

EE 703: Digital Message Transmission

Instructor: Saravanan Vijayakumaran

Indian Institute of Technology Bombay

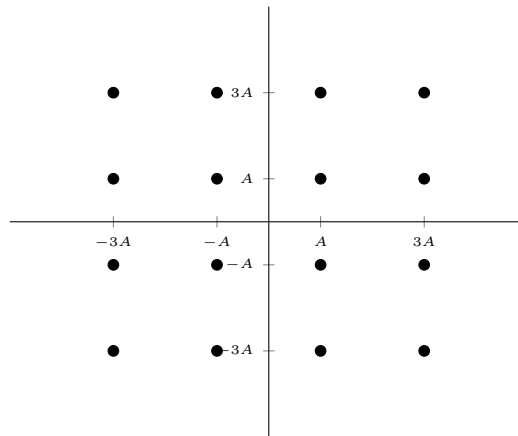
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Assignment 5

Due Date: October 24, 2013

1. For the 16-QAM constellation shown below calculate E_b in terms of A . Assume that the transmitted symbol is corrupted by adding $N \sim \mathcal{CN}(0, N_0)$. If all the constellation points are equally likely to be transmitted, calculate the following in terms of E_b and N_0 .

- The exact error probability of the optimal decision rule.
- The union bound on the exact error probability.
- The intelligent union bound on the exact error probability.
- The nearest neighbor approximation of the exact error probability.



2. In the table given below, show that the modulation schemes in the first column have the power efficiencies in the second column.

Modulation Scheme	η_p
Orthogonal signaling	2
Antipodal signaling	4
BPSK	4
QPSK	4
16-QAM	1.6