Question 1: A stream of digital data with data rate of 20 Mb/s is to be transmitted in an additive white Gaussian noise channel with single sided power spectral density of 2×10^{-10} Watts/Hz where the available bandwidth is 4 MHz. The required system performance is a bit error rate of 10^{-5}. If the received signal power is 25 milli-watts, find the best modulation scheme (MQAM or MPSK). Justify your solution and explain why your result is the best you can get. If it is not possible to find any modulation scheme, explain why.

Question 2: 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 pf overload should be less than 1%. c) Find the SQNR for a Gaussian source designed for it. Compare with what information theory (rate-distortion theory) suggests.

Question 3: 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