Preliminary version of 18 December 2009

Course Information

Course structure for Spring 2010

The course examines recent developments in the theory and experiments of computing at the nanoscale. Following an introduction into biomolecular computing in general, we will focus on DNA-based computing.

The course is participatory, and involves *extensive reading assignments*. There will be 3–4 homework assignments reinforcing the topics covered in class.

Assignments and grading

Homework assignments (30%), in-class work and presentations (70%). You are expected to attend class regularly, read the assigned reading before class, prepare to present assigned material, and participate in class discussion.

Attendance

Attendance is mandatory.

Prerequisites in detail

No background in biology or chemistry is assumed. All graduate students and interested undergraduate students are welcome.

Lectures

Tuesdays and Thursdays 2-3:15 (tentative), FEC 345

Instructor

Darko Stefanovic, office FEC 345C, phone +1 505 2776561, email darko — office hours TBA

Mailing list

A course-specific mailing list will be used for class discussion and administrative announcements, see `http://mail.cs.unm.edu/cgi-bin/mailman/listinfo/cs591mc`.

UNM statement of compliance with ADA

Qualified students with disabilities needing appropriate academic adjustments should contact the instructor as soon as possible to ensure their needs are met in a timely manner. Handouts are available in alternative accessible formats upon request.

Topics and Readings (subject to change)

Suitable on-line material will be used throughout the course. The readings shown here are indicative of the topics but not necessarily the definitive selection; we will seek tutorial articles wherever possible. Final selection of the topics and the readings will take place according to course participants' interests.

- Prelude: Molecular automata [8]
- Background: Biomolecular chemistry
- Background: Chemical kinetics
- Background: Nonlinear dynamics
- Combinatorial biochemical computing [1, 6]
- Self-assembly [12, 14, 16]
- Molecular automata [3, 9]
- Computing with DNA enzymes [7, 15]
- Molecular movers and machines [2, 10, 17]
- Library design for molecular devices [11, 13]
- Formal models of molecular devices [4, 5]

References

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[12] ROTHEMUND, P. W. K. Folding DNA to create nanoscale shapes and patterns. *Nature 440* (Mar. 2006), 297–302.

[13] SAGER, J., AND STEFANOVIC, D. Designing nucleotide sequences for computation: A survey of constraints. In *DNA11, 11th International Meeting on DNA Computing* (2005), pp. 275–289.

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[15] STOJANOVIC, M. N., MITCHELL, T. E., AND STEFANOVIC, D. Deoxyribozyme-based logic gates. *Journal of the American Chemical Society 124*, 14 (Apr. 2002), 3555–3561.

[16] WINFREE, E., YANG, X., AND SEEMAN, N. C. Universal computation via self-assembly of DNA: Some theory and experiments. In *DNA Based Computers II, DIMACS Workshop 1996 (Princeton University: Princeton, NJ)* (1999), L. F. Landweber and E. B. Baum, Eds., vol. 44 of *Series in Discrete Mathematics and Theoretical Computer Science*, American Mathematical Society, pp. 191–213. Errata: http://www.dna.caltech.edu/Papers/self-assem.errata.

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