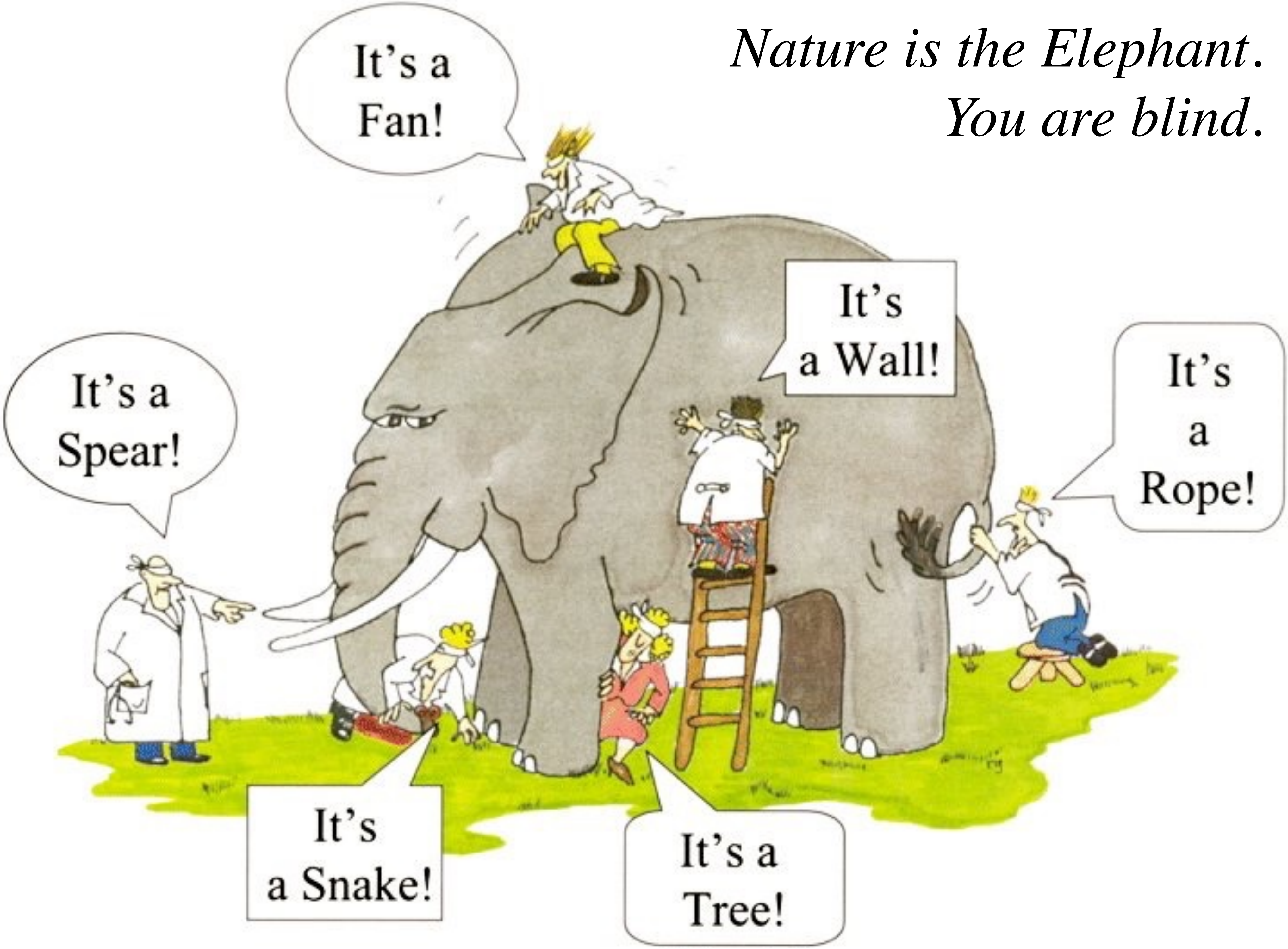
Nature is the Elephant.
You are blind.

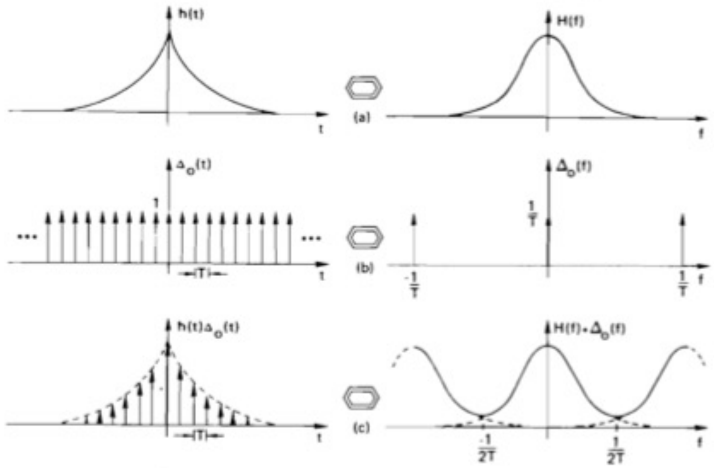


Discrete Fourier Transforms

Domains: Time, t Frequency, f

Elephant

Act-1



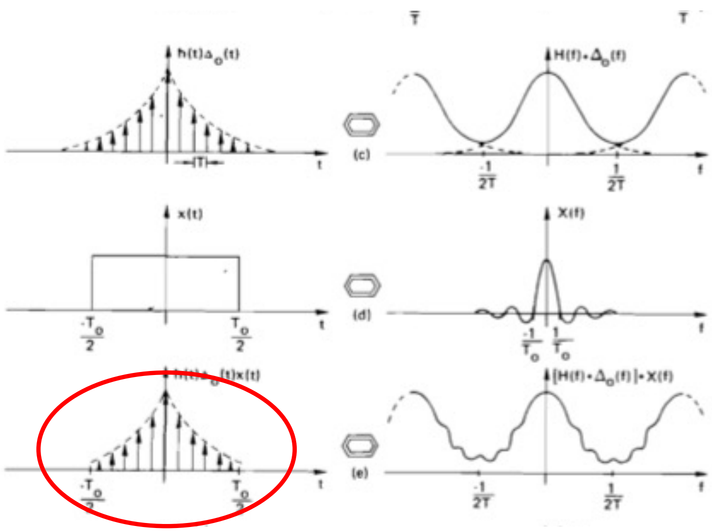
Contineous signal in t and f

Sifting via time step Δt

Sampled data in t

Discrete Fourier Transforms

Domains:	Time, t	Frequency, f



Sampled data in t

Act-2

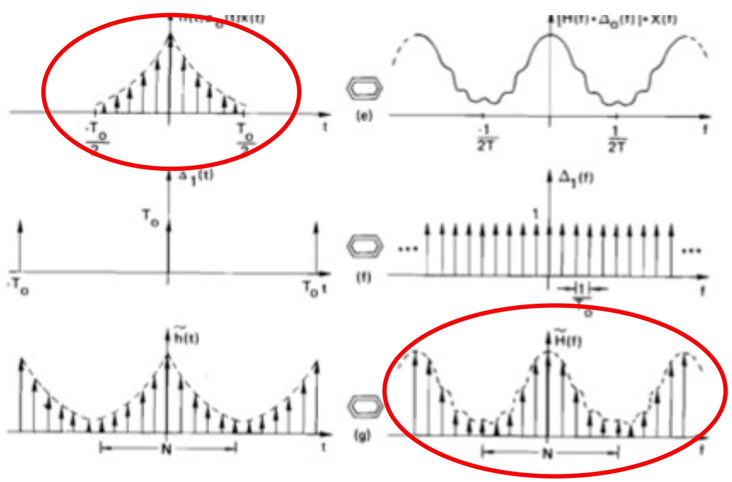
Finite record length T

Sampled data in t (finite)

Discrete Fourier Transforms

Domains:	Time, t	Frequency, f

Act-3



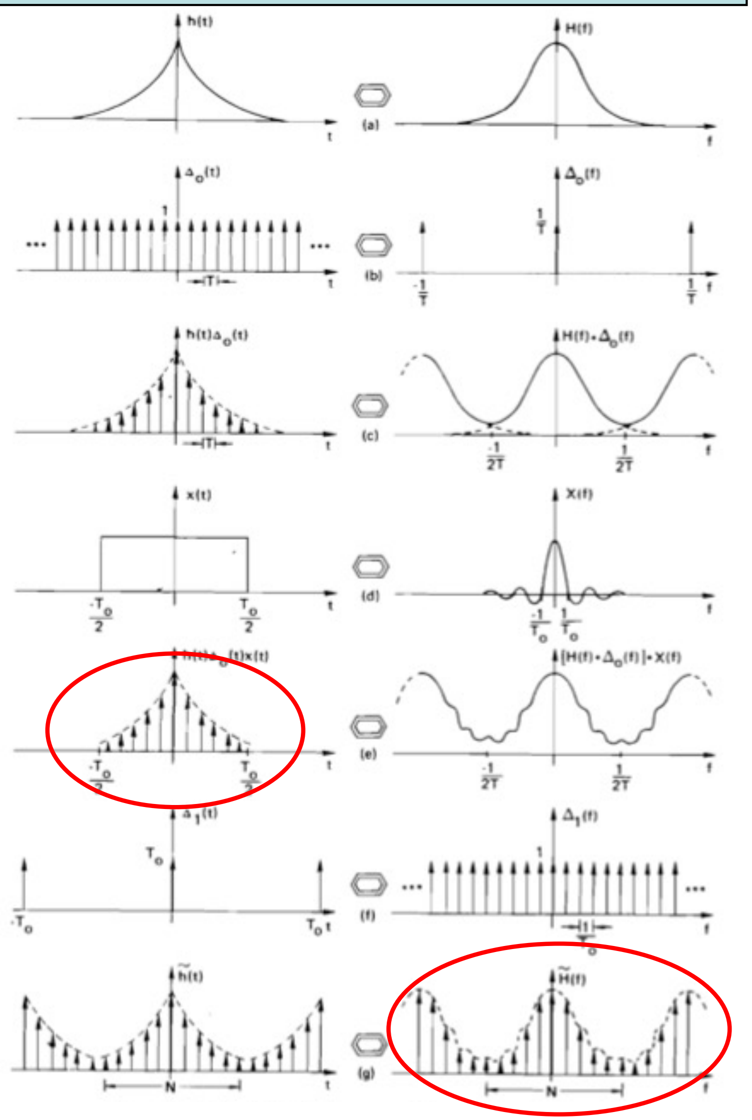
Sampled data in t (finite)

Sifting via frequency $\Delta f = 1/T$

Sampled data in t and f

Discrete Fourier Transforms

Domains:	Time, t	Frequency, f



Elephant — Contineous signal in t and f

Act-1 — Sifting via time step Δt

Sampled data in t

Act-2 — Finite record length T

Sampled data in t (finite)

Act-3 — Sifting via frequency $\Delta f = 1/T$

Sampled data in t and f

Frequency Convolution Theorem

continеous signal

sampling delta-functions

sampled data

sampled FT

Fourier Transform Pairs

Fourier Transform Pairs

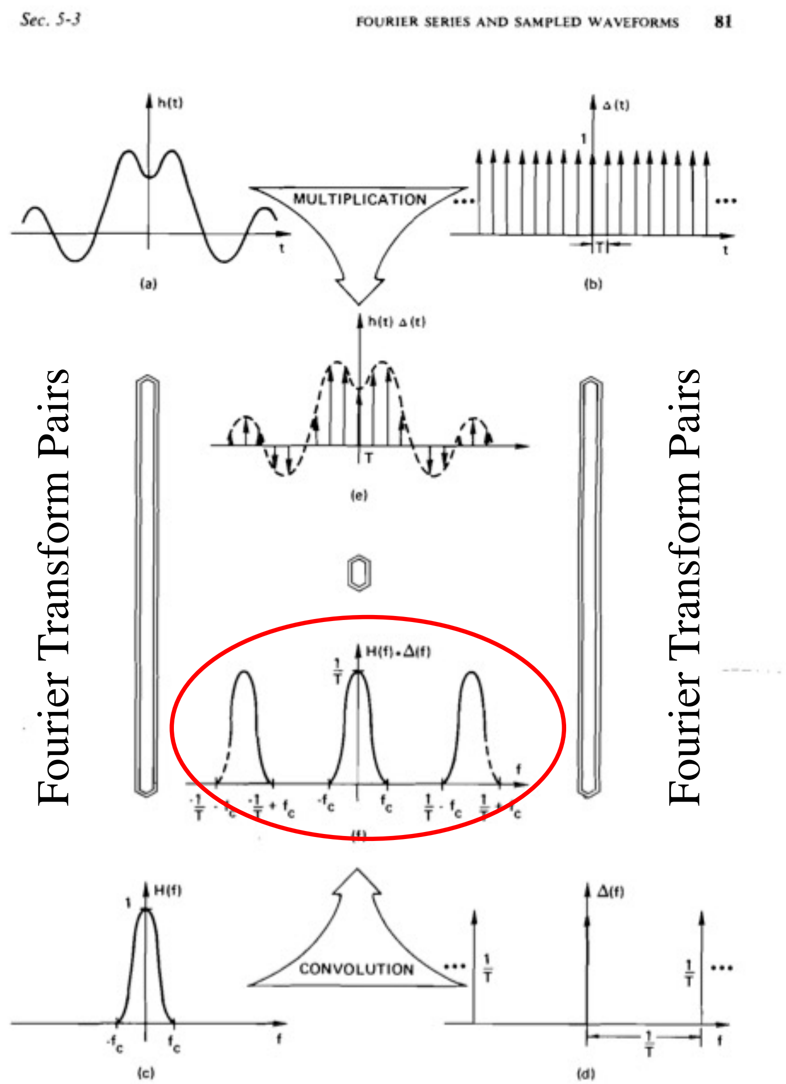


Figure 5-3. Graphical frequency convolution theorem development of the Fourier transform of a sampled waveform.

adapted from Brigham (1974)

Aliasing

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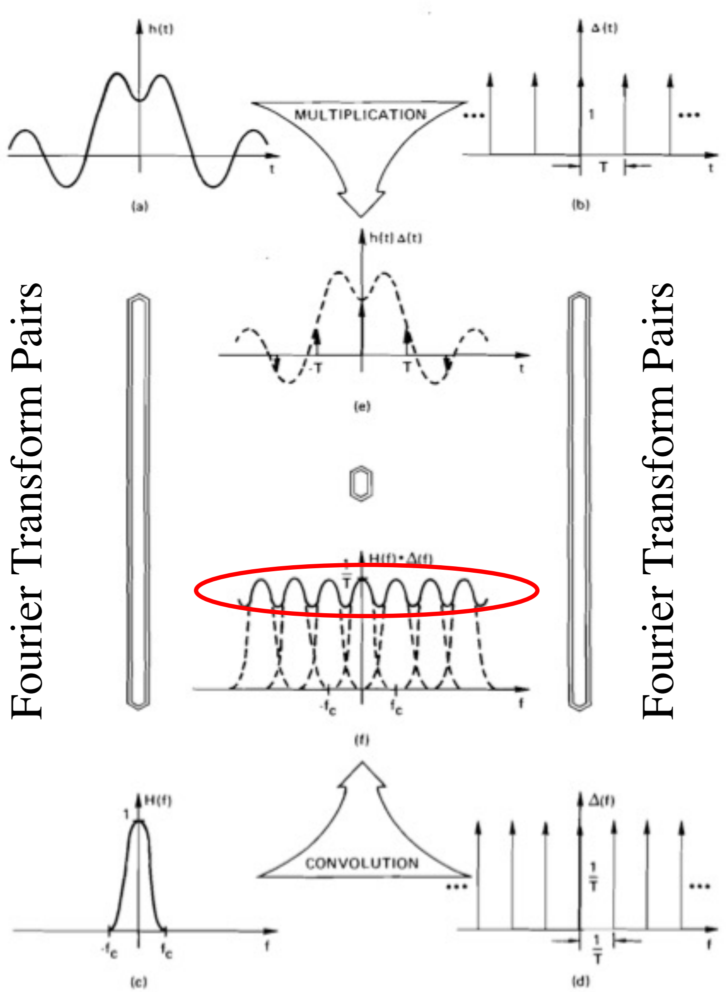
contineous signal

sampling delta-functions



sampled data

sampled FT

Figure 5-4. Aliased Fourier transform of a waveform sampled at an insufficient rate.

adapted from Brigham (1974)

Optimal Sampling at Nyquist Frequency $\Delta f = 1/2\ \Delta t$

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continеous signal

sampling delta-functions

sampled data

sampled FT

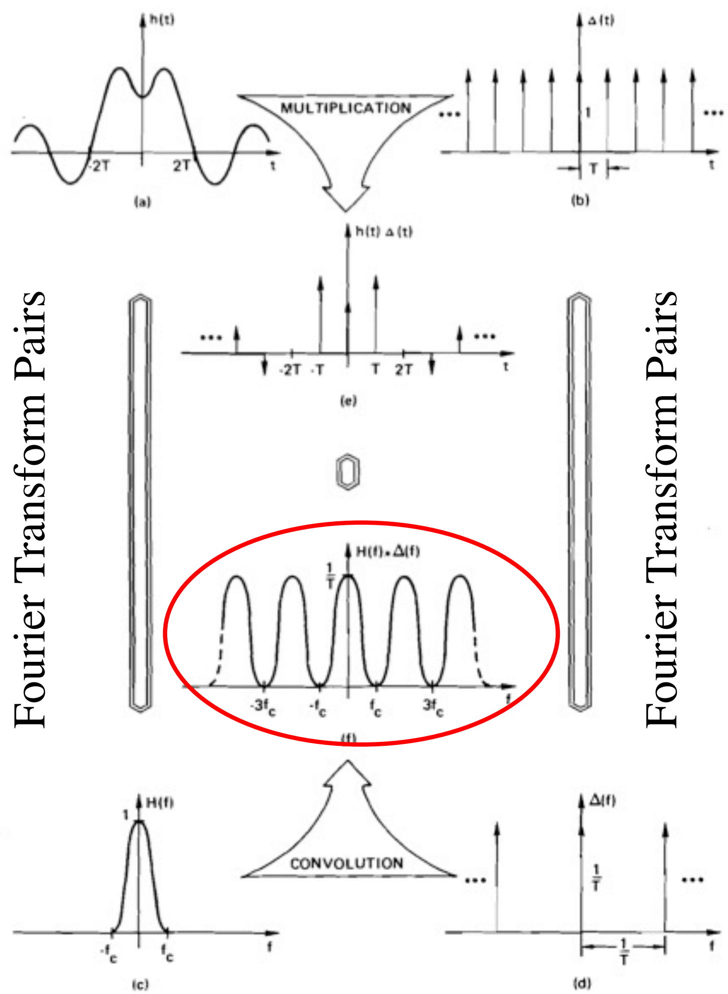

Figure 5-5. Fourier transform of a waveform sampled at the Nyquist sampling rate.

adapted from Brigham (1974)

Sampling Theorem

resolved frequencies
(band-limited signal)

Sampled signal
(time step)

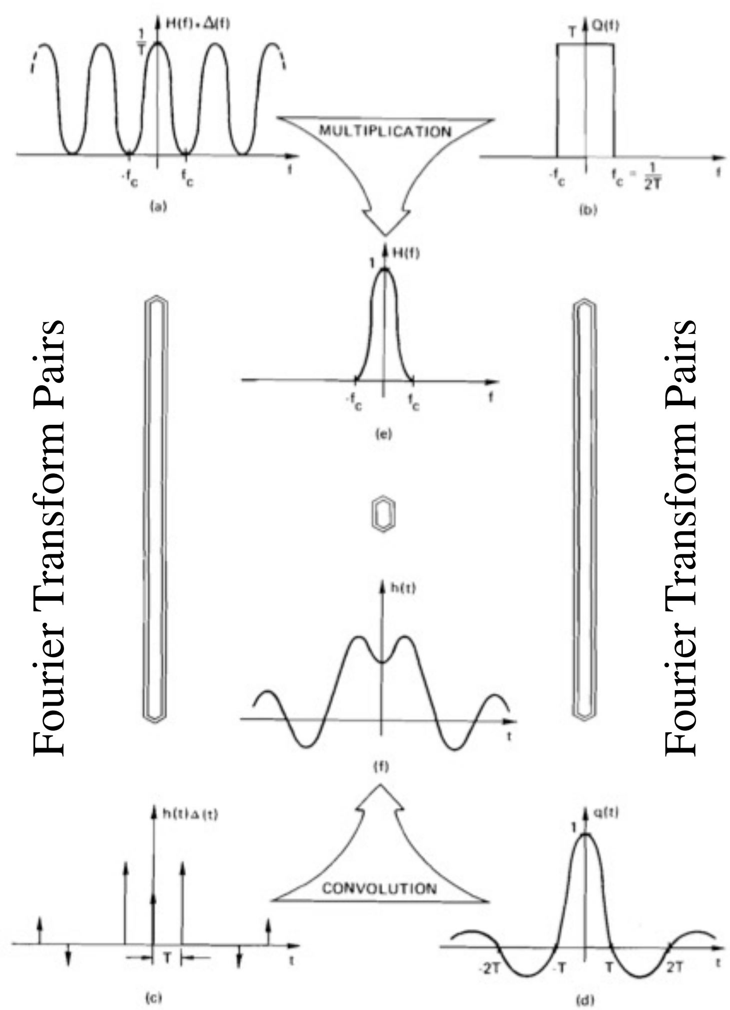

Figure 5-6. Graphical derivation of the sampling theorem.

adapted from Brigham (1974)