## CS 867 / QIC 890 Quantum Query and Communication Complexity Winter 2021 Course Outline

Last revised: January 15, 2021

Course website: https://cs.uwaterloo.ca/~s4bendav/CS867QIC890W21.html Course message board: https://piazza.com/uwaterloo.ca/winter2021/cs867qic890 Youtube: https://www.voutube.com/channel/UCUj5LuDhKE7vjCEERF7KZwA Instructor: Shaley Ben-David

Please note that the content of this document is decided tentatively at the beginning of the term, and is subject to change.

## CS 867 / QIC 890 Description

This course is a graduate reading course on quantum query and communication complexity. We may cover some of the following topics:

- 1. The query and communication complexity models
- 2. Shor's and Grover's algorithms in the query model
- 3. Amplitude amplification/estimation
- 4. The polynomial method for quantum lower bounds
- 5. The adversary method for quantum lower bounds
- 6. Quantum walks
- 7. Learning graphs
- 8. approximate logrank and gamma 2 norm
- 9. quantum information cost

Each week, a video lecture and/or written lecture notes will be posted to provide background on one or more of these lower bound techniques, and one or more papers will be assigned as readings. Students will take turns presenting the papers in weekly live video meetings (which will be recorded).

Additionally, we will have one assignment on quantum lower bounds, as well as a course project. Students will also give a presentation on their project.