St. Francis Xavier University
Department of Computer Science

CSCI 550: Approximation Algorithms
Student Presentation and Report
Fall 2022

The student presentation and report are the two major assessments of this course. The student presentation assessment is designed to give you experience with planning and structuring a small lesson/talk, independently studying a topic related to this course that interests you most, and communicating that topic clearly and effectively to your peers. The report assessment gives you an opportunity to reflect on your presentation by describing how you decided to present the material, sharing the resources you created/used, and explaining areas of strength or improvement from the presentation.

The student presentation component is worth a total of 30% of your final grade. The report component is worth a total of 20% of your final grade. You must complete both components in order to pass the course.

Do not leave these assessments until the last minute! Start as soon as possible!

Student Presentation

The student presentation assessment consists of two components: the lesson plan and the presentation itself.

Lesson Plan

Due October 20, 2022 at 1:15pm

In the lesson plan component, you will give a brief description of the topic you have chosen for your presentation. You will state the topic, review the main points you want to present, and describe the background you assume the audience has.

Your lesson plan should be a 1–2 page double-spaced document written in 12-point text containing, at a minimum, the following information: your topic, your chosen presentation date, at least three points you plan to discuss in your presentation, a description of assumed background knowledge, a rough schedule/breakdown of how you will use your time (e.g., 1 minute introduction, 2 minute background review, etc.), and a list of any references or resources you will use to create your presentation. You can include as much additional information as you like; 2 pages is not a strict upper limit.

If you choose a topic that is too similar in nature to topics chosen by other students, I will contact you to let you know so that you can plan accordingly. You may choose to refine your topic to focus on one specific idea or result, or you can choose an entirely new topic.

Your lesson plan will be marked in terms of completeness and organization.

Presentation

Due date varies (last $\sim$3 weeks of lectures)

In the presentation component, you will use your lesson plan together with any other resources you find/create to give a presentation on your chosen topic to your peers in the class.

When creating your presentation, think about the kinds of lectures you enjoy most and try to emulate those. Watching a presenter read directly from black text on white slides isn't very enjoyable for the audience. Feel free to use colourful visuals, illustrative examples, animations, and engaging activities.

Your presentation should be approximately 15 minutes in length. You will not be presenting for the entire 15 minutes; you should budget around 2–3 minutes for questions at the end. Your presentation should be delivered at a level similar to the lectures of this course: targeted at a graduate student audience that is familiar with approximation algorithms.

Please ensure that your slides and other materials are completed at least one day in advance of your presentation. You will need to submit a copy of your presentation materials to me before your presentation date.

The presentation component is worth 20% of your final grade, and it will be marked in terms of delivery, quality, and organization. Peer reviews submitted by other students will constitute a portion of your mark. Conversely, you will be expected to submit a peer review for every other student's presentation, and submitting these peer reviews will also constitute a portion of your mark.

Report

Due December 5, 2022 at 12:15pm

In the report component, you will do two things: (i) write a short exposition about your chosen topic, and (ii) reflect on your presentation and give your assessment of your performance. The report is your opportunity to explain the basic concepts of your chosen topic, what motivated you to choose your topic and conduct your presentation in a certain way, what goals you aimed to achieve with your presentation, and so on. You will also have a chance to reflect on any general thoughts on teaching to your peers.

Your report should be a 4–6 page double-spaced document written in 12-point text. Aside from the two aforementioned parts, there is no required structure for the report, but you may use any or all of the above ideas to motivate what you include. You are recommended to include an introductory section summarizing the topic you chose for your presentation, as well as the main points you covered in your presentation.

You are expected to submit all of your presentation materials along with your report, including (but not limited to) slides, notes, activities, and anything else you used to prepare or deliver your presentation.

The report component is worth 20% of your final grade, and it will be marked primarily in terms of content. Both your report itself as well as your presentation materials will be marked simultaneously.

Suggested Topics

Below, I offer a (non-comprehensive) selection of suggested topics that you can choose for your lesson plan/presentation. You do not have to choose your topic from this list; these are only some ideas. You are welcome to study and present a topic related to this course that is not on this list.

Remember that your presentation must be around 15 minutes in length. You will not have a large amount of time to cover a lot of material. It is best to choose a specific topic/problem to discuss than to try and squeeze a large, general topic into a short amount of time.

- **Part II of the Course Textbook**
  Part II of the course textbook covers a selection of additional/advanced uses of techniques we learned in this course. If you opt to present material from the textbook, do *not* choose the generic "further uses of..." as your topic; choose one *specific* problem to focus on.
  - Further uses of greedy/local search algorithms
    - Uncapacitated facility location, k-median, minimum-degree spanning trees
  - Further uses of rounding data/dynamic programming
    - Euclidean TSP, maximum independent set
  - Further uses of deterministic rounding
    - Generalized assignment, bounded-degree spanning trees, network design
  - Further uses of randomized rounding
    - Uncapacitated facility location, rent-or-buy problem, Steiner trees, large graph cuts
  - Further uses of randomized rounding of semidefinite programs
    - Approximating quadratic programs, 3-colourability, unique games
  - Further uses of the primal-dual method
    - Prize-collecting Steiner trees, feedback vertex set
- **Hardness of Approximation**
  This area of research studies the computational complexity of finding approximate solutions to certain problems. Some results on hardness of approximation that we've seen in this course include phrases like "unless $\mathsf{P} = \mathsf{NP}$".
  - Reductions that preserve approximation
  - Reductions from probabilistically checkable proofs (PCPs)
  - Reductions from unique games
- **Approximable Problems Not Discussed in the Course**
  You may wish to study one specific problem for which it is possible to obtain approximate solutions. The problem you choose should be one that we did not discuss in class. If you choose this option, it is expected that you will introduce/define the problem and provide a review of progress on the problem, showing how researchers constructed or refined approximation algorithms for the problem.
- **Research on Approximation Algorithms**
  The area of approximation algorithms is one of ongoing, active study, with many new results being published each year. You may wish to select one recent paper on approximation algorithms (published, say, in the last five years) and discuss the findings/results of the paper. Some examples of venues where you can find recent research are below. If you need to access a paper but can't find a copy, contact me and I can help.
  - Int'l Workshop on Approximation Algorithms for Combinatorial Optimization (APPROX)
  - Int'l Workshop on Randomization and Computation (RANDOM)
  - Int'l Conference on Graph Algorithms and Approximation Algorithms (ICGAAA)