Seminar on Sublinear Time Algorithms – Handout 1

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1 Administrative issues

Contact. Ziskind 222, email `robert.krauthgamer@weizmann.ac.il`, phone extension 4281. This link and other information is available at the course's webpage:

`www.wisdom.weizmann.ac.il/~robi/teaching/2010b-SeminarSublinearAlgs/`

Course requirements.

- Problem sets (homework), which should be submitted within 2 classes (usually 2 weeks).
- Presenting a paper (in class)
- Writing scribes (1-2 pages brief summary of the class).

Reading material. Recommended references and other resources will be posted on the website.

2 Today's topics

- Introduction to sublinear time algorithms
- Approximating the diameter of a metric (point set)
- Searching in a sorted list
- Approximating the average degree in a graph

3 Homework

1. The *normalized Hamming weight* of a vector $x \in \{0,1\}^n$ is the fraction of coordinates in x that are nonzero, formally $\mathrm{wt}(x) = \Pr_{j\in[n]}[x_j \neq 0]$. Give a sublinear-time algorithm that estimates the normalized Hamming weight $\mathrm{wt}(x)$ of an input vector $x \in \{0,1\}^n$ within additive $\varepsilon > 0$.

   Remark: Specify the algorithm's running time (for success probability 2/3). It should depend only on ε (independent of n).

   Hint: Use Chernoff (or Chebyshev's) bound

2. Give a sublinear time algorithm that when given as input a permutation $\pi : [n] \to [n]$, estimates within additive $\varepsilon > 0$ the fraction of inversions (pairs of indices $i < j$ for which $\pi(i) > \pi(j)$).