EE 703: Digital Message Transmission (Autumn 2021)
Instructor: Saravanan Vijayakumaran
Indian Institute of Technology Bombay

Assignment 5: 20 points — Date: October 6, 2021

1. For the 16-QAM constellation shown below calculate E_b in terms of A. Assume that the transmitted symbol is corrupted by adding $N = N_c + jN_s$ where N_c and N_s are independent zero-mean Gaussian random variables with variance $\frac{N_0}{2}$. If all the constellation points are equally likely to be transmitted, calculate the following in terms of E_b and N_0.
   (a) [5 points] The exact error probability of the optimal decision rule.
   (b) [5 points] The union bound on the exact error probability.
   (c) [5 points] The intelligent union bound on the exact error probability.
   (d) [5 points] The nearest neighbor approximation of the exact error probability.