# Teaching Statement

Tarikul Islam Papon (cs-people.bu.edu/papon/)

Teaching is a means of instilling a passion for learning, nurturing critical thinking skills, and preparing students for the challenges they will face academically, professionally, and in their everyday lives. My enthusiasm for teaching began informally in 2010 when I was an undergraduate student, offering private tuition to high school students in Bangladesh. Since then, my passion has only grown. I spent five years (2010-2014) training students at a coaching center, guiding over 2000 students in their college admission preparations. After completing my bachelor's, I served as a lecturer for four years (2015-2019) in the Department of Computer Science and Engineering at Bangladesh University of Engineering and Technology (BUET). During this time, I instructed four theory courses and numerous lab courses. Throughout my PhD (2019-present), I served as an instructor of a graduate-level course, as a teaching assistant for four courses and as a mentor to several undergrad and masters students, as well as high school interns. I consider teaching as one of the most rewarding and impactful aspects of my life. The interactions with these brilliant, young minds have contributed to my intellectual growth and shaped me into a better individual.

## Teaching Experience

**Course Instructor at Boston University.** I served as an instructor of the graduate-level course on Data Systems Architectures (CS 561) in Spring 2024. My goal for this course was to familiarize students with the essential trade-offs inherent in all data system designs, introduce the open research challenges in modern big data systems, and provide them with the opportunity to engage in hands-on problem-solving through small-scale projects. In this course, I discussed how to design data systems that can address the core big data management challenges like evolving hardware, parallelize query processing in multi-core, fast data ingestion, real-time analytics. I used examples from several data management areas including relational systems, distributed database systems, key-value stores, newSQL and NoSQL systems, data systems for machine learning (and machine learning for data systems), interactive analytics, and data management as a service. The website for this course is archived at bu-disc.github.io/CS561-Spring2024/. This was be a great opportunity for me to experience teaching at full-scale in the US. The class was very well-received among the students and I am continuing research collaboration with two students from the class. The course feedback can be found here cs-people.bu.edu/papon/pdfs/CS561_feedback.pdf.

**Teaching Fellow at Boston University.** During my PhD, I was a teaching assistant in four courses: (i) CS 210: Computer Systems (Fall 2023), (ii) CS 561: Data Systems Architecture (Spring 2023), (iii) CS 460: Database Systems (Fall 2021, Fall 2020), and (iv) CS 561: Data Systems Architecture (Spring 2021). My core responsibilities were to design assignments, set exam questions, and evaluate assignments and exams. I also hold weekly office hours to guide students with their assignments and clarify any concepts.

I served as a teaching fellow for the Computer Systems course, an undergraduate-level class with 300 students. The course aims to establish a software-oriented understanding of computer systems, covering fundamental concepts such as UNIX (shell) programming, the von Neumann computer architecture, assembly programming, and the C programming language. In my role, I conducted weekly discussion (lab) classes, offering a hands-on approach to familiarize students with tools like GDB, emacs, and vim, as well as concepts like shell scripting, assembly programming, and C programming. This course experience has provided valuable insights into effectively teaching fundamental concepts to a large number of young students.

The Data Systems Architecture course delves into cutting-edge research papers in the data management field, involving paper readings, in-class presentations, critical research analysis, and a small-scale systems/research project. I was the teaching assistant for this course twice and my primary role was to assist students with their projects. I really enjoyed this experience since it gave me opportunities to brainstorm new research ideas with the students on several projects and help them work on large-scale production codebases. I have been continuing my collaboration with two students for the past year to develop an SSD-aware graph manager, which started as a research project for this course.

The Database Systems course introduces fundamental concepts of modern data systems and provides insights into commercial data store operations. The course involves a project that allows hands-on experience in implementing different modules of a small-scale database management system named SimpleDB. Personally, this course allowed me to explain complex data system principles to a younger audience effectively.

**Lecturer at Bangladesh University of Engineering & Technology (BUET).** Before starting my PhD, I served as a lecturer for four years in the Department of Computer Science and Engineering (CSE) at BUET. During this time, I was the instructor of four theory courses – CSE 453: High-Performance Database Systems (Jan 2019), CSE 433: Digital Image Processing (Jan 2018, Jul 2016), CSE 317: Numerical Methods (Jul 2017), and CSE 307: Software Engineering & Information System Design (Jan 2017). I was the first to offer the High-Performance Database Systems course in 5 years where I introduced the students to modern data systems fundamentals, LSM-based key-value stores, distributed database systems, and recent research trends in data management. The class was well-received (rating: $4.14$ out of $5$), and at least two students consulted with me about pursuing higher studies in Data Systems, both of whom are now pursuing PhDs in the USA. Additionally, I taught Digital Image Processing twice, covering fundamental image processing techniques, hands-on implementation in Octave, and more complex concepts like image processing in the frequency domain and video processing. The class received an *excellent* rating of $4.61$. In the Numerical Methods course, I introduced common numerical methods, and their applications, and taught students to derive numerical methods for various mathematical operations. The Software Engineering & Information System Design course aimed to illustrate software engineering fundamentals through a large-scale project, allowing students to interpret software development steps and practices, discover research problems, and engineer solutions.

Further, I was involved in a total of $12$ sessional (lab) courses. Some of them were fundamental courses like Data Structures & Algorithms, Object Oriented Programming Lab, while some of them were advanced courses like Artificial Intelligence and Digital System Design. Sessional courses at CSE, BUET were designed to teach the concepts in a more hands-on manner by heavily focusing on programming assignments. My responsibility for the lab classes was to design these assignments, deliver lectures, evaluate and discuss solutions. The diverse set of courses taught has prepared me well to be able to cover a diverse range of courses from the fundamental concepts of computer systems to more advanced subjects. One of the highlights of my sessional courses was the Object Oriented Programming Lab where I received a rating of $4.48$ with some excellent comments from the students. Some of the noteworthy course ratings and feedback from my courses at CSE, BUET can be found here cs-people.bu.edu/papon/pdfs/cse_buet_feedback.pdf.

**Mentorship.** During my PhD, I had the privilege of closely collaborating with several young motivated students. I worked with Taishan Chen (current PhD student @ BU) and Shuo Zhang (current master's student @ Columbia University) on developing an SSD concurrency-aware graph manager. This work started as a research project proposed by me for their course *Data Systems Architecture* and eventually turned out a full-scale project. Our manuscript was published in SIGMOD 2024 and was presented in Santiago, Chile. I am currently working with Yiyun Zheng, a visiting undergraduate student on the effectiveness of SIEVE page replacement algorithm for database usecases. This work is a continuation of another project that happened over last summer with a high-school RISE intern Prisha Shah. In that summer, I also worked with a high-school intern Ronin Bae on developing an interactive demonstration for an asymmetry/concurrency-aware (ACE) database bufferpool (IEEE ICDE 2023), which incorporates crucial features of modern storage devices (read/write asymmetry & concurrency) to enhance performance. We are currently working on preparing the manuscript. I further worked with Subin (Rachael) Kim, another high-school intern on creating an interactive tool to analyze the impact of the Parametric I/O Model (DaMoN 2021) which captures the fundamental properties of modern storage devices. During my master's, I collaborated with Tariq Adnan and Saiful Islam on designing a distributed k-core decomposition to identify influential spreaders in a distributed environment, considering both user and topological information. This work was published in the Journal of Social Network Analysis and Mining (SNAM). Working with these young talents has been very rewarding for me since this offers a chance to explain complex database concepts efficiently.

**Trainer at Sunrise Coaching Center.** My teaching journey began in 2010 when I was one of the lecturers at a training center named "Sunrise Coaching Center". In Bangladesh, while the higher secondary exam is relatively manageable, securing admission to top universities poses a formidable challenge due to intense competition. To give an idea, although approximately 100,000 students ace their higher secondary exams with the highest grade annually, BUET admits only around 1000 students. At Sunrise, I trained prospective undergraduate students for their college admission test. My selection as a lecturer was based on *ranking 9th during my own admission.* Over five years, I taught more than 2000 students across seven branches, spanning four major divisions of Bangladesh. My teaching philosophy centered on articulating basic concepts, extensive problem-solving practice, continuous concept clarification, and providing crucial mental support during the rigorous four-month preparation period. I cherished interacting with students, and many who passed through my classes have successfully graduated from BUET and have ongoing connections with me.

## Teaching Philosophy

Being a good teacher, to me, means caring about students in every way. While it is important to teach them what they need to know, it is just as crucial to help them grow as individuals. I want to support students in reaching their short-term goals, while my bigger goal is to guide them toward their long-term dreams and maybe even spark an interest in research. I believe in creating an inclusive and collaborative learning environment that caters to diverse learning styles, nurtures intellectual curiosity, promotes active engagement, and encourages a shared commitment to the pursuit of knowledge.

My core teaching philosophy revolves around breaking down complex concepts into fundamental principles. In my classes, I simplify complicated ideas by starting with basic questions and gradually building a comprehensive understanding. This approach fosters creative and independent thinking among students. At the same time, I strongly believe that exposing the students to real-world systems is key to motivating them to learn practical principles, trade-offs, and current research trends. I have consistently applied this approach throughout my teaching career, where students went from basic assignments to creating systems with advanced features. For example, in the Computer Systems course at BU, students began with a basic shell programming assignment and progressed to building a system in C programming language, incorporating structures, linked lists, and multi-threading support. Having said this, building things from scratch or working on real-world systems is not a trivial task. That is why I want to create an interactive and supportive learning environment that motivates students to ask questions, work together, and think independently. Through this approach, I aim to equip students not only with subject-specific expertise but also with the essential skills and perspectives needed for lifelong learning and success. As a faculty, I aim to offer an environment that will offer equal opportunity to all students who are interested in learning or in doing research. Removing barriers to knowledge is not just my job as a teacher but also my responsibility as a member of the community.

## Teaching Plan

I am interested in teaching courses both at the undergraduate and graduate levels. My background enables me to teach various introductory-level courses in computer science like computer systems, data structures, algorithms and operating systems. Further, my research and teaching experience make me well-suited for teaching subjects related to databases, data management, and big data systems.

I am also interested in offering a course on *Modern Data Systems: Fundamentals and Trade-offs.* The goal of this new course will be to provide a comprehensive understanding of modern production-scale data systems, covering diverse design choices, implementations, tuning, workloads, performance, and trade-offs. It will delve into common system-level design principles, such as data structure, physical data layout, memory management, and data access while exploring the nuanced performance trade-offs between hardware and access methods. Additionally, I plan to highlight the impact of modern hardware and new dimensions in data systems for enhanced performance. The objective is to familiarize students with practical data management challenges, enabling them to develop essential skills and intuition for both industry and academia.