

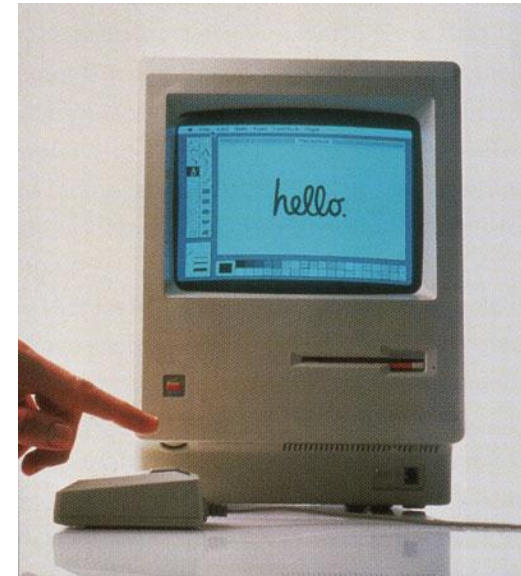
4202 Digital Multimedia

Lecture 1

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What is Multimedia?

- “Multimedia” has no strict definition.
- Multimedia is a computer technology (multimedia computing) for more efficient utilization, communication, and use of different media types:
 - Text
 - Audio and speech
 - Images
 - Graphics
 - Video



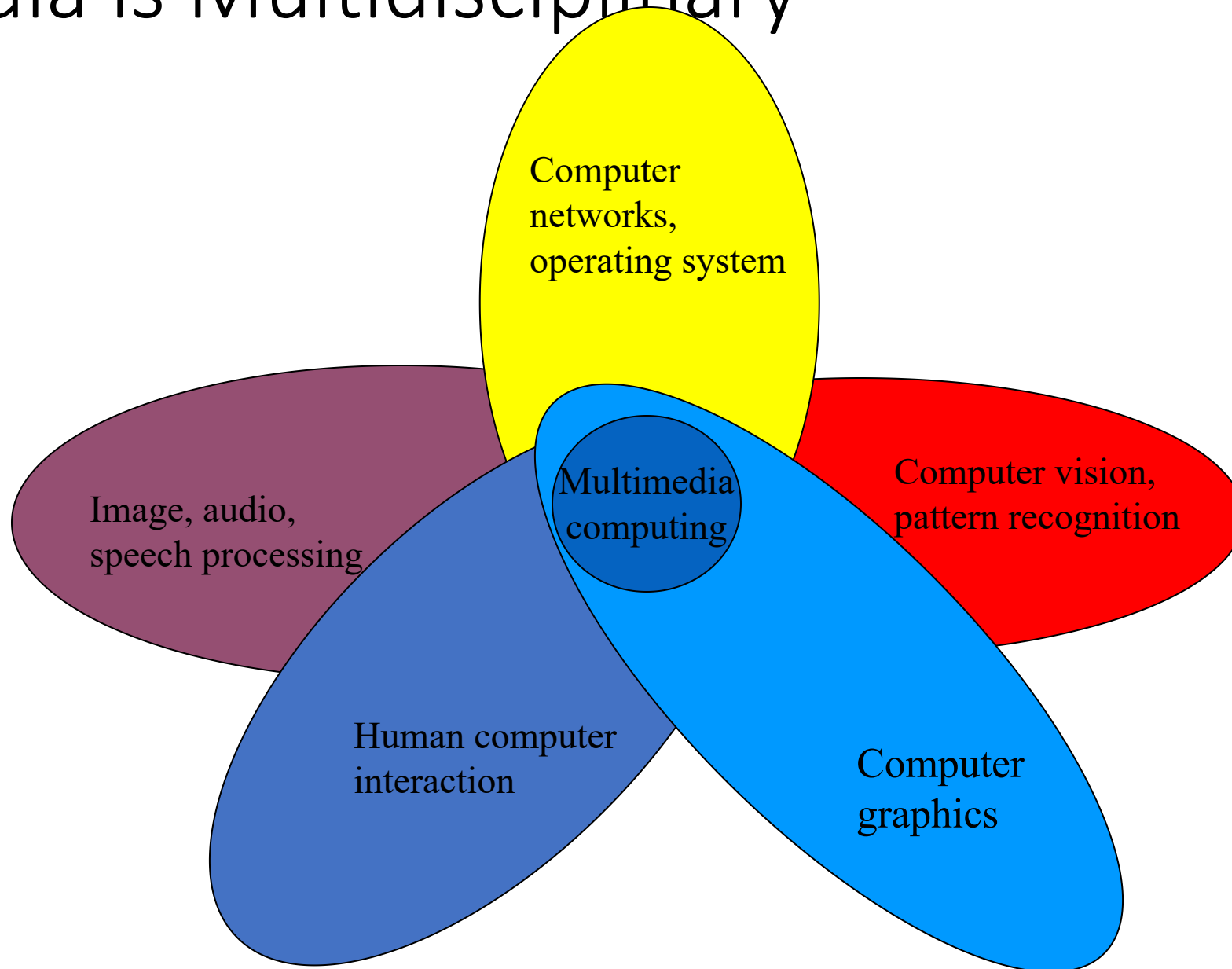
Multimedia System

- Multimedia involves more than simple addition of new data types.
- It integrates a wide range of symbol modes simultaneously into a coherent framework.
- The framework is usually denoted as a multimedia system.

Challenges of Multimedia Computing

- Developing a successful multimedia system is non-trivial.
 - Continuous media types such as video need a lot of space to store and very high bandwidth to transmit.
 - They also have tight timing constraints.
 - Automatically analyzing, indexing and organizing information in audio, image and video is much harder than from text.
 - Multimedia involves many different research areas and needs more complex and more **efficient** algorithms and hardware platforms.

Multimedia is Multidisciplinary



Multimedia Computing

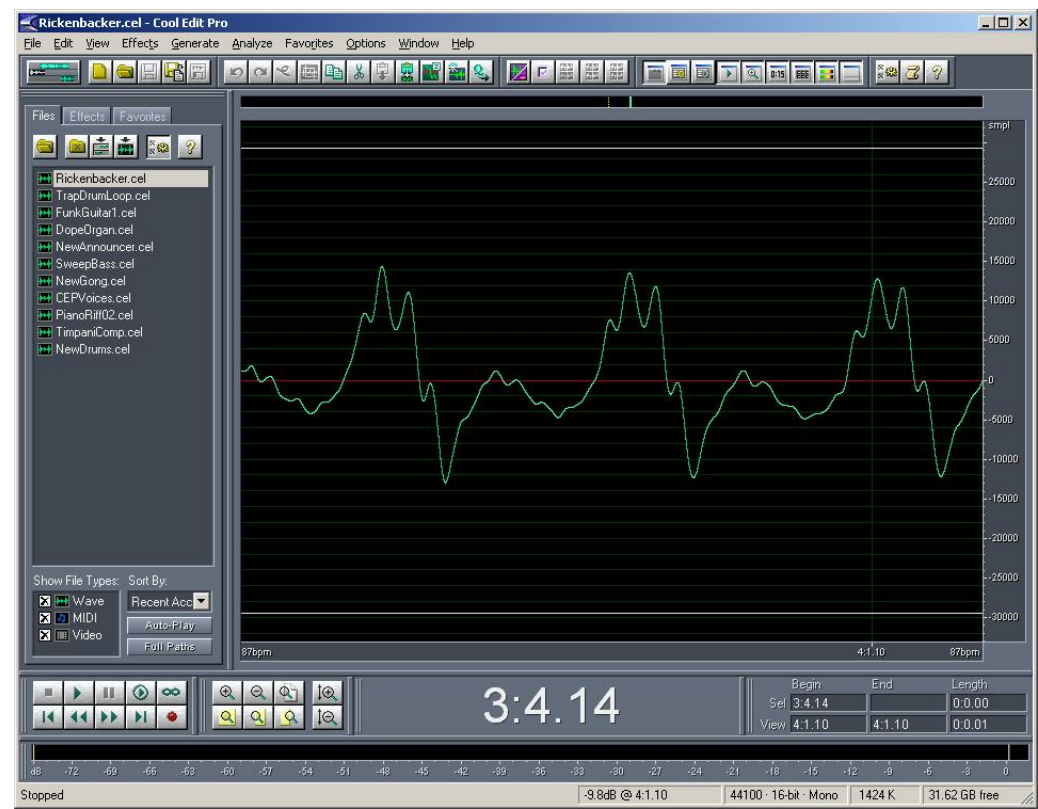
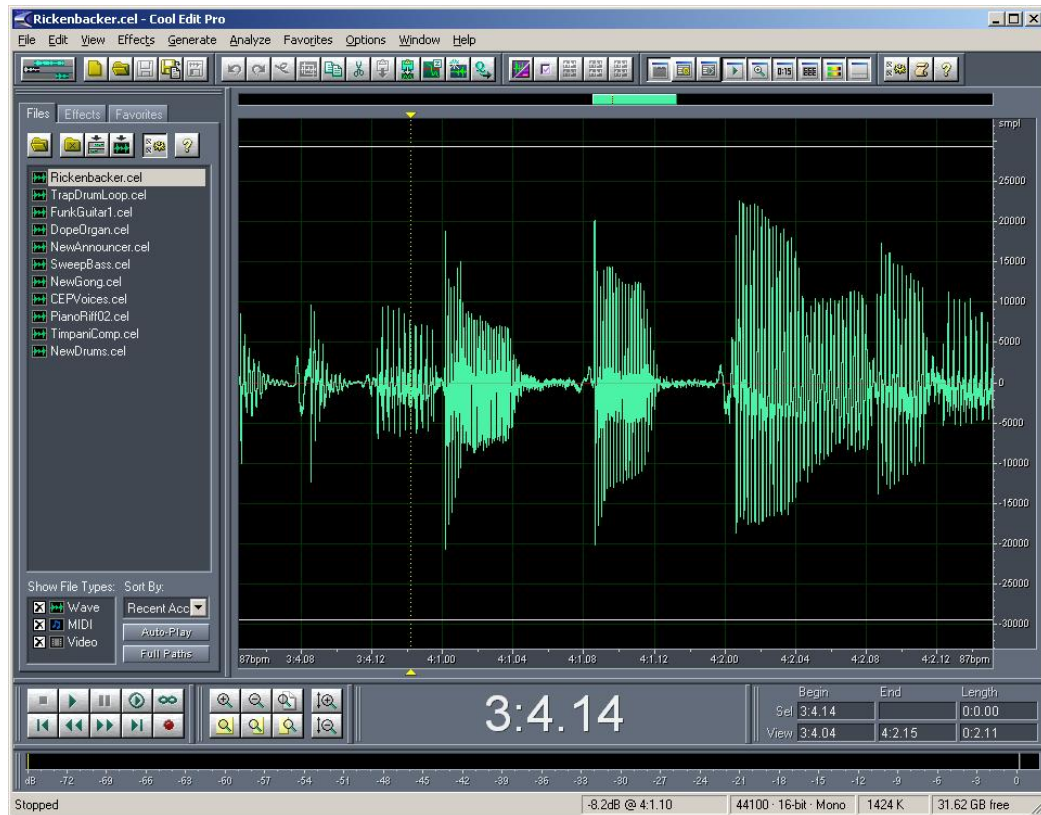
Multimedia systems Basic Topics Domains /(What are planed to study):-

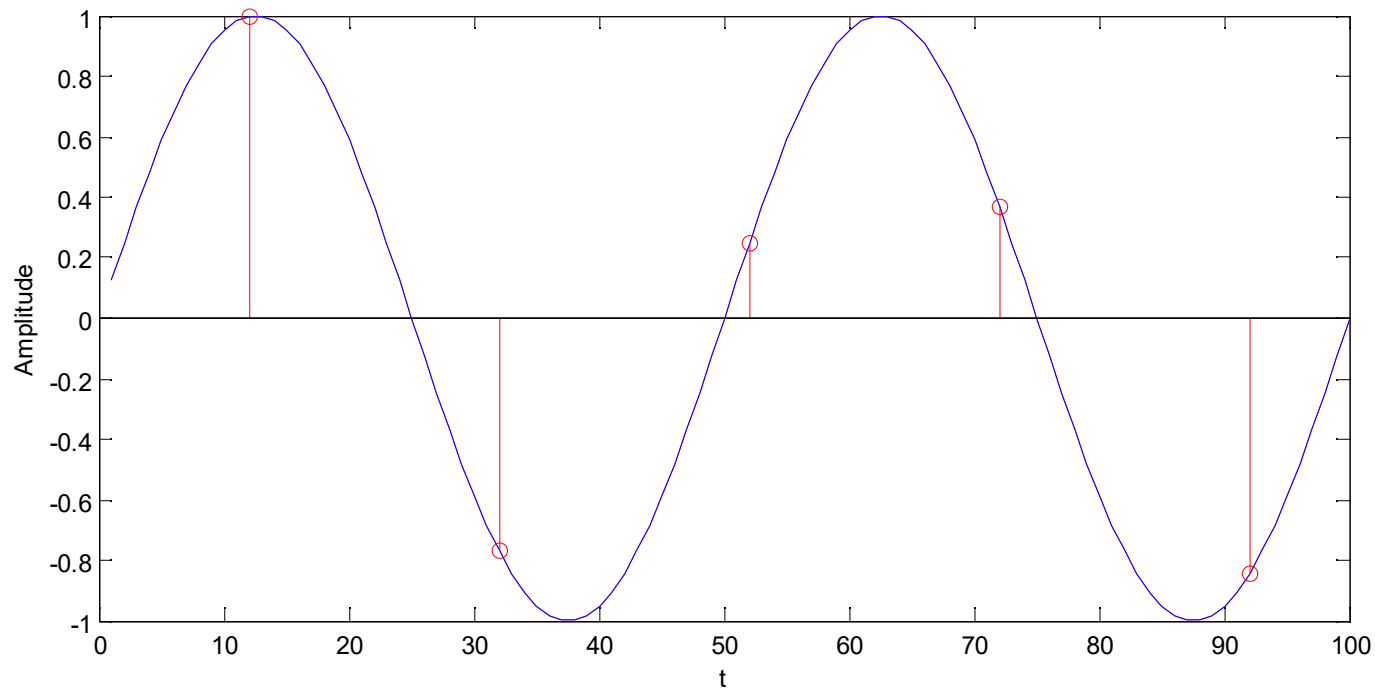
- **Multimedia data Acquisition.**
- **Multimedia data representation and compression.**
- Multimedia data processing and analysis.
- Transmitting multimedia data through communication networks.
- **Multimedia database, indexing and retrieval.**
- **Water marking of multimedia files**

Digital Media Capturing

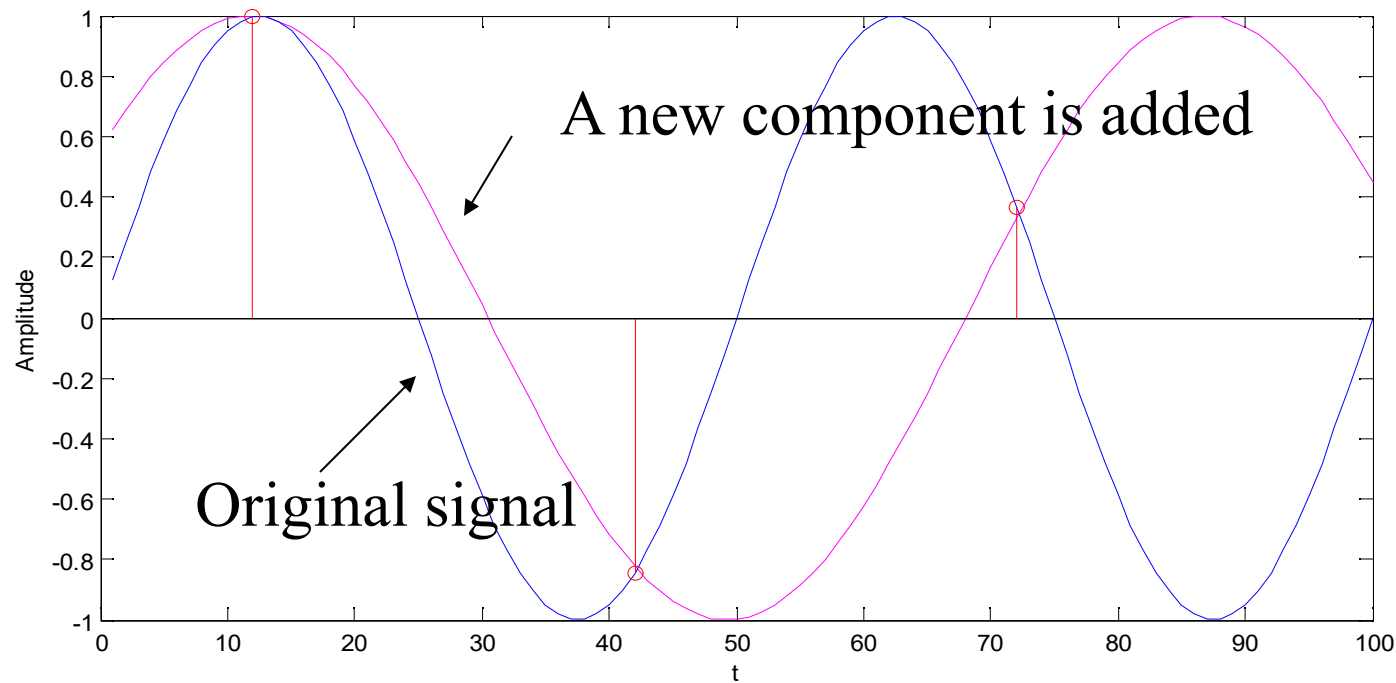
- To get a digital image, an audio or a video clip, we need some media capturing device such as
 - a digital camera or a scanner,
 - a digital audio recorder,
 - or a digital camcorder.
- All these devices have to complete tasks:
 - Sampling: To convert a continuous media into discrete formats.
 - Quantization: To convert continuous samples into finite number of digital numbers.
 - There are probably some further compression process.

An Audio Signal



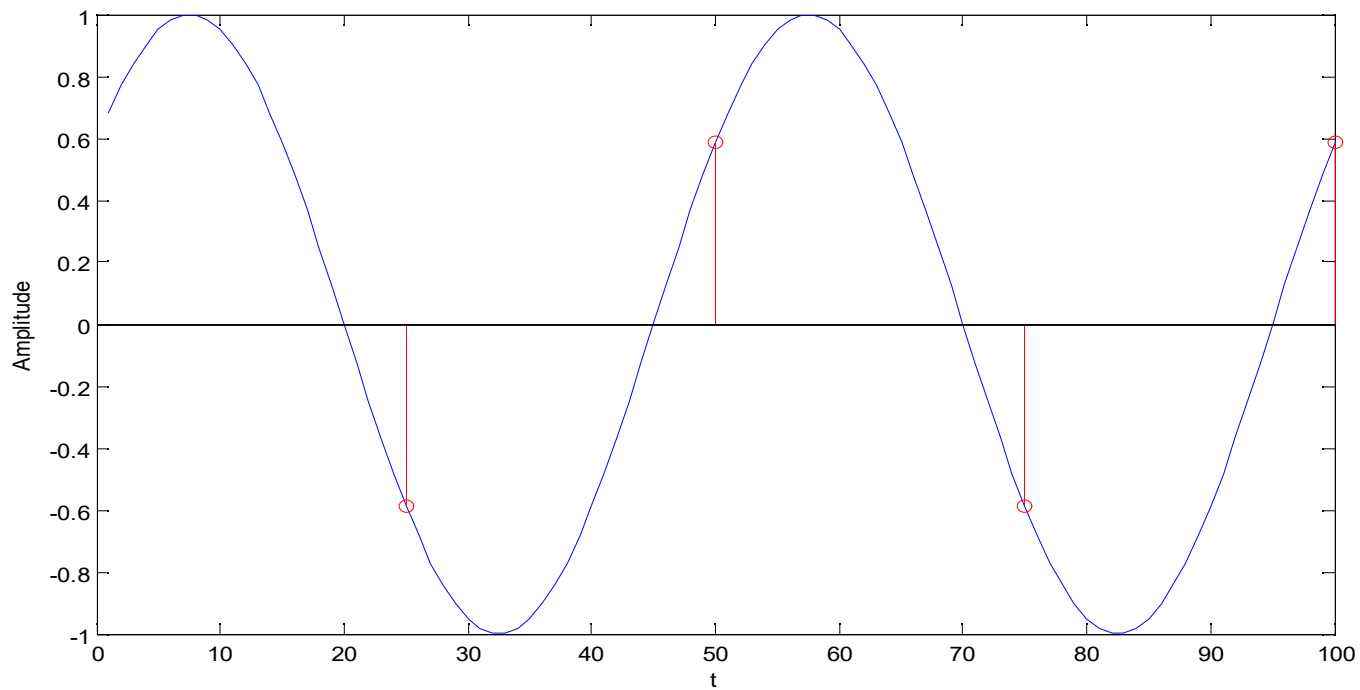


$$f_s = 2.5f$$

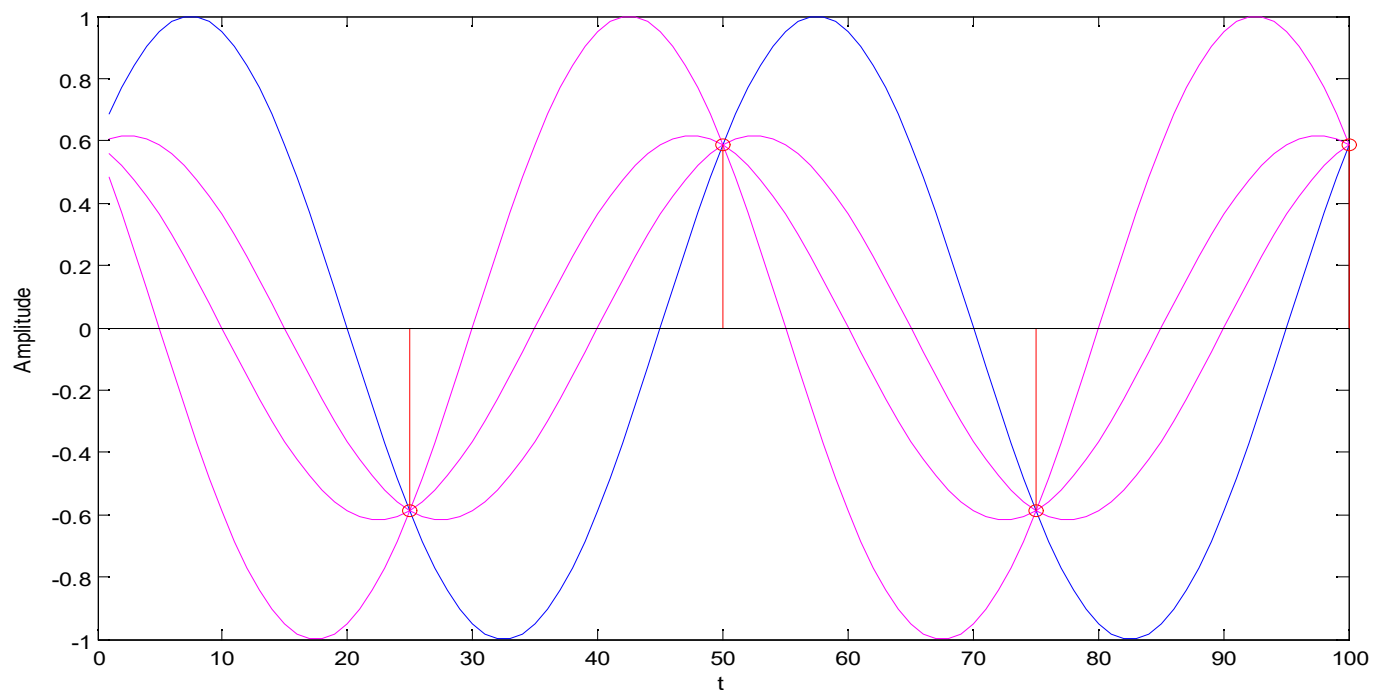


$$f_s = 1.67f$$

This is denoted
as aliasing.

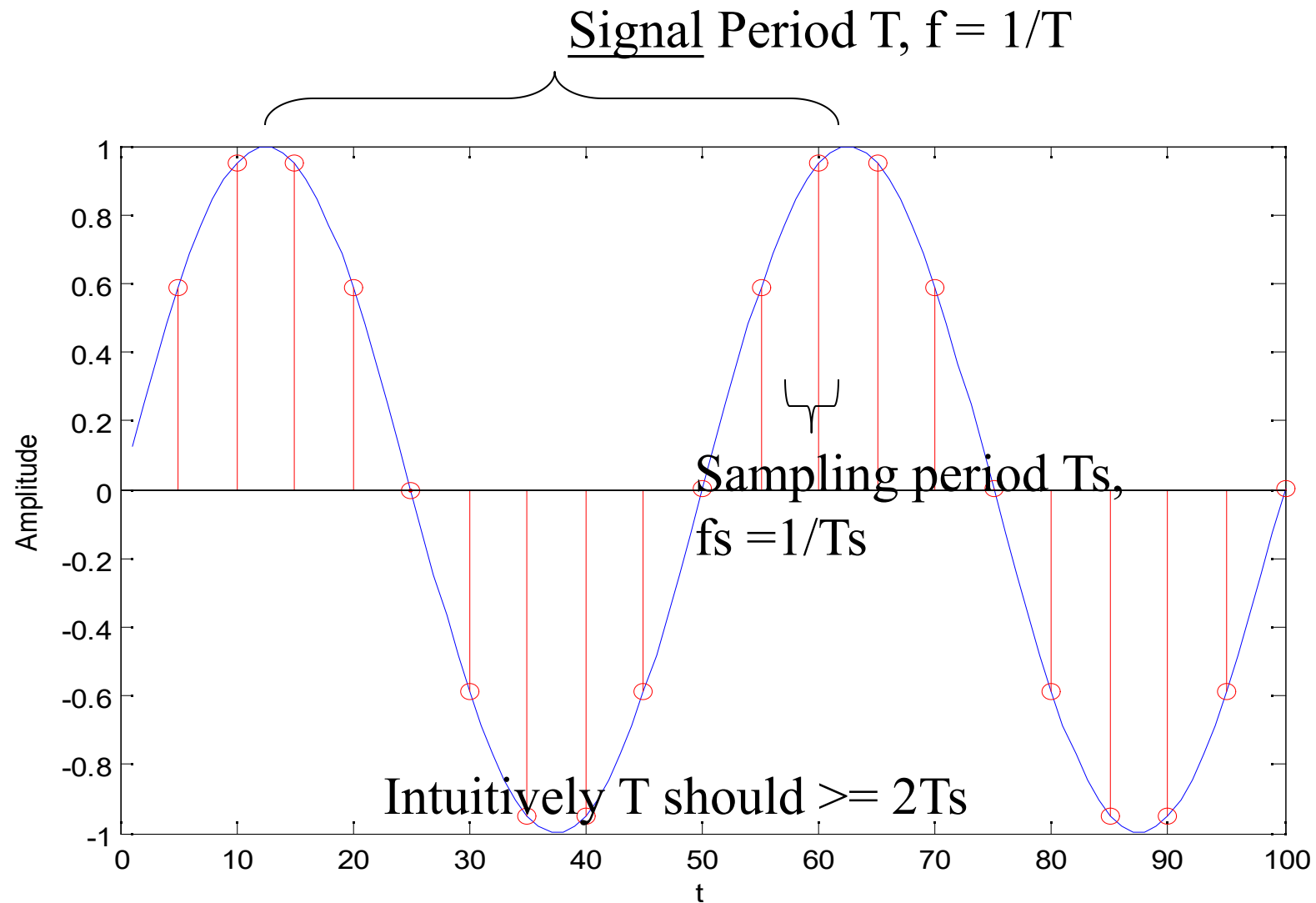


$$f_s = 2f$$



There are
infinite number
of possible sin
waves going through
the sampling points

Sampling for an Audio Signal



Frequency Decomposition

- Any signal can be represented as the summation of sin waves (possibly infinite number of them).
- We can use “Fourier Transform” to compute these frequency components.
- We can now extend our analysis to any signals.
- *If we have a signal has frequency components $\{f_1 < f_2 < f_3 \dots < f_n\}$ so what is the minimum sampling frequency we should use?*

Nyquist Theorem

- Nyquist theorem
 - The necessary condition of reconstructing a continuous signal from the sampling version is that the sampling frequency

$$f_s > 2f_{\max}$$

f_{\max} is the highest frequency component in the signal.

- If a signal's frequency components are restricted in $[f_1, f_2]$, we need $f_s > 2(f_2 - f_1)$.