Report on 1st GSSI Summer Meeting on Algorithms

A report by M. Flammini and G. Persiano

The first GSSI Summer Meeting on Algorithms was held at the Gran Sasso Science Institute in L'Aquila, Italy, on July, 9th, 2016. The Gran Sasso Science Institute (GSSI) is a new international research center and PhD school. The GSSI has been recently funded with the objective to create a new center of scientific excellence in L'Aquila fostering the skills and highly specialized structures already present in the area, such as the Gran Sasso National Laboratories of the National Institute for Nuclear Physics (INFN) and the University of L'Aquila.

The aim of the meeting was to bring together top researchers in the area of algorithms to have presentations of recent results and informal discussions. The morning started with Paul Spirakis (U. Liverpool) that gave a presentation entitled "The Complexity of Greedy Matchings." The study of greedy matchings is motivated by the fact that in several cases a matching in a graph is stable if and only if it is produced by a greedy algorithm. A greed matching algorithm considers edges by decreasing weight and choices are to be made when edges have equal weight. In wide contrast to the maximum weight matching problem, for which many efficient algorithms are known, the talk showed that GreedyMatching is strongly NP-hard and APX-complete, and thus it does not admit a PTAS unless P=NP, even on simple graphs.

Moti Yung (Columbia U. and Snapchat Inc.) gave a perspective on the difficulties one encounters in the deployment of advance cryptographic protocols in a commercial environment. Specifically, the reasons for the inherent difficulty of developing secure multi-party protocols for achieving actual business goals have been discussed. Secure computation protocols were invented as a basic theoretical notion, capturing specific and then general computational tasks, about 40 years ago and in spite of its theoretical and even more recent commendable experimentation success, the notion has not yet been widely and seriously used in achieving routine relevant business goals in contrast with symmetric key and public key cryptosystems and protocols, which were also proposed a little more than 40 years ago and are used extensively, primarily to implement secure authenticated channels.

Yuval Rabani (Hebrew U.) presented results regarding the convergence of Fisher Markets with constant elasticities of substitution (CES) utilities with respect to a limited rationality dynamics. Specifically, the talk considered a "control theoretic" approach to the dynamics of economic exchange, based on limited lookahead situational analysis of the participating agents. It is motivated by and

generalizes the level k model in which a level 0 player adopts a very simple response to current conditions, a level 1 player best-responds to a model in which others take level 0 actions, and so forth. The main result shows the dynamics a linear rate of convergence.

In the afternoon, we started with a talk by Pierre Fraigniaud (U. Paris-Diderot) that discussed property testing in the context of distributed computing. It is known that testing whether a graph is triangle-free can be done in a constant number of rounds, where the constant depends on how far the input graph is from being triangle-free. This result is extended to H-freeness, for every connected 4-node graph H. Quite surprisingly, testing K_k-freeness and C_k-freeness for $k \geq 5$ appears to be more difficult as natural algorithms (the DFS and the BSF testers) require more than a constant number fo rounds.

The last talk of the seminar was given by Seffi Naor (The Technion) oon the metric multi-labeling problem, that is motivated by applications in multi-label learning. The metric multilabeling problem is NP-hard, and the talk tackles it by formulating an integer program capturing the deviation from a benchmark representing an "ideal" labeling. This approach leads a tight 2-approximation algorithm for metric multi-labeling by using a counterintuitive approach that distorts the optimal likelihood values computed by the linear programming relaxation.