Middle East Technical University
Department of Mathematics

GENERAL SEMINAR

"Guessing and Sequential Decoding"

Abstract: The guessing problem is the following: Let $(X, Y) \sim P_{X,Y}$ be a pair of discrete random variables with X taking one of M possible values. Suppose the value of X is to be determined, given the value of Y, by asking questions of the form 'Is X equal to x?' until the answer is 'Yes.' Let $G(x|y)$ denote the number of guesses in any such guessing scheme when $X = x$, $Y = y$. We prove that the moments of the guessing effort satify the inequality $E[G(X|Y)^\rho] \geq (1 + \ln M)^{-\rho} \sum_y [\sum_x P_{X,Y}(x, y)^{\frac{1}{1+\rho}}]^{1+\rho}$ for any $\rho \geq 0$.

We apply this inequality to the estimation of the computational complexity in sequential decoding, which is a decoding algorithm for error correction codes. For this, we regard X as the input, Y as the output of a communication channel. Given Y, the sequential decoding algorithm works essentially by guessing X, one value at a time, until the guess is correct. Thus, the computational complexity of sequential decoding, which is a random variable, is given by a guessing function $G(X|Y)$ that is defined by the order in which nodes in the tree code are hypothesized by the decoder. This observation, combined with the above lower bound on moments of $G(X|Y)$, yields lower bounds on moments of computation for sequential decoding, and furnishes a simple method for determining the *computational cutoff rate* for single-user and multi-access channels.

Speaker: Erdal Arıkan (Bilkent University)

Date: 11 May 2006 Thursday
Place: G. Ikeda Seminar Room
Time: 15:40