CS 671: Seminar in Computer Science:
Graph Streaming Algorithms and Lower Bounds
(Fall 2020)

Course Syllabus

1 Course Information

General information

Instructor: Sepehr Assadi. Email: `sepehr.assadi@rutgers.edu`. Office: CoRE 310.

Lectures: Tuesdays 12:00pm – 3:00pm; Online (see Canvas for the link).

Office hours: Mondays 3:00pm – 4:00pm or by appointment; Online (see Canvas for the link).

Prerequisites: Background on (randomized) algorithms, complexity theory, discrete mathematics, and probability theory (basic concentration inequalities). Mathematical maturity and some experience with theoretical computer science beyond the introductory level, say, Advanced Algorithms (CS 513, CS 514, or an equivalent) is necessary for this course.

Textbook: There is no textbook for this course but some useful resources on introductory materials and background are listed on the course webpage.

Webpage: https://www.cs.rutgers.edu/~sa1497/courses/cs671-f20.html

The webpage contains updated syllabus information as the semester progresses and the schedule of lectures. The reading list and notes for each lecture will also be posted on the webpage. We will use Canvas for the announcements and releasing grades.

Students with disabilities: Students with disabilities are encouraged to discuss with the Instructor any appropriate accommodations that we might make on their behalf following the guidelines of the Office of Disability Services[1].

Academic integrity: Students are expected to follow Rutgers academic integrity policy[2] for all their work in this course. Please familiarize yourself with this policy if you have not done so yet.

Online Lectures

Lectures: The class will be taught via Zoom. This is a seminar course and the students are expected to attend every lecture. Moreover, the students are required to keep their videos ON during the class; please contact the Instructor in advance if you have a valid reason for not doing so.

Technology recommendation: The students need a working microphone for discussions during the lectures and for their own presentations. For their presentations, the students may choose to use slides and/or an online blackboard; a stylus is necessary for the latter option as trackpads and external mouses do not work fine for an entire presentation on a board.

[1] https://ods.rutgers.edu/

[2] https://nbprovost.rutgers.edu/academic-integrity-students

Recordings: The lectures may be recorded for students who are not able to attend the lecture. They will be posted only on Canvas. These recordings are solely for the students registered in the course and are not to be redistributed outside of this class.

What should you expect to learn from this course?

This is a seminar course organized in the format of a focused reading group on the topic of *Graph Streaming* algorithms and lower bounds. Graph streaming is a theoretical model of computation for addressing some of the key aspects of processing massive graphs in practice such as I/O-efficiency and handling evolving graphs. The goal of this course is to present the students with a general picture of the landscape of powers and limitations of graph streaming algorithms, some of the key ideas in establishing these results, and some of the main open questions and gaps in our understanding of this model.

2 Assignments and Grading

Grading

- 25% Reviews
- 25% Problem sets
- 50% Presentations

Reviews

A key component of this course is to write critical reviews for the discussed papers in a format of conference reviews for TCS papers. Each review should contain one or two paragraphs for each of the following items:

- **Paper summary**: What are the main results of the paper?
- **Technical contribution**: What are the key techniques used and/or introduced in the paper?
- **Strength**: What is this paper's "claim to fame"? Does it solve a longstanding open problem, present new techniques, overcome a technical barrier, or put forth a new research direction or model?
- **Weakness**: This could include lack of originality, small increment over previous work, unsubstantiated claims, or bad presentation.
- **Opinion:** The personal opinion of the reviewer about the paper. Did you like the paper? Are you interested in knowing more about the results of the paper, perhaps by attending a talk on this paper? Do you think the techniques of the paper are applicable to what other problems? What do you think was left unanswered by this paper and what is your favorite open question related to this paper?

The main purpose of the reviews is to familiarize the students with each paper *before* they are being discussed in the class. The logistics for reviews are as follows:

– **Timing:** The reviews are for the weekly assigned readings and are due on **11:59pm EST on Monday** each week, the day before the corresponding paper is being discussed in the class.

– **Format:** The reviews should be turned in on Canvas in the given text box in the format specified above. Avoid using complicated latex commands in the reviews as they will not be readable. This is more or less the standard approach for TCS reviewing.

– **Grading:** The grades for each review is either Complete or Incomplete.

– **Collaboration:** The reviews should be done individually.

Problem Sets

Each week, we will also have a single algorithmic or lower bound problem on the topic of the discussed paper. The main goal of these problem sets is to allow the students to test their understanding of the discussed topics in more depths. The logistics of problem sets are as follows:

- **Timing:** The problem sets will be released weekly on Tuesdays after the lecture and are due on **11:59pm EST on Tuesday** the week after.
- **Format:** Problem sets should be turned in on Canvas as **a single pdf file**. Moreover, **solutions must be typeset in LaTeX**. Simple instructions on using LaTeX are available on the course webpage and a template will be released with each problem set.
- **Collaboration:** The students are allowed to discuss the problem sets among themselves and there is no limit on the number of involved students. However, (1) the students should write their solutions *completely* independently (in particular, you should understand and be able to explain everything that is written in your solution); (2) you should include the name of your collaborators in your solutions.

  When writing your solutions, you are *allowed* to use materials not discussed in the class (say, related research papers) **as long as you cite these references appropriately**. However, you are *not* allowed to get help from someone who is not currently enrolled in the class.

Presentations

Each student is expected to present one or two papers to the class during the semester as follows:

- **Preparing presentation:** The students are expected to send their presentation materials **a week before their in-class presentation** to the Instructor.
- **In-class presentation:** The students should **prepare an entire lecture** on the topic of the assigned paper including any required background. It is expected that the entire proof of the main results of the paper[3] is covered in the lecture in an accessible way to all students. The presentations should be in a format of a reading group and encourage discussion among the students.
- **Report:** Each presenter is expected to prepare a detailed note on their presentation, including all steps of the proofs, with ample illustrations and figures. This is **due on the same day as the presentation**. The main target of these notes are other students in the class, and the notes in particular should help other students to answer the problem set given for this presentation.

The students do not need to write a review nor turn in a solution for the problem set on the paper they are presenting themselves.

The list of papers for presentation along with their allocated time slot and proper instructions is available on the course webpage. Students should send a list of three papers they would like to present to the Instructor by **September 14th, 11:59PM EST**.

[3] For every paper, we will discuss what is the main result *for our purpose* in this course.