PROBLEM 1. Problem 3.5

PROBLEM 2. Problem 3.11

PROBLEM 3. Problem D.4. Use this result to compute the expected number of codewords of weight \( w = 0, 1, 2, 3 \) for the \((l, r)\)-regular ensemble.

PROBLEM 4. Consider an \((l, r)\)-regular ensemble of LDPC codes of length \( n \) as introduced in class. Pick a random edge and consider the computation graph of this edge of depth \( \ell \). Prove that if \( \ell \) is fixed and if \( n \) tends to infinity, then this computation graph is a tree with probability \( 1 - o_n(1) \), where \( o_n(1) \) denotes a quantity which converges to 0 as \( n \) tends to infinity.