Multiple-Choice Questions (MCQs) for Module 1: Audio Signals Fundamentals

Sampling and Analog-to-Digital Conversion

1. What does sampling rate refer to?
a) Number of amplitude levels
b) Number of samples per second (Hz)
c) Duration of the recorded audio
d) Loudness of the audio

2. According to the Nyquist theorem, if the highest frequency in a signal is 10 kHz, what is the minimum required sampling rate?
a) 5 kHz
b) 10 kHz
c) 15 kHz
d) 20 kHz

3. Which artifact occurs if the sampling rate is too low?
a) Distortion
b) Aliasing
c) Clipping
d) Quantization noise

4. The Nyquist frequency is defined as:
a) Half the sampling rate
b) Twice the sampling rate
c) Equal to sampling rate
d) The highest frequency captured exactly

5. An anti-aliasing filter:
a) Removes low frequencies
b) Removes frequencies above the Nyquist frequency
c) Enhances high-frequency content
d) Increases bit depth

Bit Depth and Quantization

6. Bit depth controls:
a) Sampling rate
b) Frequency resolution
c) Amplitude resolution
d) Maximum frequency

7. How many discrete amplitude levels can 8-bit audio represent?
a) 8
b) 16
c) 128
d) 256

8. What happens when audio bit depth is very low (e.g., 8-bit)?
a) Higher dynamic range
b) Audible quantization noise
c) Clearer audio
d) Higher maximum frequency

9. Each additional bit in bit depth roughly adds how much dynamic range?
a) 1 dB
b) 3 dB
c) 6 dB
d) 12 dB

10. What does quantization error refer to?
a) Errors in the timing of samples
b) Errors due to rounding amplitude levels
c) Errors in microphone placement
d) Errors in frequency selection

Amplitude and Decibels (dB)

11. In digital audio, 0 dBFS refers to:
a) Absolute silence
b) Maximum possible amplitude
c) Minimum audible amplitude
d) Reference amplitude for loudness

12. Doubling amplitude corresponds to approximately what dB increase?
a) 3 dB
b) 6 dB
c) 10 dB
d) 12 dB

13. A sound at -12 dBFS compared to one at -6 dBFS is:
a) Louder
b) The same loudness
c) Half the amplitude
d) Twice the amplitude

14. Decibels are measured on what type of scale?
a) Linear
b) Exponential
c) Logarithmic
d) Quadratic

15. Which unit represents digital audio amplitude?
a) dB SPL
b) dBFS
c) dBm
d) Hz

Frequency and Pitch

16. Frequency is measured in:
a) Decibels
b) Seconds
c) Hertz
d) Bits

17. A tone of 500 Hz compared to 250 Hz is perceived as:
a) Lower pitch
b) Same pitch
c) Higher pitch
d) Same loudness

18. Humans generally hear frequencies in what range?
a) 20 Hz to 2 kHz
b) 100 Hz to 10 kHz
c) 20 Hz to 20 kHz
d) 1 kHz to 100 kHz

19. The fundamental frequency of speech primarily determines:
a) Loudness
b) Pitch
c) Formant structure
d) Amplitude resolution

20. What are harmonics in audio signals?
a) Frequencies below the fundamental frequency
b) Integer multiples of fundamental frequency
c) Unrelated background noises
d) Frequencies above human hearing

Voice Characteristics

21. An adult male's typical fundamental frequency is around:
a) 60 Hz
b) 120 Hz
c) 500 Hz
d) 1000 Hz

22. Children's voices differ from adults' mainly because:
a) Their vocal folds vibrate more slowly
b) Their vocal tract resonances (formants) are lower
c) Their fundamental and formant frequencies are higher
d) They produce fewer harmonics

23. Formants are:
a) Low-frequency noise
b) High-frequency harmonics only
c) Vocal tract resonance frequencies
d) Related to loudness only

24. What most strongly influences voice timbre?
a) Sampling rate
b) Fundamental frequency alone
c) Vocal tract resonances (formants)
d) Bit depth

25. Which statement about adult female voices compared to male voices is typically true?
a) Lower pitch and formants
b) Higher pitch and formants
c) Same pitch, different formants
d) Higher pitch, lower formants

General Audio Processing Concepts

26. Dynamic range in audio signals describes:
a) Range between the lowest and the highest frequency
b) Range between the quietest and the loudest sound
c) Number of bits per second
d) Frequency spectrum spread

27. Which factor primarily determines the highest frequency captured in digital audio?
a) Bit depth
b) Sampling rate
c) Dynamic range
d) Audio length

28. Which type of noise is directly introduced by low bit depth?
a) Aliasing
b) Quantization noise
c) White noise
d) Hum noise

29. In digital audio, if amplitude exceeds 0 dBFS, what happens?
a) Louder sound without issues
b) Clipping distortion occurs
c) Audio improves clarity
d) Frequency decreases

30. Which describes a higher sample rate's effect within audible range (20 Hz–20 kHz)?

a) Improved frequency response for human hearing

b) Improved amplitude resolution

c) No audible improvement if above Nyquist requirement

d) Increased loudness