

Question 1: In MPEG video encoding used in DVB and ATSC standards, encoded data is transmitted as a data stream called Transport Stream (TS). The transport stream consists of TS packets each 188 bytes long.

- a) If a movie is encoded at a rate of 20 Mbps, how many TS streams will be in a two hour movie?
- b) The bit error rate (BER) is the probability of a bit transmitted being received erroneously. What should be the probability of error if the TV station requires that no more than one packet be dropped per day?

Note: A packet is dropped if even one bit of it is received erroneously.

Question 2: In a linear predictive coding (LPC) speech encoder samples of a 20 ms. speech segment is used to detect whether it is voiced or unvoiced and estimate its LPC filter parameters, pitch period (for voiced signal) and its gain (power) via speech signal analysis. Assume that it uses:

- Pitch period (T): 7 bits
- Voiced/unvoiced decision: to indicate whether it is voiced or unvoiced segment a single binary bit is enough.
- Gain (G) or signal power: coded in 5 bits.
- Vocal tract model coefficients: or LPC filter coefficients, usually, an FIR filter of order 10, coded using 41 bits.

- a) Find the bit rate of the above voice encoder.
- b) How many of these LPC lines can be carried by one PCM channel.

Question 3: a) Find the SQNR in dB for a sinusoidal signal with amplitude A quantized with an 8 bit uniform quantizer. b) Find SQNR for a Gaussian source quantized with an 8 bit uniform quantizer. The probability of overload should be less than 1%.

Question 4: For the source with five symbols with probability distribution $\mathbf{p} = (0.3, 0.3, 0.2, 0.1, 0.1)$ construct a binary Huffman code and find its average length.