Minufiya University
Faculty of Electronic Engineering
Dep. of Electronic and Communication Eng.

4'th Year

Information Theory and Coding

Selected problems from previous exams

Q.1 (a) Determine the minimum distance of Hamming code (8,4) if the check equations are given by :
c1=k2⊕ k3⊕ k4 , c2= k1⊕k2⊕ k3 ,
c3=k1⊕ k2⊕ k4 and c4=k1⊕ k3⊕ k4

(b) Determine the generator and check matrices in standard form.

(c) What is the number of errors that can be detected and Corrected?

(d) Sketch an encoding circuit for this code.

Q.2 (a) Decode the following received words which have been encoded by the (7,4) Hamming code (assume that they are either error free or contain one error .)
(i) 1110100 (ii) 0011100 (iii) 0010110

(b) An (8,4) linear block code has the following check equations :
c1=k2⊕ k3⊕ k4, c2=k1⊕ k2 ⊕k3 ,
c3= k1⊕ k2 ⊕k4 and c4=k1⊕ k3⊕ k4

(i) Determine the generator matrix.
(ii) What is the min distance of this code?
(iii) Sketch an encoding circuit for this code.

Q.3 Design an encoder for the (7,4) binary cyclic code generated by the polynomial $(11)_{10}$ and verify its operation using the message vector $(12)_{10}$ (MSB on the left) Assume the error polynomial $e(x) = x^6$.
Discuss the synthesis of a code capable of correcting this single error showing the content of the register at the successive steps.

Q.4 A convolutional coder of rate ½, constraint length =3, and with generator polynomial g_0 =101 and g_1 =111 has been used to encode the data 100111 , what is the output of the encoder. (assume the first input bit is the left most bit) and the coder starts with 0 in both stages.

Q.5 (a) A binary sources sends a binary 1 with a probability of 0.3 Evaluate the average information for the source.

(b) For a binary source find the probability for sending a Binary 1 and a binary 0 such that the average source Information will be maximized.

Q.6 (a) Derive the output from a 3-stage scrambler with the tap Polynomial $1+D+D^3$ when the input is the repeating sequence 1010….. if the scramblers starts with a 0 in the first and third stages , and a 1 in the second

(b) Calculate the radix, redundancy and efficiency of the HDB3, AMI and 4B3T line codes.