

Simple LTC Good LDPC Codes

David Ponarovsky

January 30, 2023

Abstract

We propose a new simple construction based on Tanner Codes, which yields a good LDPC testable code.

ex1. Find a simple description of the work-function algorithm in the case of uniform metric space.

ex2. Consider the following 3-point metric space, $w(a, b) = 1$ and $w(\cdot, c) = M$. The initial configuration is $\{b, c\}$ (2 servers). Show that randomized competitive ratio, for some value of M is $> H_2 = 1 + \frac{1}{2}$.

ex3. Show that randomized marking algorithm cannot be c -competitive against the adaptive online adversary, for $c = o(k)$.

ex4 - Ski Rental. At each step, the adversary decides either continue or stop. Stop terminate the game. If it continues, the online algorithm decides, either rent or buy. Rent costs 1 Buy costs $M > 1$. Design a primal-dual randomized online ski-rental algorithm with better than 2 competitive ratio.

ex5. Prove Yao's minimax principle.

$$\forall \text{rand. alg} \exists \sigma$$

$$\mathbf{E} [c_{\text{alg}}(\sigma) : \sigma \sim \tilde{\text{alg}}] \geq c \cdot c_{\text{base}}(\sigma)$$

$$\Leftrightarrow \exists \text{rand. } \tilde{\sigma} \forall \text{alg}$$

$$\mathbf{E} [c_{\text{alg}}(\sigma) : \sigma \sim \tilde{\sigma}] \geq c \mathbf{E} [c_{\text{base}}(\sigma) : \sigma \sim \tilde{\sigma}]$$

Solution. First direction, assume through contradiction that for all distributions $\tilde{\sigma}$ there exists an algorithm such that:

$$\mathbf{E} [c_{\text{alg}}(\sigma) : \sigma \sim \tilde{\sigma}] < c \mathbf{E} [c_{\text{base}}(\sigma) : \sigma \sim \tilde{\sigma}]$$

Now let $\tilde{\sigma}$ be the uniform distribution, and notice that by definition $c_{\text{base}}(\sigma) \leq c_{\text{alg}}(\sigma)$. By the fact that probability function must be non negative we obtain that. By the monotonic property of random variables we have