Test on 2009. december 14.

Name/Code:

1. (20p)	**2.** (20 p)	**3.** (20 p)	**4.** (20 p)	**5.** (20 p)	**Total (100p)**	**Grade**

IMPORTANT

- **Apart from the test questions (where each correct answer must be indicated by a tick) each problem must be worked out on a separate sheet on which your name and code must be clearly indicated!**
- **The notations and conventions you use must be conform with the ones used in the lecture series !**
- **Each solution requires a compact reasoning. Without this reasonong the answer is not considered to be valid even though the final result is correct.**

IMPORTANT

1. Given a linear block codes with the generator matrix $\mathbf{G} = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 \end{pmatrix}$

a) Give the type of the code! (5p)
b) How many errors can be corrected and detected ? (5p)
c) What is the error group belonging to the syndrome vector $\mathbf{s} = (10)$? (5p)
d) What is the detected error vector? (5p)

2. Indicate the correct answers by a tick (20p can only be scored if all the correct statement have been marked, otherwise 0 point).
a) The parity check polynom of a $C(n,k)$ cyclic code divides the polynom $x^n - 1$.
b) The mutual information of two independent random variables is 2.
c) To run the LZ 77 data compression algorithm, one has to know the source distribution .
d) The OTP (One Time Pad) algorithm, ($Y_i = X_i \oplus K_i, i = 1,...,N$) is a public key cryptography protocol.
e) The channel capacity of a BSC with $P_b = 1$ is zero.

3. Give the parity check polynom of an RS code capable of correcting any double error over GF(8) (the power table is given bellow)!

$y^0 \to 1, y^1 \to y, y^2 \to y^2, y^3 \to y+1, y^4 \to y^2 + y, y^5 \to y^2 + y + 1, y^6 \to y^2 + 1, y^7 \to 1, y^8 \to y, ...$

4 Give the results by a number (each correct answer merits 5 p)
a) Given the two binary distribution $p_0 = 0.4$ $p_1 = 0.6$, $q_0 = 0.2$ determine $q_1 = 0.8$ $D(p\|q)$!
b) What is the error correcting capability of a code *C(8,2)* ?
c) Given a binary source with distribution $q_0 = 0.2$, $q_1 = 0.8$. Give the approximate size of the typical set in case of *n*=20 length sequences.
d) What is 6*2 in GF(8) ? Depict the corresponding shift register implementation.

5 De-compress the sequence 00000001001000111000010110101 which has been obtained by compressing the source b algorithm (the indices in the data compression algorithm were encoded in three bits)

Elégtelen	Elégséges	Közepes	Jó	Jeles
0-39 pont	40-53 pont	54-67 pont	68-81 pont	82-100 pont