

## **CS6104 ONLINE ALGORITHMS**

Online algorithms are “decision-making” algorithms that typically do not have the entire data known to them. As data arrives, these algorithms process the data and make an irrevocable decision with a goal of maximizing or minimizing some objective function. For example, when we search on google, based on our search query, an online algorithm displays relevant ads on the side of our search results. For this problem, “data” is the search query, the algorithm decides on “which ads to display” and the objective function could be to maximize the ad revenues. Apart from ad-display, online algorithms have found a wide range of applicability in the design of real-time solutions for problems arising in the context of logistic operations, operating systems, transportation networks, processing large scale data and online machine learning. Many of these “provable” algorithms have found their way into practice. For example, the online algorithm responsible for almost all of the ad revenues of Google is based on Karp-Vazirani-Vazirani’s “RANKING” algorithm. With growing importance of real-time solutions, graduate students with a good understanding of online algorithms will be valuable in the job market.

In this course, we will study design and evaluation of online algorithms. Most topics covered will be based on recent progress in the area of online algorithms. We will consider designing algorithms under different assumptions on the data. For example, we will design efficient algorithms where we have some stochastic information of the input.

This course will be a “seminar” style course. In the first few lectures, I will introduce the different models in the online framework. The majority of the remaining lectures would involve discussing advanced papers with presentations by both students and invited guests.

**PREREQUISITES:** A strong background in algorithms and probability theory will be useful.

**PROJECTS:** A large part of your grade is based on the project outcome. Students can either take a “theory” project or an “applied” project. “Applied” projects will involve implementing existing online algorithms in a specific setting and fine-tuning the algorithm for this specific instance. “Theory” projects will involve surveying well-known approaches for designing online algorithms with an objective of coming up with an improvement for some special case.

**ASSIGNMENTS:** Tentatively, one or a group of students may be expected to write a summary of the paper discussed in the class. Each student will have to write no more than 2 papers.

**EXAMS:** None