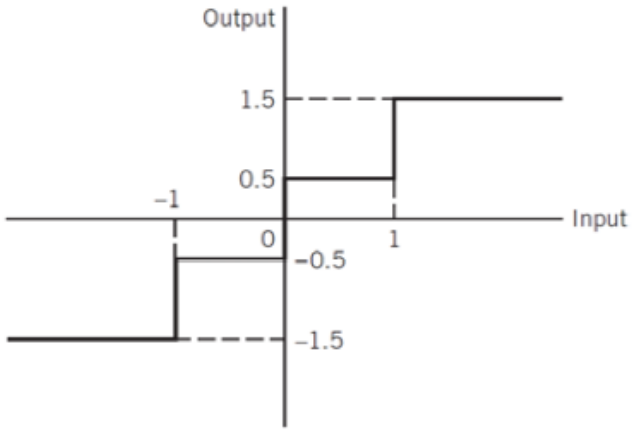
Q1) Calculating the average codeword length of a Normal resource after quantization

Samples of a Gaussian resource with 0 mean and 1 variance are quantized by a uniform quantizer which input-output diagram of this quantizer is as follows:



Generate 10000 samples with the above specifications and quantize samples with the use of the presented quantizer and then assign Huffman codes (designed in the previous part) to quantized samples. At the end calculate the average codeword length per each output and compare it with the value obtained from the theoretical calculation.

Q2) Coding and decoding process

Consider a linear block code with the below generating matrix:

$$G = \begin{bmatrix} 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Apply coding to a binary string of a message with 30000 bits length and send it through a channel with error probability ε (convert 0 to 1 and 1 to 0 with probability ε) then in the receiver apply decoding on the received message by using the best and the worst standard array and plot the bit error probability for these two cases and compare their results.

Q3) Calculating Pe for M-PAM and gray coding

Plot probability of symbol error against γ_b in M-PAM modulation for M=2,4,8,16. Repeat this part again for gray coding and evaluate the results

Q4) Calculating Pe for BPSK and OOK

Use on-off keying (OOK) signalling for transferring data through an AWGN channel Plot the bit error probability against $\gamma_{b.}$ Repeat this step for BPSK modulation.