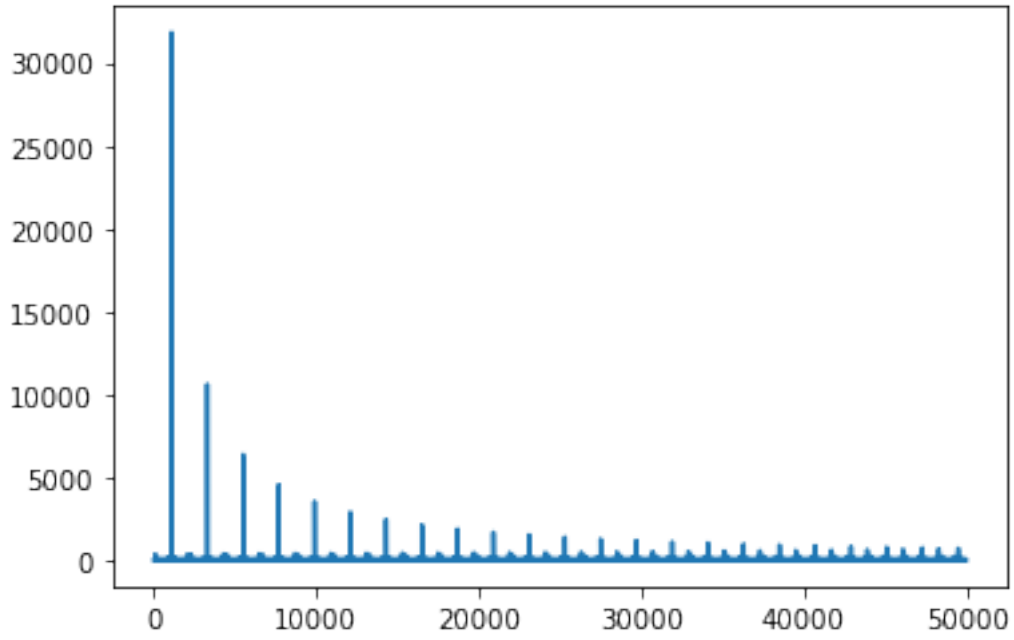
March 16, 2022

[ ]:
```
from thinkdsp import SquareSignal
from thinkdsp import TriangleSignal
from thinkdsp import SawtoothSignal
```

1 Exercise 03

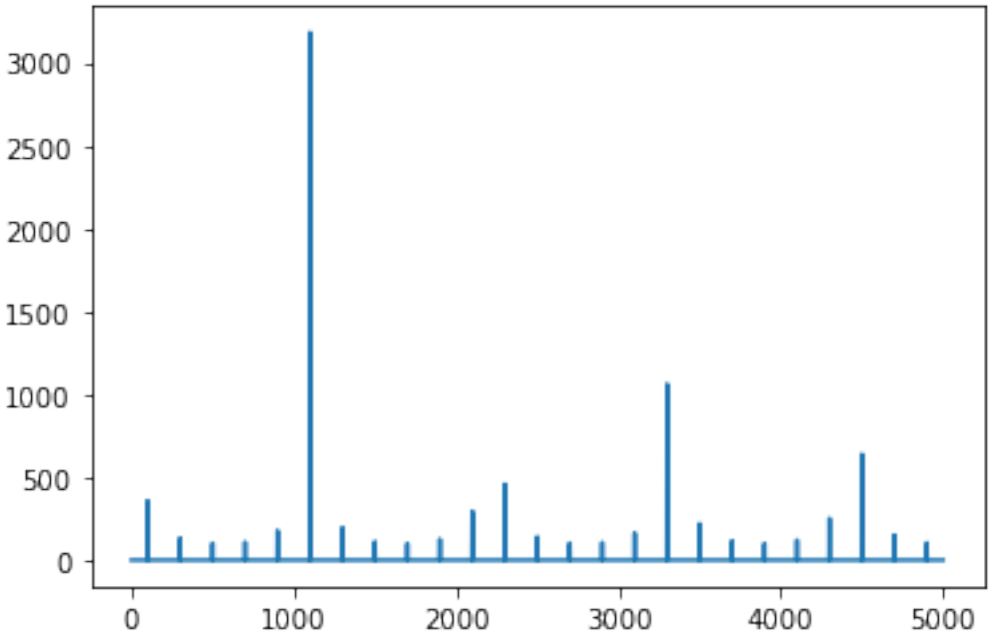
[ ]:
```
signal_square = SquareSignal(freq=1100)
wave_square = signal_square.make_wave(duration=0.5, framerate=100000)
spectrum_square = wave_square.make_spectrum()
spectrum_square.plot()
wave_square.write('output/square2')
```

```
Writing output/square2
```



[ ]:
```
wave_square = signal_square.make_wave(duration=0.5, framerate=10000)
spectrum_square = wave_square.make_spectrum()
spectrum_square.plot()
wave_square.write('output/square2_fold')
```

```
Writing output/square2_fold
```



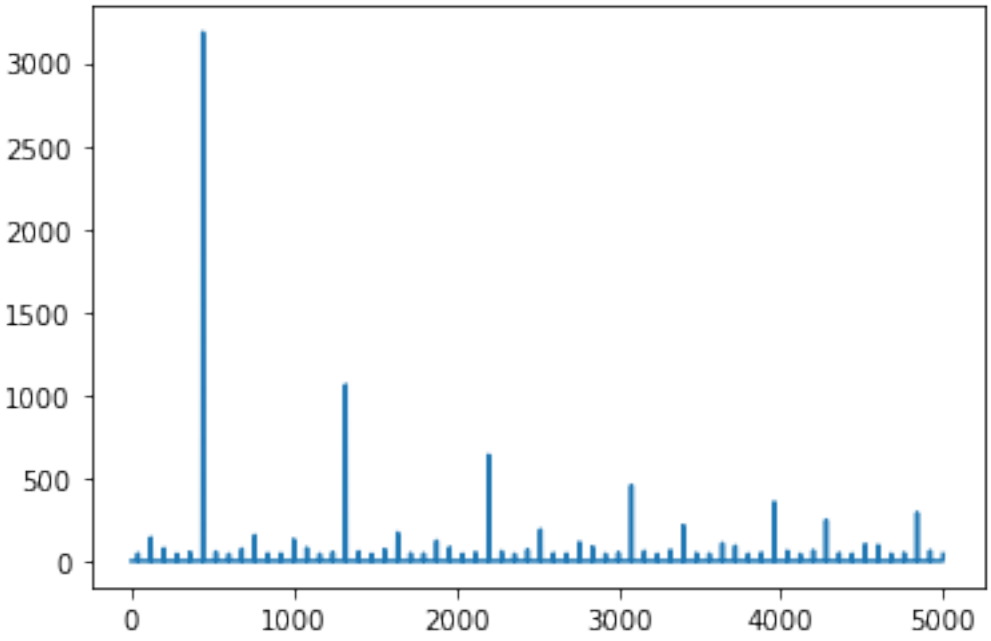
SquareSignal has component frequency : Basic Frequency 3X 5X... but 5500HZ is larger than Nyquist frequency 5000HZ (half of sampling rate) so 5500HZ signal was fold to 4500HZ 7700HZ was fold to 2300HZ which is shown in figure.

The sound was diffrent as the one with high sampling rate, because folding happened when low sample rate using, cause high frequency signal loss, and many complex noise appear.

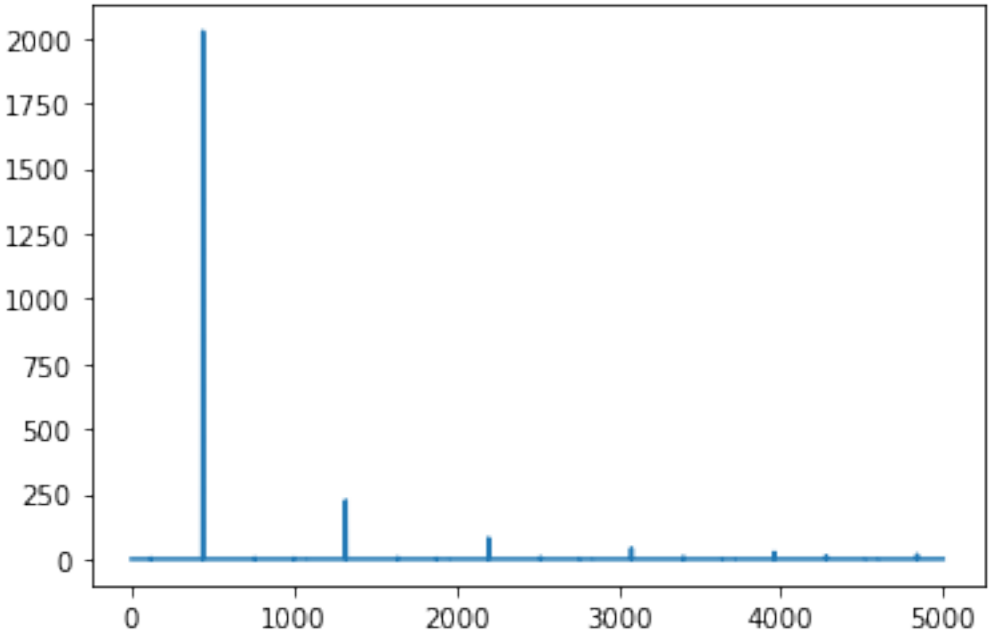
B0829024 -> 24%5=4, 4+1=5 Exercise 05

2 Exercise 05

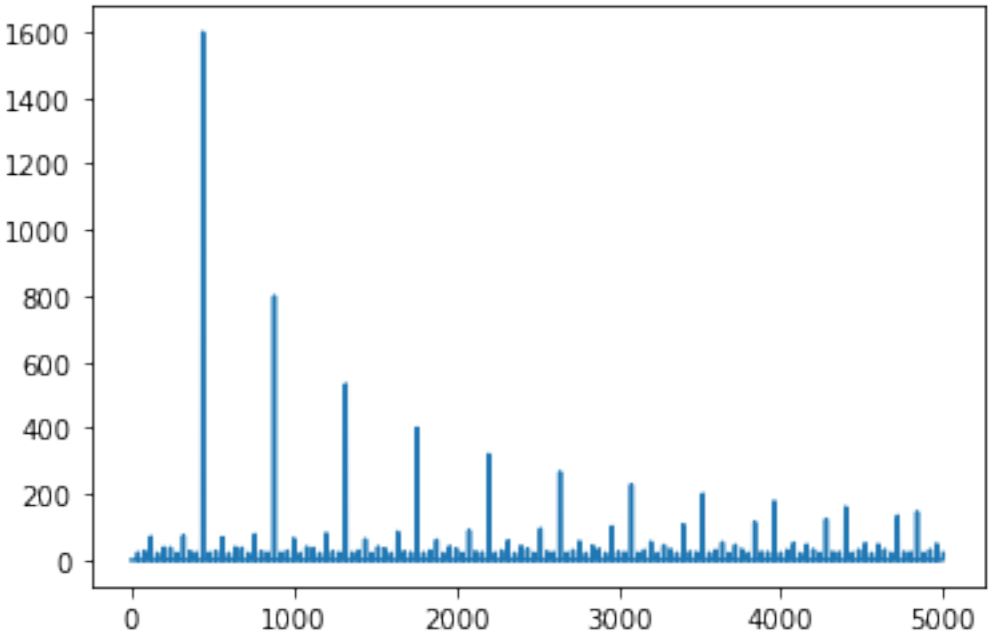
[ ]:
```
signal_square = SquareSignal(freq=440)
wave_square = signal_square.make_wave(duration=0.5, framerate=10000)
spectrum_square = wave_square.make_spectrum()
spectrum_square.plot()
```



[ ]:
```
signal_triangle = TriangleSignal(freq=440)
wave_triangle = signal_triangle.make_wave(duration=0.5, framerate=10000)
spectrum_triangle = wave_triangle.make_spectrum()
spectrum_triangle.plot()
```



[ ]:
```
signal_sawtooth = SawtoothSignal(freq=440)
wave_sawtooth = signal_sawtooth.make_wave(duration=0.5, framerate=10000)
spectrum_sawtooth = wave_sawtooth.make_spectrum()
spectrum_sawtooth.plot()
```

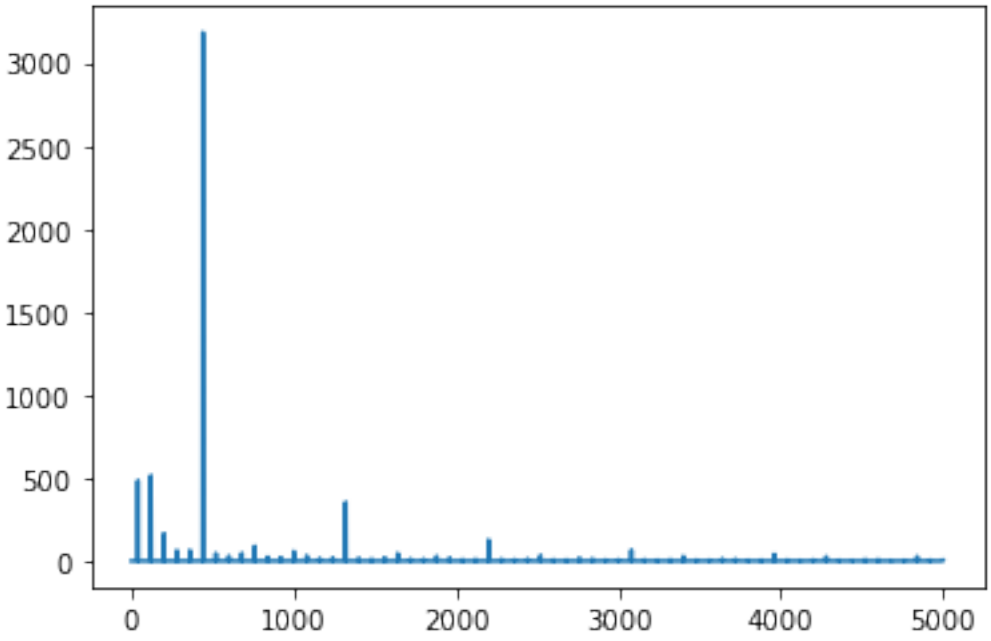


[ ]:
```
wave_square.write('output/square_origin.wav')
wave_triangle.write('output/triangle_origin.wav')
wave_sawtooth.write('output/sawtooth_origin.wav')
```

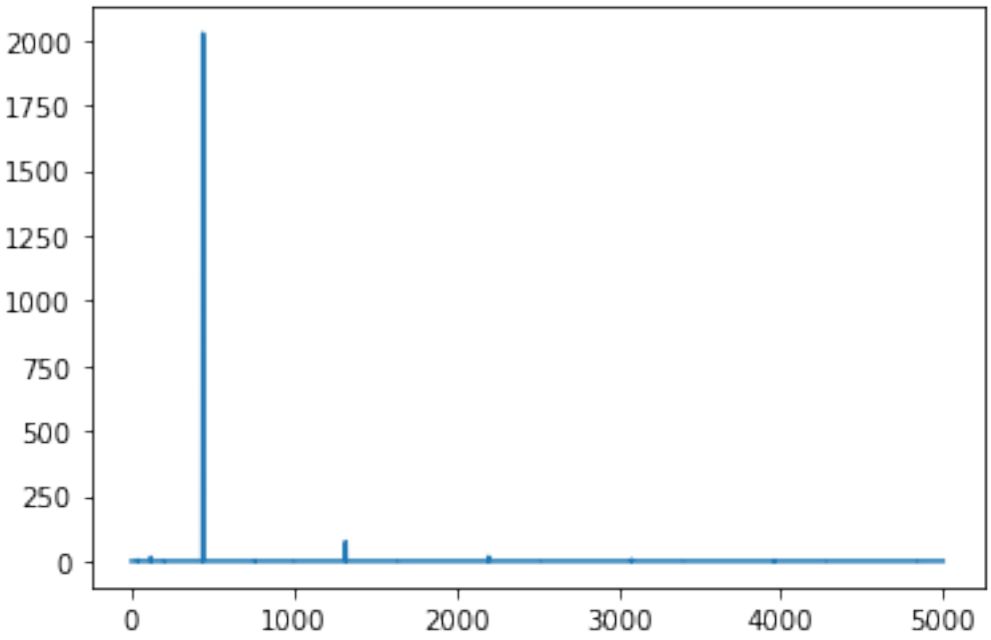
```
Writing output/square_origin.wav
Writing output/triangle_origin.wav
Writing output/sawtooth_origin.wav
```

[ ]:
```
def algorithm(spectrum):
    spectrum.hs[1:] = spectrum.hs[1:]/spectrum.fs[1:]
    spectrum.hs[0] = 0
    spectrum.scale(440) #          ==
```

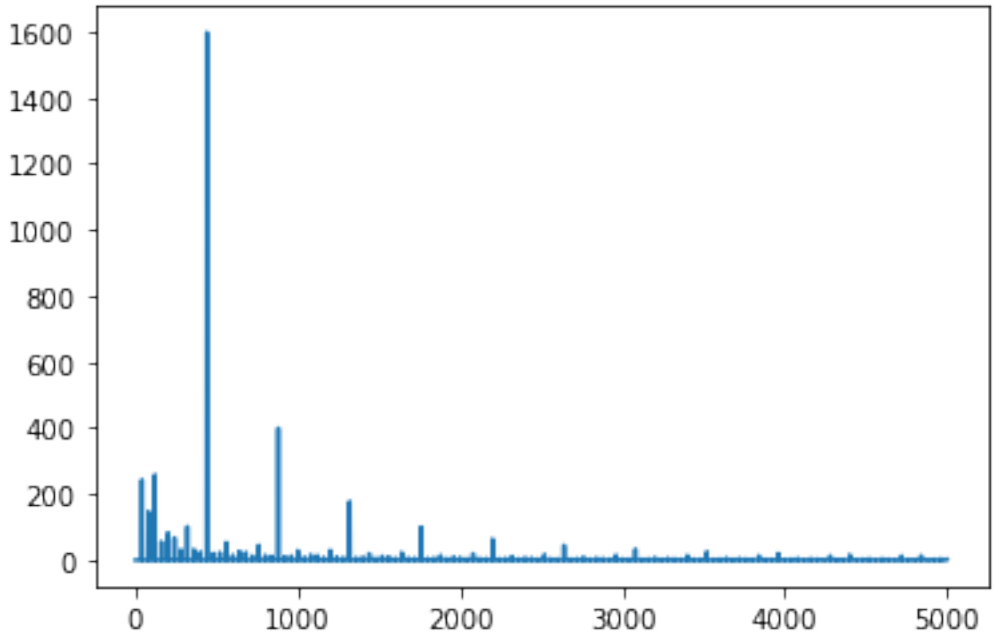
[ ]:
```
algorithm(spectrum_square)
spectrum_square.plot()
```



[ ]:
```
algorithm(spectrum_triangle)
spectrum_triangle.plot()
```



[ ]:
```
algorithm(spectrum_sawtooth)
spectrum_sawtooth.plot()
```



[ ]:
```
spectrum_square.make_wave().write('output/square_fix.wav')
spectrum_triangle.make_wave().write('output/triangle_fix.wav')
spectrum_sawtooth.make_wave().write('output/sawtooth_fix.wav')
```

```
Writing output/square_fix.wav
Writing output/triangle_fix.wav
Writing output/sawtooth_fix.wav
```

```
/Users/toby/MEGA/CGU/110-2 Signal and System/code/hw02/thinkdsp.py:1173:
UserWarning: Warning: normalizing before quantizing.
  warnings.warn("Warning: normalizing before quantizing.")
```

hs/fs will filter high frequency signal, which will remove aliasing signal. So sounds like only SinSignal wave.