University of Konstanz
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Network Dynamics
Winter 2013/14

Assignment 9

Ausgabe: 18 Dec 2013 **Abgabe:** 8 Jan 2014

For a map $F : \{0,1\}^n \to \{0,1\}^n$, let the modified version of the Derrida relation be defined as follows:

$$\mathcal{D}'(F) =_{\text{def}} \{ \ (h_1, h_2) \ \ | \ \ h_1 < n \text{ and there are } x_1, x_2 \text{ such that } d_H(x_1, x_2) = h_1 \text{ and } d_H(F(x_1), F(x_2)) = h_2 \ \}$$

Note that the Hamming distance $d_H(x, y)$ can be as high as n, e.g., for $x = 0^n$ and $y = 1^n$. Moreover, define the modified Derrida coefficient $\mathrm{Dc}'(F)$ as

$$\mathrm{Dc}'(F) =_{\text{def}} \log_2 \beta,$$

where β is the regression coefficient of the multiset of points of $\mathcal{D}'(F)$.

Problem 1: Plots — 10 Points

Determine the value $\mathrm{Dc}'(F)$ for the map

$$F : \{0,1\}^3 \to \{0,1\}^3 : (x_1, x_2, x_3) \mapsto (x_1 \oplus (x_2 \vee x_3), 1 \oplus x_1 \oplus x_2, x_2 \oplus x_3).$$

Hint: You may run an appropriate computer program.

Problem 2: Plots — 20 Points

Find a map $F : \{0,1\}^3 \to \{0,1\}^3$ that maximizes the modified Derrida coefficient, i.e., F should satisfy

$$\mathrm{Dc}'(F) \geq \mathrm{Dc}'(F') \text{ for all functions } F' : \{0,1\}^3 \to \{0,1\}^3.$$

Determine also the maximal value of that map.

Hint: You are strongly encouraged to design and run an appropriate computer program.

Problem 3: Netlogo — 0 Points

Download and install a local copy of the Netlogo software from

`http://ccl.northwestern.edu/netlogo/`

on your computer.

Merry Christmas and a Happy New Year!