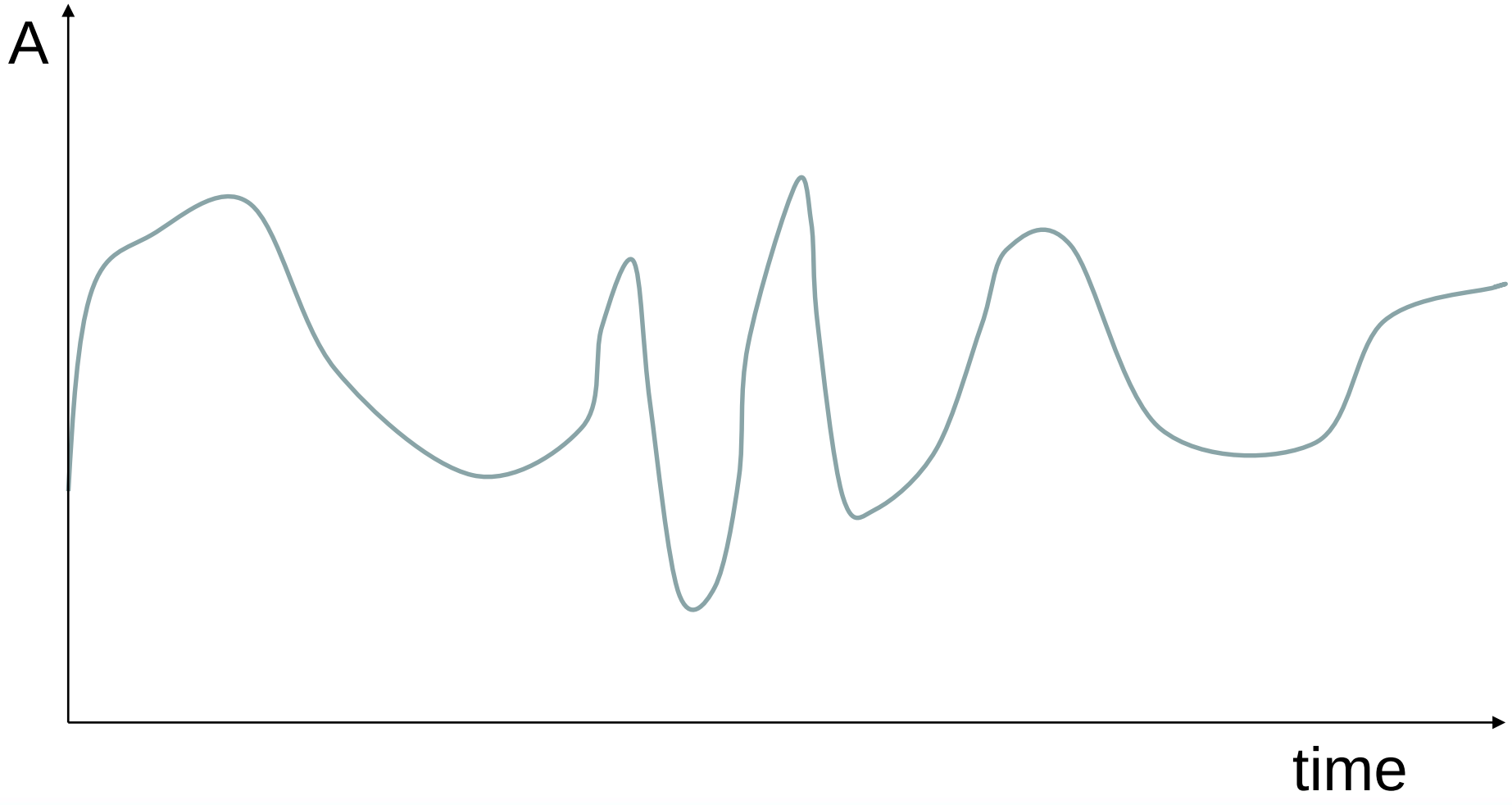
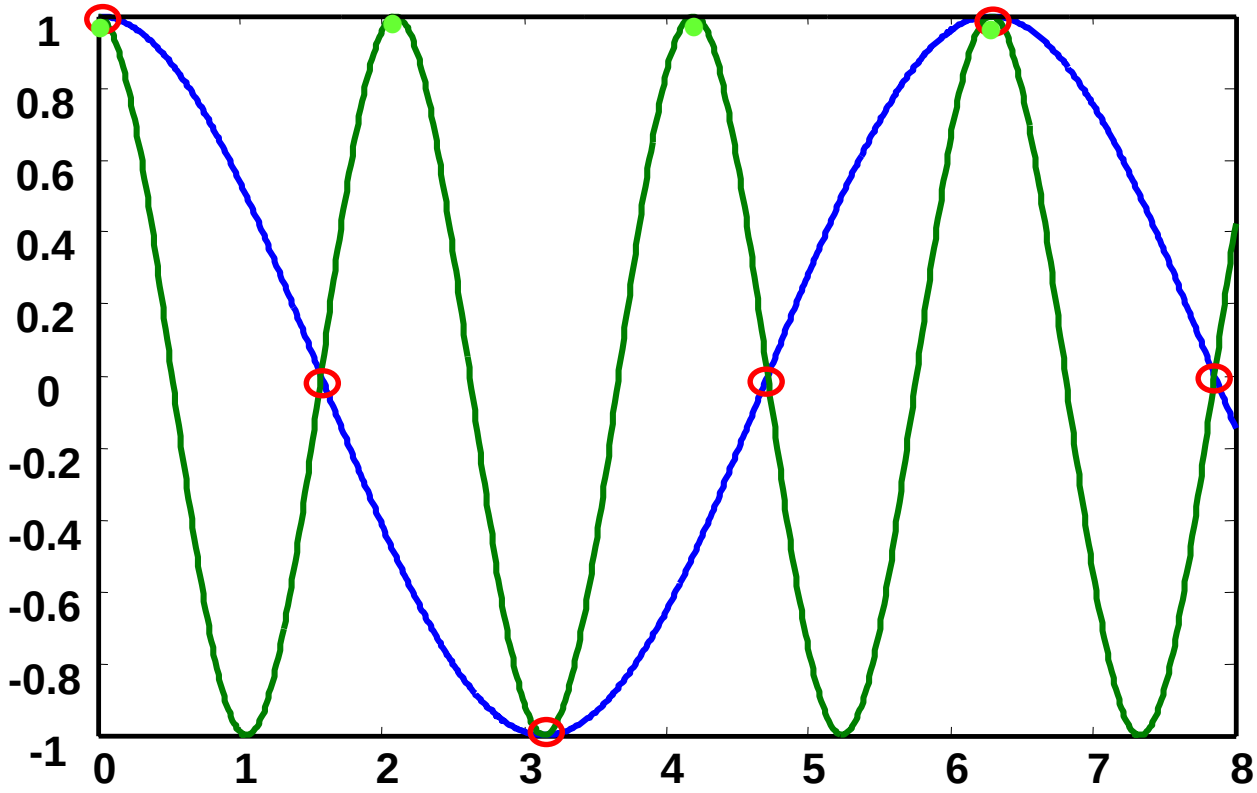
Signal sampling

- sampling period (Δt), frequency (f_s)



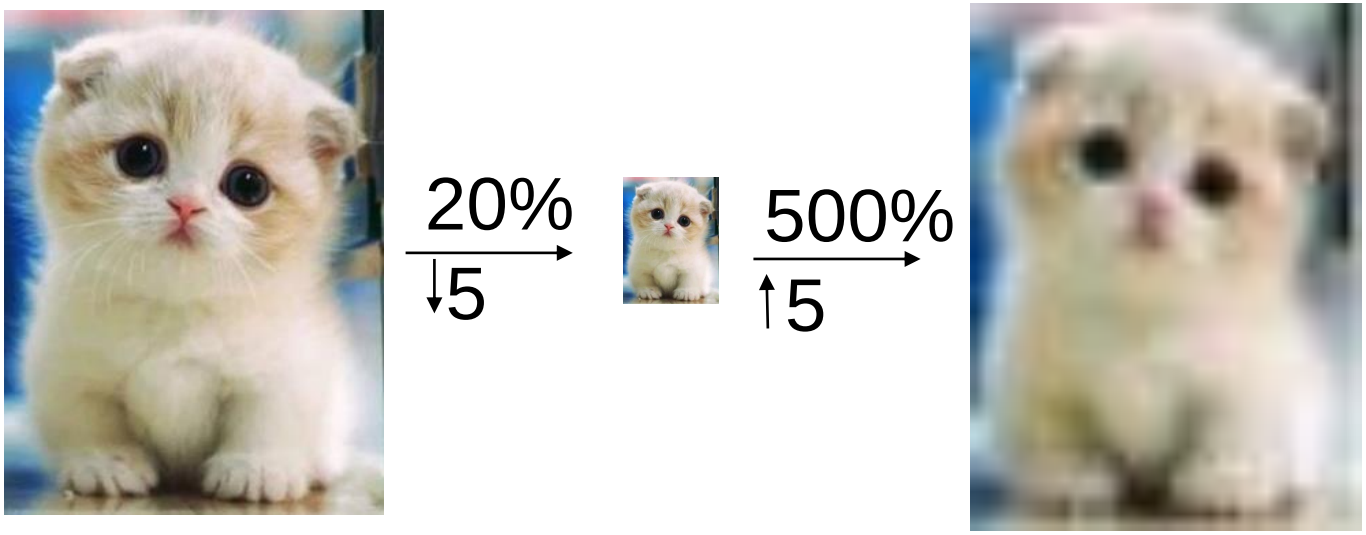

Przebiegi sygnałów w dziedzinie czasu (kanał lewy)
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
2.272
2.274
2.276
2.278
2.28
2.282
2.284
czas w sekundach

Aliasing



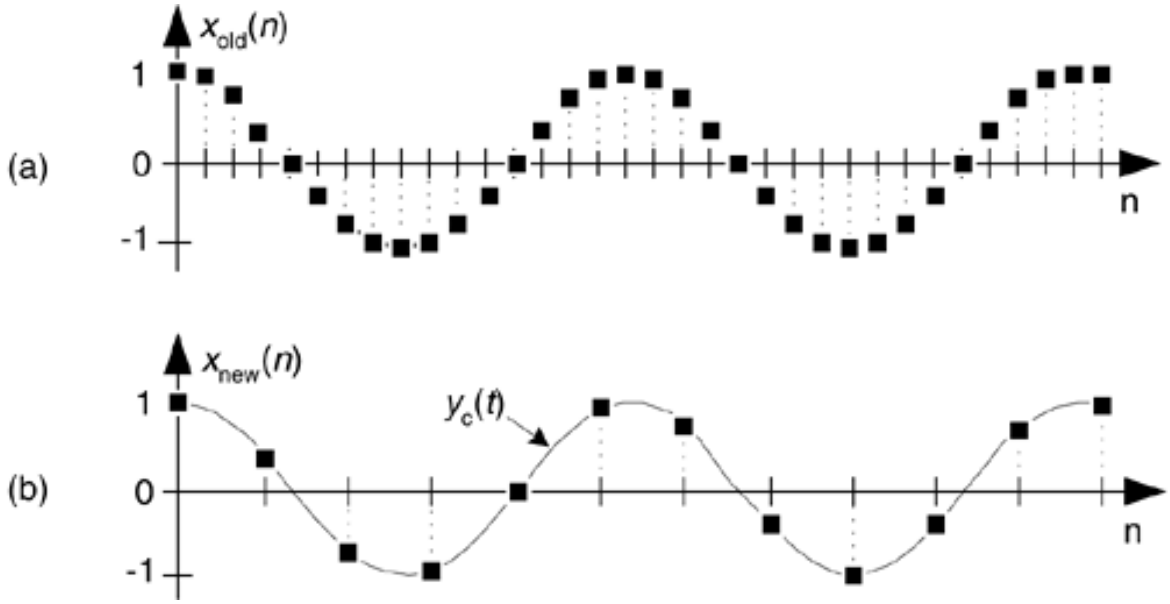
Resampling
Sampling rate conversion

- Changes signal representation sampling frequency
- Does not add information
- May reduce information (in downsamplig, decimation)
- Typical usecases: 48kHz <> 44.1kHz <> 16kHz <> 8kHz
- 720 <> 1080



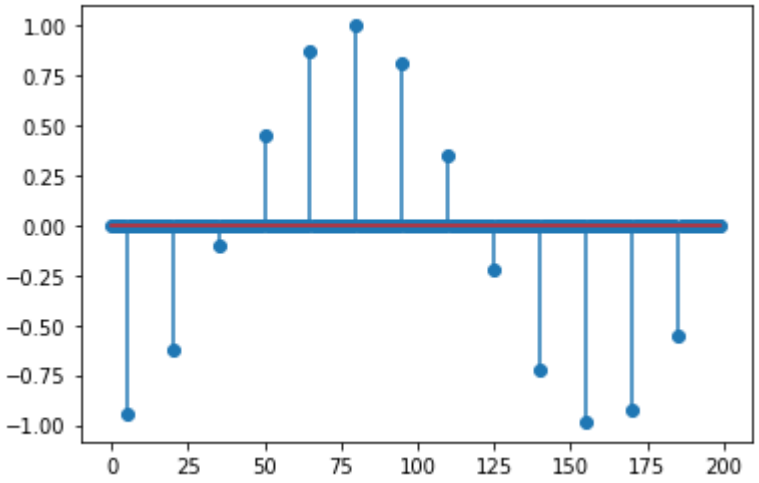
Decimation

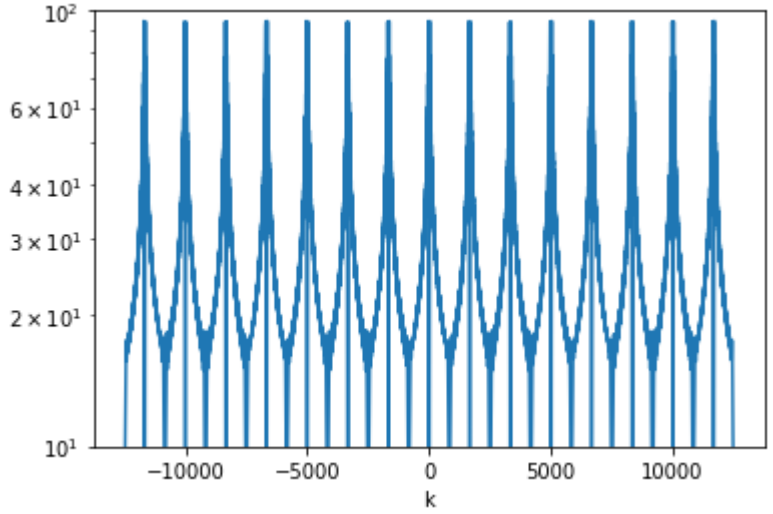
- Reduction of number of samples
- *N*-fold decimation (*N*=2, 3, 4, 5, …)



Sampling / N-fold decimation

- Keeps only every N-th sample
- Discard other samples
- ↓N, example below: N=15





Down-sampling

- Input signal at Fs (Hz)
- Atialiasing = Low-Pass Filtering $H_{LP}(z)$
- $F_c=F_s$ / N (Hz)
- Decimate by *N*
- New $F_s' = F_s/N$ (Hz)

Upsampling

- Inserting (M-1) zero samples between every two samples (creates comb-like signal)
- *M*-fold upsampling
- Cloning of spectra

1. Upsample signal using (*M*-1) zeros
2. Antialiasing using Low-Pass Filter $H_{LP}(z)$

   $F_c = F_s / 2$ Hz
3. New $F_s' = M * F_s$

Resampling

- „Almost” free change of the sampling rate of the signal
- Sampling Rate change possible only with M/N ratios (intiger ratios)

- First – upsample
- Second – downsample

- Do it in stages, to reduce filter order, and upsampling factors
- M/N = (M1*M2*M3*…) / (N1*N2*N3*…)