Helsinki University of Technology
Communications Laboratory

EXAM
5.9.2002

S-72.341 Coding Methods

1. (6p.) Define the following concepts (just writing out what abbreviations stand for is not sufficient):
   (a) AWGN
   (b) design distance (of BCH code)
   (c) impulse response (of convolutional encoder)
   (d) soft-decision decoding
   (e) BER
   (f) throughput (of ARQ protocol)
2. (6p.) Algebra.
   (a) Factor $x^2 - 1 \in \mathrm{GF}(4)[x]$ into irreducible polynomials.
   (b) Simplify $(x^7 + x)/(x^8 + 1)$ in the ring $\mathrm{GF}(2)[x]/(x^4 + x + 1)$.
3. (6p.) (Tutorial) Give a parity check matrix $\boldsymbol{H}$ for the binary Hamming code of length 7. Find the weight enumerating function of this code by using the formula

$$A(x) = \frac{1}{n+1}\left\{(1+x)^n + n(1-x)(1-x^2)^{(n-1)/2}\right\}.$$

   Using $\boldsymbol{H}$, extract all codewords of weight 3 and check correctness of the corresponding term of the weight enumerating function.
4. (6p.) (Essay) Trellis Coded Modulation.