

Quantum Computation Seminar

Prof. Dr. Blömer & Prof. Dr. Gharibian



UNIVERSITÄT PADERBORN
Die Universität der Informationsgesellschaft

In addition to a solid grasp of linear algebra you should have basic knowledge in at least two of the following areas

- data structures and algorithms
- complexity theory
- quantum computation
- probability theory and stochastics

- **All meetings are mandatory**
- **General kick-off meeting (today)**
- **Topic choice**
 - Send us your top 3 topics sevag.gharibian@upb.de (ranked order)
 - We distribute the topics
 - You can also swap your topic once with another willing person
- **Introductory Talk**
 - We will give a talk on the style of a scientific paper and how to work with literature.

- **Topic kick-off Meeting**

- Meeting with your supervisor.
- You should have read your assigned topic paper and understood main ideas
- We discuss your tasks and questions you have

- **Q&A day**

- We answer all of your questions in a personal meeting

- **Essay Draft**

- You hand in a "feature complete" draft of your essay
- "feature complete", i.e. everything you plan to have in the final essay should be included in this version.
- This is your chance to get comprehensive feedback on your work.

- **Talk Slides**

- We ask you to turn in the slides of your talk (presentation). We will give feedback for this.

- **Talk**

- You will present your topic for all seminar participants and the supervisors
- Your talk should last 1h including discussion (plan to talk 40-45 minutes).

- **Essay Final Version**

- The final version of the essay should incorporate the feedback given for the draft version and your talk.

Topics



Quantum cryptography

Quantum computation and lattice problems (Regev)

Quantum complexity theory

Quantum Arthur–Merlin games (Marriot, Watrous)

Quantum Algorithms

- An exact quantum polynomial-time algorithm for Simon's problem (Brassard and Hoyer)
- Quantum random walks hit exponentially faster. (Kempe)
- Quantum algorithm for linear systems of equations (Harrow, Hassidim, Lloyd)
- A subexponential-time quantum algorithm for the dihedral hidden subgroup problem (Kuperberg)
- Variable time amplitude amplification and quantum algorithms for linear algebra problems (Ambainis)
- Quantum speed-up of Markov chain based algorithms (Szegedy)
- A Grand Unification of Quantum Algorithms (Martin, Rossi, Tang, Chuang)
- Quantum lower bounds by quantum arguments (Ambainis)
- Quantum amplitude amplification and estimation (Brassard, Hoyer, Mosca and Tapp)

Dates



| Deadlines/Dates | What |
|---|--|
| 3.11.2021 | send top 3 topics and preferred slot |
| 5.11.2021 | assignment of topics (exchange if desired amongst yourselves; inform us) |
| Individual meetings with supervisor (latest 3.12.2021) | topic kick-off meeting (private meeting 1) |
| TBA | Q&A day (private meeting 2) |
| 25.1.2022 | first slot for talk |
| 1.02.2022 | second slot for talk |
| 15.2.2022 | essay draft |
| 1.3.2022 | deadline: essay final version |

Communication

- Likely to be entirely through PAUL
- Check your PAUL messages for BigBlueButton room link and access code

Websites for quantum papers etc

- Arxiv.org (go to quant-ph)
- Scirate (an arxiv overlay where people vote on papers)
- QIP websites (flagship annual theoretical quantum computation conference, eg QIP)

Questions...



UNIVERSITÄT PADERBORN
Die Universität der Informationsgesellschaft