SOLUTION.

(a) $K = 153$, at $K = 154$ the code rate will be already above 0.6 which is the capacity of the channel.

(b) These are the indices of the best 64 synthetic channels:

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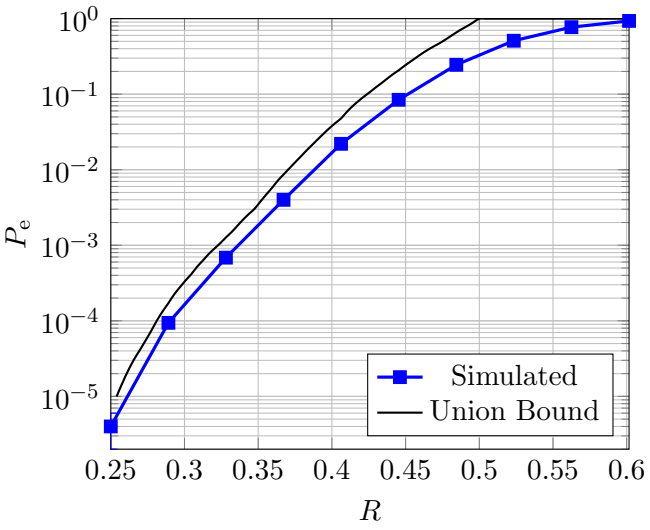
 95, 111, 119, 123, 125, 126, 127, 159,
173, 174, 175, 179, 181, 182, 183, 185,
186, 187, 188, 189, 190, 191, 199, 203,
205, 206, 207, 211, 213, 214, 215, 217,
218, 219, 220, 221, 222, 223, 227, 229,
230, 231, 233, 234, 235, 236, 237, 238,
239, 241, 242, 243, 244, 245, 246, 247,
248, 249, 250, 251, 252, 253, 254, 255,
```

(c) Here is a plot of the block-error probability versus the rate of polar codes of different rates when used for communication over our BEC with erasure probability 0.4. We have also plotted the upper bound on the block-error probability obtained by the union bound:



(d) You could try to simulate the code but will most probably see no errors. This is due to the fact that the union bound on the block-error probability is around 4.2×10^{-12} (hence we need roughly 10^{12} Monte Carlo trials to even see one error!). Nevertheless, we can guarantee that the block-error probability of the code is *at most* 4.2×10^{-12}.