Statement of Purpose

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AB/SM Concurrent Master’s Program in Computer Science

Embarking on a graduate degree is a significant decision, motivated in my case by a combination of passion, curiosity, and strategic planning. My journey towards a Concurrent Master’s (AB/SM) in Computer Science has been influenced by prior graduate-level studies, academic interests, and research goals. I developed a deep interest in the research process through my engagement in thought-provoking research projects. This sparked the idea of taking more advanced, research-oriented courses throughout my time at Harvard, and generated my interest in pursuing an advanced degree concurrently with my undergraduate training.

My interest in learning more advanced concepts in Computer Science is driven by the ability of technical ideas to be applied to unrelated fields with great success. I have seen this firsthand through my research project *CS252R: Advanced Topics in Programming Languages*, a graduate-level program synthesis class. In 252R, we expanded on cutting-edge published work (*e.g.*, Stokes *et al.* in *Nature Machine Intelligence*) and applied Monte Carlo Tree Search (MCTS) to drug design and biomolecular synthesis. Using MCTS, we combined a library of molecular building blocks and biochemical reactions to create advanced chemical compounds that satisfy desired properties, like blood-brain-barrier permeability and binding affinity to brain targets. I find it fascinating that the same MCTS algorithm used to synthesize advanced computer programs can be also applied to generating molecules. The project underscored the potential for interdisciplinary technological applications, which when combined with the diverse collection of coursework that the AB/SM has to offer, can radically increase my exposure to different fields and expand the impact of my work.

I also find it impressive that Computer Science theory can shed light on social problems that would be difficult to analyze otherwise. My research in *CS 136: Economics and Computation* showed me how computational game theory concepts can be used to explain how humans behave in complex environments. My project focused on the dynamics of human cooperation, modeling repeated encounters between individuals as an infinitely-repeated game. The goal was twofold: to identify what settings lead to cooperative and spiteful behavior, and to verify through simulation the convergence of agent behavior to theoretically determined equilibria given specific conditions. By varying the quality of agents’ memory, we could check whether a better recall of past events made agents more spiteful, and by varying the discount factor of the rewards for each iteration we could verify for which ranges certain strategies were equilibriums. This exploration was not only academically enriching but also laid the groundwork for future work exploring the use of game theory to model human behavior and design systems where individual incentives are aligned with outcomes that are socially optimal. By tapping into the SM resources and increasing the breadth of courses I take, I hope to continue to make academic breakthroughs like this and accelerate my rate of discovery.

One such course that piqued my interest – which I intend to take – is *CS 238: Optimized Democracy*, which focuses on applying game-theoretic principles to real-world scenarios, such as national elections. This course offers an opportunity to understand the strategies of political parties and explore ways to incentivize voter participation. These areas align with my broader interest in applying computational methods to social and political challenges, demonstrating the versatility and relevance of computer science in contemporary societal issues. Pursuing the SM concurrently with my undergraduate degree would further contextualize the theoretical knowledge that I’ve gained from more fundamental undergraduate courses, exposing me to the many practical applications of Computer Science. This exposure would be especially beneficial for a potential future PhD, as I would gain additional clarity on the areas of research that interest me and that align with my set of skills, allowing me to produce more impactful research.

There are further professional reasons for pursuing a Master’s degree at this time. Many roles that interest me post graduation, particularly in the ever-evolving field of AI/ML, require an advanced degree. The increasing democratization of knowledge and use of AI as a productivity tool has raised the bar of complexity for meaningful contributions to the field. A thoughtful mix of undergraduate and graduate classes would allow me to not only understand the practical implications of the latest research in the field, but also to appreciate the theoretical underpinnings. This training would elevate me from an implementer to an engineer: someone who can closely follow the field and contribute to it meaningfully in the form of new models and applications.

Even though academic and professional aspirations are my main drivers compelling me to complete the AB/SM, financial considerations also play a role in my decision. As an international student, the financial landscape of U.S. education presents significant challenges. Doing the SM together with my AB would allow me to use my existing financial aid package, making obtaining an advanced degree less financially burdensome. This aspect removes a significant barrier to my higher education that international students often face.

On balance, with the above benefits in mind, I believe the AB/SM would be a valuable opportunity to advance my personal and career goals. My track record of excelling in rigorous and diverse classes has prepared me for an overload of courses and increase in rigor. Pursuing a Concurrent Master’s degree will be not just an extension of my education but a strategic step towards my ambitions to make significant contributions to the field of Computer Science and beyond.

My journey is characterized by a deep-seated interest in research and a desire to apply computational methods to complex, interdisciplinary problems. As I embark on this new phase of my academic journey, I am eager and prepared to embrace the challenges and opportunities that lie ahead. The opportunity of pursuing an AB/SM is filled with potential for personal growth and academic achievement, and I am excited to see where this path will lead.