

**EBU5303 Multimedia Fundamentals**

# Worksheet 4: Perceptual Encoding, Digital Broadcasting

## Question 1. Do you remember?

1. What is psychoacoustics and how does it contribute to sound compression?
2. Define the threshold of hearing in quiet.
3. Define digital broadcasting.
4. What compression standard is used for source coding in DVB-S?

## Question 2. Do you understand?

1. With A-law coding, larger signals are represented with greater precision (more bits) than smaller signals. Is this statement true or false? Justify your answer.
2. Explain why frequency masking raises the threshold of hearing.
3. Explain using your own words the following terms: source coding, transport stream and channel coding.
4. Explain how the Reed-Solomon Error Protection scheme works.

## Question 3. Can you apply your knowledge?

1. Say that an uncompressed band value is 10,000 and values from all bands are quantised by dividing by 128 and rounding down. What is the quantisation error? Show your calculations. Now suppose that this band requires less precision because of a strong masking tone, and that it should be scaled by a factor of 0.1. Recalculate the quantisation error.
2. With an MP3 bitrate of 128 kbit/s, calculate the compression ratio that is achieved on a CD quality digital audio signal.

c) Assuming a symbol rate of 27.5 MS/s, QPSK modulation, Reed-Solomon code with rate (204, 188), and a code rate of ¾ are used, calculate the bit stream net data rate. Show your calculations.

## Question 4. Can you analyse and/or evaluate?

1. There are 24 critical bands in the human hearing range, but critical bands for low frequencies are narrower than those for high frequencies. What is this statement telling us about the human ability to distinguish between frequencies?
2. In MP3, one way to reduce the amount of data in the compressed signal is to use scaling factors that increase the quantisation error where it doesn’t matter. How can you find the parts of the signal that will be multiplied by a large scaling factor?
3. Evaluate the importance of using standards in digital broadcasting.

## Question 5. Can you create?

1. Find mp3 files of different music genres and using MATLAB print their respective spectrograms. Comment what you see.
2. Devise a pseudo code to perform MP3 decoding (decompression).
3. Write a simple Matlab program that reads a message and encode it using Reed-Solomon (use the Matlab function: rsenc). Try different n, k values and comment the outputs.
4. Research the similarities and differences between Hamming code and Reed-Solomon code and write a summary of your findings.