SAMPLE C
Science and Technology Policy

Bachelor of Science
Date when Proposed

Proposed By:
Name of Student
UID
Address
Phone Number
Email

Sponsored By:
Name of Faculty Mentor, with Title
Department of Program
Phone Number
Email

Introduction

In 2017, I took a year off from school to work as the first product manager for a small post-Series A startup in San Francisco called Clara Labs. Clara Labs is building a software-as-a-service (SaaS) product, Clara, which leverages machine learning and humans to make email scheduling easier. In essence, Clara is a virtual scheduling assistant that works from a user's email to respond and work with participants in order to find a meeting time. The product fits into the highly anticipated and growing space of artificially intelligent (AI) consumer and enterprise products that are replacing typically human work tasks. Clara was challenging the need for human scheduling assistants. Being in this consumer AI tools market helped spark my interest in the future of work, and what that means in a society that is progressively adopting new solutions that remove the need for certain types of human labor.

There are a lot of moving pieces as we watch technologies disrupt work, such as the introduction of new jobs and industries, and growing populations of workers with unneeded skillsets. The importance of understanding the economic impacts can be seen through multiple case studies, including the most recent presidential election—the massive support from disenfranchised workers who were losing their jobs to technology and other competing forces was arguably a big reason why President Trump was elected.

Technology's influence on the future of work is just one example of how technology is impacting society. Other examples include how we share and digest information, how information accessibility is shifting our decision-making processes, and more. I am interested in developing a further understanding of the state and the progression of technology, the economic impacts of public introduction of various technologies, and what types of public policy around technology can be implemented to address these moving pieces. I am pursuing the Individual

Studies Program because it gives me the ability to build a tailored foundation in a range of subjects that intersect under technology policy, a major that is not otherwise offered at the university. IVSP will allow me to develop the informed multidisciplinary mindset needed to understand policy creation around technology and society.

Science and Technology Policy

The study of Science and Technology Policy focuses on the interdependency of technology, the economy, and policy. This major investigates how technology, specifically software, is developed, what the economic impacts are of technology introduction, and how policy can be created and implemented to encourage the responsible integration of technology into society. The three main concentrations of this major include public policy, computer science, and economics.

Public policy courses will develop an understanding of policy implementation and governance around emerging technology. The courses in this concentration will explore policy development within the context of an increasingly globalized world. Understanding how to maneuver the political climate and develop thoughtful policy around emerging technology is important in encouraging responsible technology adoption. These classes will allow me to develop a robust understanding of advocacy, forms of governances, and policy implementation. This concentration includes courses specifically focused on science and technology policy, including in the international arena.

Computer science courses provide the knowledge, such as software development and algorithm design, necessary to understand the underlying technology behind innovations that are shifting our society. Having this intensive comprehension of the technology will support a more robust analysis of the current state of technology and the trajectory of consumer products as enabled by technical improvements, such as algorithms. This is important because thorough technical literacy can offer valuable insights when considering the true economic impacts of different technology. The classes within this concentration focus on software development and theoretical computer science.

Economics will help develop skills to understand the incentives that drive technology innovation, as well as the impact on markets from emerging technology. The courses in this concentration allow for the comprehension of microeconomics, macroeconomics and behavioral economics. This concentration complements public policy and computer science by providing a basic understanding of what economic incentives actors, such as private technology companies, react to when developing software-dependent services, and how economies react to technology-enabled change.

Learning Object and Future Goals

Through the Science and Technology Policy major, I will build the skills necessary to assess the societal impacts of technology and develop meaningful governance structures to encourage responsible technology development. At the completion of my major, I will allow me to:

- Develop and demonstrate proficiency in computer programming, algorithms, and digital technology development
- Identify various public and private governance methods and frameworks used internationally
- Understand the domestic and international market dynamics (micro and macroeconomics) that influence technology development and consumption
- Realize the historical impact of technology in global economic growth
- Analyze existing domestic and international technology governance approaches
- Build quantitative and qualitative research skills, such as statistical modeling, qualitative coding, and literature reviews

This educational background will enable me to pursue my professional goals to become a policy advisor in science and technology policy.

During my remaining time at UMD, I am working in a human-computer interaction (HCI) lab that researches how emerging technologies, such as Amazon Alexa and various smartphone applications, can empower individuals to positively shift their health habits. In doing so, the lab is observing what impacts this has on doctor-patient relationships. This topic is relevant to my interest in science and technology policy as we observe how everyday

applications of well-designed software can catalyze a change in traditional work and expectations for doctors.

While at UMD, I also plan to participate in the Global Fellows concentration on Science Diplomacy: Foreign Policy and Science, Technology and Innovation. In conjunction with that program, I will engage in an internship related to science policy, perhaps at the Department of State, the Potomac Institute for Policy Studies, Booz Allen, or the White House Office of Science and Technology Policy.

After graduating, I want to gain a better understanding of the development strategies and limitations of AI products hitting the markets by working directly on technology products for example, Amazon's Echo, Microsoft's Cortana, Cruise Automation's autonomous car, or Nuance AI's medical assistant. After working in the industry for two to three years, I plan to pursue a master's or PhD program in science and technology policy to better lay the foundation necessary to eventually enter a formal policy role. Examples of programs that explore the intersection of technology, economics and policy include MIT's Technology and Policy Program, Carnegie Melon's Engineering and Public Policy program, and Stanford's Management Science and Engineering program.

My ultimate goal is to be able to work on researching impacts and governance of emerging technologies and advise groups on how we can create policy to adopt technology in a sustainable manner. Such policy advising can take place in a number of arenas including the White House Office of Science and Technology Policy, think tanks such as the Brooking Institution's Center of Technology Innovation, and private consulting groups such as McKinsey & Company.

Capstone Project

Amazon Go was founded in 2016 and is a grocery store operated by the online retail company, Amazon. This grocery store offers a new experience by removing the requirement of checkout lines. It is marketed to be the most advanced in-person shopping experience ever to be introduced to society. The crafting of this unique experience is grounded in facial recognition software and a variety of other detectors, including some in mobile devices, to track the movement and decisions of individual shoppers. This technology, as claimed, is extremely advanced, but it is also extremely disruptive. According to the Bureau of Labor Statistics in 2016, grocery stores alone employed around two and a half million Americans; retail shops overall employed about 16 million people. Without the need for as many cashiers, the retail industry's rate of employment is projected to decrease by over six million in the next ten years according to a study by Cornerstone Capital Group.

It is important to note though, that there are technical limitations that would require humans to still be a big part of this in-store shopping experience. Further, as technology develops, the experience model for these stores will shift as well and therefore continue to change the economic impacts. Since policy implementation is relatively long lasting, especially compared to the rate of technological innovation, it is important to keep future projections in mind when thinking about what policies could be enacted to regulate the responsible adoption of Amazon Go stores.

My capstone aims to answer the following questions: What is the technical trajectory of Amazon Go over the next 10 years, and what are the foreseeable economic impacts based on this trajectory? Given this prediction, how can policy guide responsible public adoption of these new stores? This project ties together the three concentrations defined within the major of Science

and Technology Policy by thoroughly analyzing the technical characteristics of the product, the economic impacts of public introduction, and the policy options that can help shape society's adoption of Amazon Go.

In order to conduct this research, I will collect informative resources about the technical characteristics of the store, such as Amazon's patents and public algorithms behind comparable technology, in order to understand the capabilities and limitations of the current model. This will enable me also to research the projected developments of this type of AI technology in order to understand how Amazon will be empowered to continue to iterate on this product. From there, I will use these technical insights to gather relevant employment data from sources such as The Bureau of Labor Statistics and Data USA, and research the potential impact on job markets. I will also conduct surveys with policy researchers from Amazon and other groups, such as McKinsey & Company's Future of Work division, around potential policy pathways to foster net positive social impact of technology introduction.

Ultimately, my final paper will start with a literature review to understand the state of technology relevant to Go, and the projection of technology development to recognize how the product will evolve in the next decade. Then, I will set the research question and methodology, compile and analyze findings with regards to economic impact, and conclude with policy recommendations regarding responsible adoption of the Amazon Go product.

Coursework by Concentration

** indicates courses already taken*
(CE) indicates currently enrolled courses

Public Policy

ENEE200*	**3**	**Technology and Consequences: Engineering, Ethics, and Humanity:** What makes a technology socially responsible? In this midst of this complexity, people make decisions with far reaching impacts. How then do we follow our passion for technology and innovation but also stay skeptical in a way that allows us to consider the potential and shortcomings of technology? Designed for both engineering and non-engineering students wishing to explore and assess the impact of engineering technology on society and the role of society in generating that technology.
HONR269P*	**3**	**Honors Seminar; Formulating U.S. Science and Technology Policy:** The U.S. competes in a global economy primarily on the basis of knowledge and creativity. Much of our success comes from capabilities in science and technology. This honors seminar will explore the facts needed to make policy decisions around science and technology, and students will be challenged to make recommendations to policy-makers.
HONR278G*	**3**	**Honors Seminar; Exploring How Foreign Policy Is Developed:** This course focused on the history of the U.S. National Security Council in order to study how U.S. foreign policy development has been formulated under different presidents. At the end of the course, students developed their own policy memos to prepare for a mock National Security Council meeting.
PLCY313 (CE)	**3**	**Advocacy in the American Political System:** Introduces students to the creation of law through the legislative process with a special focus on the Maryland General Assembly.
PLCY388V (CE)	**3**	**Special Topics in Public Policy; From Artificial Intelligence to Genetic Engineering: The Policy Implications of Emerging Technologies:** This course will study contemporary science and technology policy controversies as reflected in the news; the course material will be designed to respond flexibly to unforeseen policy issues that may arise during the course of the semester.
PLCY388C	**3**	**Special Topics in Public Policy; Cybersecurity Policy; Practical Hacking for Policy Makers:** This course explores the key issues facing policy makers attempting to manage the problem of

		cybersecurity from its technical foundations to domestic and international policy considerations surrounding governance, privacy, risk management, and operational orchestration. It is designed for students with no background in information technology and will provide the principles to understand the current debates shaping a rapidly evolving security landscape.
PLCY401 (CE)	**3**	**Contemporary Issues in Public Policy:** An integrative course that allows policy students to explore the complexities of the policy-making process from the perspective of specific policy topics.
FGMS370	**3**	**Science Diplomacy: Foreign Policy & Science, Technology, and Innovation:** An exploration of the critical roles scientific knowledge and technological innovation play in the formation and implementation of foreign policy issues, including energy and climate change, public health, space and innovation, and economic development.
FGSM398	**3-9**	**Federal and Global Experiential Learning**

Computer Science

CMSC131*	**4**	**Object-Oriented Programming I:** Introduction to programming and computer science. Emphasizes understanding and implementation of applications using object-oriented techniques. Develops skills such as program design and testing as well as implementation of programs using a graphical IDE. Programming done in Java.
CMSC132*	**4**	**Object-Oriented Programming II:** Introduction to use of computers to solve problems using software engineering principles. Design, build, test, and debug medium -size software systems and learn to use relevant tools. Use object-oriented methods to create effective and efficient problem solutions. Use and implement application programming interfaces (APIs). Programming done in Java.
CMSC216*	**4**	**Introduction to Computer Systems:** Machine representation of data including integers and floating point. Modern computer architectural features and their interaction with software (registers, caches). Interaction between user programs and the OS: system class, process, and thread management. Optimizing software to improve runtime performance using both compilers and hand turning.

CMSC250H*	**4**	**Discrete Structures:** Fundamental mathematical concepts related to computer science, including finite and infinite sets, relations, functions, and propositional logic. Introduction to other techniques, modeling and solving problems in computer science. Introduction to permutations, combinations, graphs, and trees with selected applications.
CMSC351*	**3**	**Algorithms:** A systematic study of the complexity of some elementary algorithms related to sorting, graphs and trees, and combinatorics. Algorithms are analyzed using mathematical techniques to solve recurrences and summations.
ENES461 (CE)	**3**	**Advanced Entrepreneurial Opportunity Analysis in Technology Ventures:** Explores the factors that influence entrepreneurial opportunity analysis in technology-based ventures. Uses a cognitive theoretical framework to examine the integration of motivation, emotions and information processing modes to make complex entrepreneurial decisions in fast pace technology venture environments.
INST309	**3**	**Independent Study in Information Science:** Learn more about design thinking strategies and human-computer interaction elements with regards to data visualization in mobile applications. My advisor, Dr. Eun Kyoung Choe, will guide me through a series on online content and readings in order to understand best practices for conducting user research and developing prototypes.

Economics

MATH141H*	**4**	**Calculus II:** Continuation of MATH140, including techniques of integration, improper integrals, applications of integration (such as volumes, work, arc length, moments), inverse functions, exponential and logarithmic functions, sequences and series.
HONR288N*	**3**	**Honors Seminar; Understanding the Global Economic Environment:** A brief history of global trade, and monetary and fiscal policy that influenced international markets.
ECON200 (CE)	**3**	**Principles of Microeconomic:** Introduces economic models used to analyze economic behavior by individuals and firms and consequent market outcomes. Applies conceptual analysis to several policy issues and surveys a variety of specific topics within the broad scope of microeconomics.
ECON201 (CE)	**3**	**Principles of Macroeconomics:** An introduction to how market economies behave at the aggregate level. The determination of

		national income/output and the problems of unemployment inflation, will be examined, along with monetary and fiscal policy.
ECON305	**3**	**Intermediate Macroeconomic Analysis Theory and Policy:** Analysis of the determination of national income, employment, and price levels. Discussion of consumption, investment, inflation, and government fiscal and monetary policy.
ECON306	**3**	**Intermediate Microeconomic Analysis Theory and Policy:** Analysis of the theories of consumer behavior, producer behavior, different market structures, and various sources of inefficient outcomes. Analysis of microeconomic policies designed to improve market outcomes.
ECON399	**3**	**Independent Study in Economics**
STAT400	**4**	**Applied Probability and Statistics I**: Random variables, standard distributions, moments, law of large numbers and central limit theorem. Sampling methods, estimation of parameters, testing of hypotheses.

Individual Studies

IVSP 317	**1**	**Progress Report**
IVSP 420	**3**	**Senior Paper**
Writing Craft Course	**3**	**ENGL294: Persuasion and Cleverness in Social Media**

Credits from 300+ level courses (excluding IVSP courses): 40-46/27 required credits in 11 courses

Total Credits including IVSP: 85-91

Current Status: 35/85-91

General Education Coursework

FUNDAMENTAL STUDIES

Category	Course(s)	Title	Semester Taken
FSAW (3)	ENGL101	Academic Writing	AP Credit
FSPW (3)	ENGL393	Technical Writing	Fall 2018
FSOC (3)	INAG110	Oral Communication	Spring 2015
FSMA (3)	MATH140	Calculus I	Fall 2014
FSAR (3)	STAT100	Elementary Statistics and Probability	AP Credit

DISTRIBUTIVE STUDIES

Category	Course(s)	Title	Semester Taken
DSNS/DSNL (7)	PHYS161	Mechanical & Particle Dynamics	Spring 2015
	PHYS260	General Physics: Vibration, Waves, Heat, Electricity and Magnetism	Fall 2015
	PHYS261	Lab: Vibration, Waves, Heat, Electricity and Magnetism	Fall 2015
DSHS (6)	HONR288N	Global Economic Environment	Spring 2016
	HONR278G	How Foreign Policy Is Developed	Fall 2016
DSHU (6)	ENEE200	Technology and Consequences: Engineering, Ethics, and Humanity	Fall 2015

	AMST298A	Shifting Sands: Constructing Cultural Mainstreams and Margins in the US	Summer 2018
DSSP (6)	ENES100	Introduction to Engineering Design	Fall 2014
	HONR269P	U.S. Science & Tech Policy	Fall 2016

I-SERIES

Category	**Course(s)**	**Title**	**Semester Taken**
SCIS (6)	HONR288N	Understanding the Global Economic Environment	Spring 2016
	AMST298A	Shifting Sands: Constructing Cultural Mainstreams and Margins in the US	Summer 2018

DIVERSITY

Category	**Course(s)**	**Title**	**Semester Taken**
DVUP (3-6)	AMST298A	Shifting Sands: Constructing Cultural Mainstreams and Margins in the US	Summer 2018
	WMST250	Introduction to Women's Studies: Women, Art and Culture	Winter 2019

Coursework by Semester

Spring 2018	
ECON200: Principles of Microeconomics	3
ECON201: Principles of Macroeconomics	3
PLCY388V: Special Topics in Public Policy; From Artificial Intelligence to Genetic Engineering: The Policy Implications of Emerging Technologies	3
PLCY313: Advocacy in the American Political System	3
PLCY401: Contemporary Issues in Public Policy	3
ENES461: Advanced Entrepreneurial Opportunity Analysis in Technology Ventures	3
	18
Summer 2018	
ENGL294: Persuasion and Cleverness in Social Media	3
AMST289A: Shifting Sands: Constructing Cultural Mainstreams and Margins in the US	3
	6
Fall 2018	
ENGL393: Technical Writing	3
INST309: Independent Study in Information Science	3
ECON305: Intermediate Macroeconomic Analysis Theory and Policy	3
ECON306: Intermediate Microeconomic Analysis Theory and Policy	3
FGSM370: Science Diplomacy: Foreign Policy & Science, Technology, and Innovation	3
STAT400: Applied Probability and Statistics I	3
	15
Winter 2019	
WMST250: Introduction to Women's Studies: Women, Art and Culture	3
	3
Spring 2019	
ECON399: Independent Study in Economics	3
PLCY388C: Special Topics in Public Policy; From Artificial Intelligence to Genetic Engineering: The Policy Implications of Emerging Technologies	3
IVSP317: Progress Report	1
IVSP420: Senior Paper	3
FGSM398: Federal and Global Experiential Learning	3-9
	13-19

Name: Amritha Jayanti
Major Title: Technology, Policy and the Public

For Office Purposes Only	COURSE#	Course Title	Credits
Concentration 1: Public Policy			
	ENEE200	Technology and Consequences: Engineering, Ethics, and Humanity	3
	HONR269P	Honors Seminar; Formulating U.S. Science and Technology Policy	3
	HONR278G	Honors Seminar; Exploring How Foreign Policy Is Developed	3
	PLCY313	Advocacy in the American Political System	3
	PLCY388V	Special Topics in Public Policy; From Artificial Intelligence to Genetic Engineering: The Policy Implications of Emerging Technologies	3
	PLCY388C	Special Topics in Public Policy; From Artificial Intelligence to Genetic Engineering: The Policy Implications of Emerging Technologies	3
	PLCY401	Contemporary Issues in Public Policy	3
	FGSM370	Science Diplomacy: Foreign Policy & Science, Technology, and Innovation	3
	FGSM398	Federal and Global Experiential Learning	3-9
Concentration 2: Computer Science			
	CMSC131	Object-Oriented Programming I	4
	CMSC132	Object-Oriented Programming II	4
	CMSC216	Introduction to Computer Systems	4
	CMSC250H	Discrete Structures	4
	CMSC351	Algorithms	3
	ENES461	Advanced Entrepreneurial Opportunity Analysis in Technology Ventures	3
	INST309	Independent Study in Information Studies	3

Concentration 3: Economics			
	MATH141H	Calculus II	4
	HONR288N	Honors Seminar; Understanding the Global Economic Environment	3
	ECON200	Principles of Microeconomic	3
	ECON201	Principles of Macroeconomics	3
	ECON305	Intermediate Macroeconomic Analysis Theory and Policy	3
	ECON306	Intermediate Microeconomic Analysis Theory and Policy	3
	ECON399	Independent Study in Economics	3
	STAT400	Applied Probability and Statistics I	4
Total 300+ Level Credits (excluding IVSP courses)			37-43
	IVSP317	Progress Report	1
	IVSP420	Senior Paper	3
	ENGL294	Persuasion and Cleverness in Social Media	3
Total Credits (including IVSP courses)			85-91