ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE
School of Computer and Communication Sciences

Handout 30 Advanced Digital Communications
Homework 13 *(Graded, Due Jan. 15, 2017)* Dec. 19, 2016

- Please submit your answers by email to `mani.bastaniparizi@epfl.ch` until January 15, 2017 at midnight.
- This homework is to be done in groups of two. You need to write computer programs to answer the questions (b)–(d).
- We expect *one* typeset report per group in PDF format plus properly commented source codes of the programs you used for answering the questions.
- You can use any programming language you prefer—as long as a compiler for that language is publicly available and we can understand your code (so, perhaps it would be wiser to use MATLAB, C, Fortran, Pascal,... rather than your personally invented language).
- If, for any reasons, you are not comfortable with typesetting your answers and prefer to submit a scanned handwritten report, please submit your answer to (b) as a separate plain-text file as well.

Good luck!

PROBLEM. Consider the problem of communicating over a binary erasure channel with erasure probability 0.4 using a linear block code of block-length $N = 256$.

(a) What is the highest possible dimension of the code for which reliable communications is possible?

For the rest of the assignment we assume we wish to use polar codes (of block-length $N = 256$) for communication.

(b) Suppose we wish to communicate at a rate of $R = 1/4$. Which indices should be used for the transmission of data bits?

Note. Please make sure that your indices range from 0 to 255.

(c) Simulate the performance of polar codes of different rates in the range of $R = 1/4$ to the capacity of the channel, decoded with the successive cancellation decoder, and plot their empirical block-error probability as a function of the rate R.

(d) Suppose we accept to sacrifice a lot in the rate and communicate at a rate of $R = 1/8$. What could you say about the block-error probability of such a code?