EE 605: Error Correcting Codes (Autumn 2014)
Instructor: Saravanan Vijayakumaran
Indian Institute of Technology Bombay

Assignment 4: 20 points — Due Date: September 18, 2014

1. [5 points] Let $\mathbf{H}$ be the parity check matrix of a Hamming code of length $n = 2^m - 1$. Consider a matrix $\mathbf{H}'$ obtained by removing all columns of even weight from $\mathbf{H}$. Let C be the code whose parity check matrix is $\mathbf{H}'$?
   (a) Find the length and dimension of C.
   (b) Show that C can correct all single bit errors and detect all two-bit errors.

2. [5 points] Find the generator matrices corresponding to the following Reed-Muller codes.
   (a) RM$(1, 3)$
   (b) RM$(2, 3)$
   (c) RM$(1, 4)$

3. [10 points] Suppose a codeword from the RM$(2, 4)$ code is transmitted over a noisy channel and the vector $\begin{bmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \end{bmatrix}$ is received. Write down the steps of majority-logic decoding and find the 11-bit transmitted message.