

1. Psychoacoustic

1. Human hearing

- (a) What is the frequency range of human sound perception?
- (b) What is the frequency range of the speech?
- (c) In the above specified range where is the human hearing the most sensitive?
- (d) Explain how the absolute threshold of hearing has been obtained.

2. Masking

- (a) What is frequency-domain masking?
- (b) What is a critical band and why is it needed for frequency masking phenomena?
- (c) Consider a_i and f_i to be respectively the amplitude and the frequency of a partial at index i and $V(a_i)$ to be the corresponding volume in dB. The difference between the level of the masker and the masking threshold is -10 dB. The masking curves towards lower and higher frequency are described respectively by left slope (27 dB/Bark) and right slope (15 dB/Bark). Explain the main steps of the frequency masking in this case and show with plots how this masking phenomena is achieved.
- (d) What are the psychoacoustic parameters used for lossy audio coding?
- (e) How can we explain the temporal masking and what is its duration after stop- ping the active masker?

2. Audio Coding

- 1. Explain the lossless coder and decoder.
- 2. What is the achievable compression factor for lossless coding?
- 3. Explain the MPEG-1 Layer III coder and decoder.
- 4. Explain the MPEG-2 AAC coder and decoder.
- 5. What is temporal noise shaping?
- 6. Explain the MPEG-4 coder and decoder.
- 7. What is the benefit of SBR?