COMP 5416 Week 9

CDMA with Noise

In the class, we have considered CDMA in an ideal system. However, in reality, we have much more complicated scenario: Users will experience noise.

Consider the scenario with one sender and one receiver. The chipping sequence is (-1 -1 -1 +1 -1 +1 +1 +1). Suppose the sender sends bit "1", then the signal sent will be (-1 -1 -1 +1 -1 +1 +1 +1). In the channel, noise is added to the signal so that the received signal will be ($-1+n_1$ $-1+n_2$ $-1+n_3$ $+1+n_4$ $-1+n_5$ $+1+n_6$ $+1+n_7$ $+1+n_8$), where n_1, …, n_8 are noise terms. They are independently normally distributed with zero mean and σ^2 variance, in this question, $\sigma^2 = 1$. Formally, $n_i \sim N(0, 1)$. You should know the normal distribution in a prerequisite course.

After the computing the inner product at the receiver, what "value" does the receiver derive? If the value is smaller than 0, it is decoded as -1, otherwise, it is decoded as 1. Use the provided table to find the probability that it is wrongly decoded as -1.

The tail probability (Q function) of a standard normal distribution is given in the attached q_function.pdf.