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Data communication - laboratory 2

Manual Calculations

For the manual calculation we chose $x^3 + x + 1$ as our generator polynomial, and we utilize our code to generate the random message 1010100

```
Ex.
Message:        1010100
Key:            1011

Modulo 2 Binary Division algorithm:

1010100000
1011
----------
 0011
 0000
----------
  0110
  0000
----------
   1100
   1011
----------
    1110
    1011
----------
     1010
     1011
----------
      0010

->
Encoded message: 1010100010
```

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Simulated and theoretical bound for error detection probability

In the simulation a total of $1.0 * 10^7$ random messages were generated with the length of nine bits and all of them were to use the same generator polynomial $x^4 + x^3 + x^2 + 1$. Without altering the messages or the polynomial a check was made to ensure a good probability of error detection, keeping in mind valid messages ⊂ all possible messages. The result of this simulation did not differ noticeably after running it multiple times.

The simulation provided us with a 93.74859% chance of detecting errors. And now running it against the theoretical probability $1 - \frac{1}{N} = 1 - \frac{1}{2^k} = 1 - \frac{1}{2^4}$, the difference of 0.0014100000000070168% is negligible.