2nd STAR-W Workshop

Computer Science Department
Graduate Center
CUNY

February 10, 2012

9:00-9:30 informal meeting and breakfast

9:30-10:00 Shoshana Neuburger: “Succinct 2D Dictionary Matching With No Slowdown”

10:00-10:30 Yosef Alayev: “Throughput Maximization in Mobile WSN Scheduling with Power Control and Rate Selection”

10:30-11:00 Feng Yu: “Traversal Times on Markovian Paths”

11:00-12:30 informal meeting and Lunch

12:30-1:00 George Rabanca: “Funding Games: the Truth but not the Whole Truth”

1:00-1:30 Valia Mitsou: “Scrabble is PSPACE-Complete”

1:30-2:00 Break

2:00-2:30 Peter Terlecky: “Maximizing Lifetime with Relays”

2:30-3:00 Ben Baumer: “Set It and Forget It: Maximizing Network Lifetime on the Line”

Title: "Succinct 2D Dictionary Matching With No Slowdown"

Speaker: Shoshana Neuburger

Status: WADS 2011

Abstract: The dictionary matching problem seeks all locations in a given text that match any of the patterns in a given dictionary. Efficient algorithms for dictionary matching scan the text once, searching for all patterns simultaneously. This paper presents the first 2-dimensional dictionary matching algorithm that operates in small space and linear time. Given d patterns, $D = \{P_1, \ldots, P_d\}$, each of size $m \times m$, and a text T of size $n \times n$, our algorithm finds all occurrences of $P_i, 1 \leq i \leq d$, in T. The preprocessing stores the dictionary in entropy compressed form, in $|D|H_k(D) + O(|D|)$ bits. Our algorithm uses $O(dm \log dm)$ bits of extra space. The time complexity of our algorithm is linear $O(|D| + |T|)$.

link: http://www.sci.brooklyn.cuny.edu/ shoshana/pub/wads11.pdf

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Title: "Throughput Maximization in Mobile WSN Scheduling with Power Control and Rate Selection"

Speaker: Yosef Alayev

Status: submitted

Abstract: We study a data dissemination scenario in which data items are to be transmitted to mobile clients via one of the stationary data access points (APs) that the clients pass by en route to their destinations. The scheduler dedicates sequences of consecutive timeslots of an AP to downloading a data item to a client during the time window in which it is in range, which corresponds to assigning a job (the clients download) to a machine (the AP) among many. The transmission rate chosen for each assignment partly corresponds to setting a machines speed, but it also has subtler effects. The APs may control transmission power to tune it transmission range making sure that no interference occurs with neighboring APs transmissions. The problem is a generalization of an already NP-hard parallel machine scheduling problem in which jobs release times and deadlines depend on the machine to which they are assigned. We define this joint timeslot, power control, and rate assignment problem formally and apply both new algorithms and adaptations of existing algorithms to it. We evaluate these algorithms through simulations which show that our proposed algorithms achieve near-optimal throughput.

Title: "Traversal Times on Markovian Paths"

Speaker: Feng Yu

Status: submitted

Abstract: In source routing, a complete path is chosen for a packet to travel from source to destination. While computing the time to traverse such a path may be straightforward in a fixed, static graph, doing so becomes much more challenging in dynamic graphs, in which the state of an edge in one timeslot (i.e., its presence or absence) is random, and may depend on its state in the previous timeslot. The traversal time is due to both time spent waiting for edges to appear and time spent crossing them once they become available. We compute the expected traversal time (ETT) for a routing path in a number of special cases of stochastic edge dynamics models, and for three edge failure models, culminating in a surprisingly challenging yet realistic setting in which the initial configuration of edge states for the entire path is known. We show that the ETT for this "initial configuration" setting can be computed in quadratic time (as a function of path length), by an algorithm based on probability generating functions. We also give several linear-time upper and lower bounds on the ETT.

Title: "Funding Games: the Truth but not the Whole Truth"

Speaker: George Rabanca

Status: to be submitted

Abstract: We introduce the Funding Game, in which m identical resources are to be allocated among n selfish agents. Each agent requests a number of resources x_i and reports a valuation $v_i(x_i)$, which verifiably lower-bounds i's true value for receiving x_i items. The pairs $(x_i, v_i(x_i))$ can be thought of as size-value pairs defining a knapsack problem with capacity m. A publicly-known algorithm is used to solve this knapsack problem, deciding which requests to satisfy in order to maximize the social welfare. We show that a simple mechanism based on the knapsack highest ratio greedy algorithm provides a PoA of 2, and we give an algorithm computing a Nash equilibrium strategy profile in $O(n^2 \log^2 m)$ time. Our primary algorithmic result shows that an extension of the mechanism to k rounds has a PoA of $1 + 1/k$, yielding a graceful tradeoff between communication complexity and the social welfare.

Title: "Scrabble is PSPACE-Complete"

Speaker: Valia Mitsou

Status: submitted

Abstract: In this paper we study the computational complexity of the game of Scrabble. We prove the PSPACE-Completeness of a derandomized model of the game, answering an open question of Erik Demaine and Robert Hearn.

Title: "Maximizing Lifetime with Relays"

Speaker: Peter Terlecky

Status: submitted

Abstract: As sensor mobility becomes more and more universal, Wireless Sensor Network configurations that utilize such mobility will become the norm. We consider the problem of maximizing the lifetime of a wireless connection between a transmitter and a receiver using mobile relays. Initially, all relays are positioned arbitrarily on the line between the transmitter and the receiver and have arbitrary battery capacities. Energy is consumed in proportion to the distance traveled for mobility and in proportion to an exponential function of the distance over which information is sent for communication. Relays can move to different locations as long as this move does not completely drain them of energy. We show how to compute an optimal solution for the case of no movement cost. In the single deployment case relays are allowed to move only once at time zero. We give an optimal dynamic programming algorithm and an optimal binary search algorithm for this case when relays are constrained to being positioned on grid points.

Title: "Set It and Forget It: Maximizing Network Lifetime on the Line"

Speaker: Ben Baumer

Status: submitted

Abstract: We consider two variations on the ADJUSTABLE RANGE RESTRICTED STRIP COVER (AR-RSC) problem: Set-Once and Duty-Cycling. Generally, the problem is to maximize the lifetime of a wireless sensor network over a one-dimensional region by devising an optimal activation schedule for a set of n wireless sensors with adjustable sensing ranges and finite batteries. In the Set-Once model, we show that if you are only allowed the set the radius of each sensor once, then the problem is NP-hard. Moreover, we prove a tight 2/3-approximation guarantee for the algorithm in which the sensors simply take turns covering the whole line. In the Duty-Cycling model, a schedule consists of a partition of the sensors into disjoint coverage groups. We prove that the same 2/3 bound holds for DC_1, the algorithm in which only one sensor can be active at a time. Furthermore, we show that the polynomial time algorithm DC_2, in which two sensors can be active at a time, has an approximation guarantee that is between 24/35 and 11/15.