WEB3, AI AND QUANTUM (WAIQ)

SUMMER COURSE

AT RCC AT HARVARD UNIVERSITY

JULY 2023

ESSENTIALS FOR THE COURSE: PRE-READINGS, QUESTIONS, AND DISCUSSIONS

PONS ESCUELA DE NEGOCIOS

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QCentroid

INTRODUCTION TO THE COURSE

The course, "Web3, AI, and Quantum Computing (WAIQ): Challenges and Opportunities for Innovators, Legal Professionals, and other Curious Minds," offers a comprehensive exploration of the transformative potential of emerging technologies from technical, legal, and ethical perspectives.

Web3, also known as the decentralized web, represents the evolution of the internet built on blockchain technology. Participants will delve into the foundational principles of Web3 and understand how it disrupts traditional models by empowering users, enabling decentralized applications, and redefining business models. They will explore the technical aspects of Web3, including blockchain, smart contracts, decentralized identity, and tokenization. The course will also emphasize the legal and regulatory implications of Web3, providing insights into the challenges and opportunities for legal professionals and entrepreneurs.

AI, or Artificial Intelligence, is reshaping industries across the globe, including the legal sector. Participants will gain an understanding of the capabilities and applications of AI in the legal field, exploring topics such as legal research automation, contract analysis, and predictive analytics. The course will highlight the ethical considerations associated with AI, addressing concerns around bias, transparency, and accountability.

Quantum Computing, a cutting-edge field of research, offers the promise of revolutionizing data processing and computation. Participants will explore the fundamentals of quantum computing and its potential to solve complex problems more efficiently than classical computers. They will examine the impact of quantum computing on cryptography, data security, optimization, and simulations.

Furthermore, it is essential for all participants to approach the course with an attentive mindset. It is strongly encouraged that students carefully read the assigned pre-readings, engage with the provided questions, and actively participate in the discussions. By thoroughly engaging with the course materials, students will be able to delve deeper into the subject matter, ask insightful questions, and contribute to meaningful discussions.

The readings, questions, and discussions are carefully curated to enhance the learning experience and facilitate a comprehensive understanding of the topics covered. They serve as valuable resources for expanding knowledge, gaining different perspectives, and fostering critical thinking. Active participation in discussions will allow students to share their insights, exchange ideas, and learn from their peers' diverse perspectives.

By fully immersing themselves in the course materials and actively participating in discussions, students will maximize their learning outcomes, deepen their understanding of the challenges and opportunities presented by Web3, AI, and Quantum Computing, and be better equipped to apply this knowledge in real-world contexts.

DAY 1: Web 3 – July 24th

PRE-READINGS

The following list of resources will help you understand the main concepts behind web3 and, more importantly, how thought leaders in technology, innovation and also the digital economy are addressing this trend. The list is clustered by subtopic within web3, with each cluster trying to include factual and descriptive must-reads that serve as a reference for learning about the topic, but also some controversial insights on concepts such as decentralisation or the economic dynamics behind them.

What is web3 – The basics

BOOKS:

Better than focus just in web3, this list review the context that enables the digital world to enlighten the concept, how internet evolves from the web to bitcoin, how blockchain grew beyond crypto and how the players in the arena face the related challenges:

- "*Weaving the Web: The Original Design and Ultimate Destiny of the World Wide Web*" by Tim Berners-Lee"
- "*Blockchain Basics: A Non-Technical Introduction in 25 Steps*" by Daniel Drescher
- "*The Infinite Machine: How an Army of Crypto Hackers Is Building the Next Internet with Ethereum*" by Camila Russo
- "*Bubble or Revolution*" by Neel Mehta, Parth Detroja, and Aditya Agashe.
- "*Web3: What is Web3? Potential of Web 3.0*" by Patrick Ejeke
- "*Blockchain Wars*" by Evan McFarland

ARTICLES, ESSAYS AND POSTS:

Simply search for Web3 in your favourite search engine or narrow it down with terms like 101, basics, foundations, or similar. You will find millions of entries, many of them interesting, almost all from spokespersons and believers of the new internet or simple opinion makers. From all of them, I personally choose these:

- The Third Web review the basics and some tips about technology and what tokens, NFTs, DAOS are. The best are the conclusions, where you can find some of the most commonly heard criticisms.
- If you prefer a straight-forward recipe, you can also review What is Web3? Explained simply wrote by one of the crypto contributors at Forbes. He also writes about UX in web3.
- What is web3? According Harvard Business Review. In fact is a compilation of essays in The Big Idea Series, published in 2022, covering from blockchain and crypto to DAOs and NFTs and insights about the so-called new era.
- On the other side, to understand web3 as the evolution of the Internet going through web 2.0 (the web of today, the web of the platforms) to end up in the web we trust (i.e. web3), the best piece is this: The story of web3
- The Meaning of Decentralization is a must-read post of Vitalik Buterin himself (one of the founders of Ethereum) to understand the logic behind decentralised networks and how they can move ecosystems to a new frontier where value chains are re-designed. Yo can also review this guide Decentralization for Web3 Builders to putting Vitalik's insights into practice.

PODCAST:

For blockchain and web3 news and related content, there are a couple of podcast you can follow:

- "web3 with a16z", the show by a16zcrypto (you can also subscribe to the newsletter "web3 weekly")
- Blockchain Won't Save the World, hosted by Antthony Day, one of the most followed web3 profiles in linkedin (also with newsletter: This Week in Web3)
-

The new economy

BOOKS:

- *The Internet of Money*" by Andreas Antonopoulos
- "*Token Economy: How the Web3 Reinvents the Internet*" by Shermin Voshmgir
- "*The Business Blockchain: Promise, Practice, and Application of the Next Internet Technology*" by William Mougayar

ARTICLES, ESSAYS AND POSTS:

- Remember than one of the main pillars of web3 are the tokens. The best explanation I found to understand what they are and its potential is this piece published by Packy McCormick in his newsletter: Own the Internet.
- For reading about doubts and concerns focused just in tokens, NFTs and the underlying economy): Web3 is the future, or a scam, or both
- You can built yourself a broader perspective of web3 as a whole economy from The ownership economy, published by the team of Variant, one of the biggest early-stage funds investing in web3.

PODCAST:

- Tokens, but How?, focused more on tlkens than the dorader web3 space

Web3 business models

BOOKS:

- "*Web3: The End of Business-As-Usual*" by Graham Cooke
- "*Into the Metaverse: The Essential Guide to the Business Opportunities of the Web3 Era*" by Cathy Hackl

ARTICLES, ESSAYS AND POSTS:

- Mapping the Web3 Identity Landscape explains from different point of views the challenges behind the umbrella of identity, key for interoperability, user-centricity, ownership, portability, etc. Remember that identity as a bundle of ensured credentials is one of the pillars of web3 to create new businesses and redesign how the digital services can create value.
- To know about web3 use cases, again you can review some of the pieces in Packy McCormick's newsletter: Web3 Use Cases: Today and Web3 Use Cases: The Future
- I particularly like how the fund a16zcrypto focus on tokens as a driver for customer acquisition proposing New mindsets, Tactics, Metrics for web3 projects go-to-marking strategy.

Regulation, ethics and law

BOOKS:

- "*Blockchain and Web 3.0: Social, Economic, and Technological Challenges (Routledge Studies in Science, Technology and Society Book 41)*" Massimo Ragnedda and Giuseppe Destefanis

ARTICLES, ESSAYS AND POSTS:

- Regulate Web3 Apps, Not Protocols, is a series of 4 pieces (here parts II, III, and IV) by a16zcrypto claiming that businesses should be the focus of regulation, whereas decentralized, autonomous software, should not.
- As the state of the world changes, laws become outdated, and forcing future generations to abide by outdated laws is unjust and inefficient. This is the thesis that support the Legal Dynamism
- Anti-money laundering by design explore how CDBC can implement o meeting regulatory objectives.

SCHEDULE

THE STATE OF THE ART	
9:00 – 9:15	**Course welcoming**
9:15 – 9:30	**What does web3 really mean and what is new about it**
José Luis Núñez – Global head of blockchain and web 3 at Telefónica Tech	
9:30 – 10:15	**Web3 and the Internet of Value: Challenges in Interoperability**
Thomas Hardjono - CTO of Connection Science and Technical Director of the MIT Trust-Data Consortium at MIT	
10:15 – 10:45	Coffee break
THE STATE OF THE LAW	
10:45 – 11:45	**Regulation by Design for Web3 and generative AI**
Robert Mahari - PhD student in the Human Dynamics group at MIT Media Lab and a JD candidate at Harvard Law School.	
11:45 – 12:45	**Legal Implications of Web3**
Alfredo Muñoz - professor of Commercial Law at the Complutense University of Madrid and Crypto and Blockchain Legal Advisor at GRANT THORNTON Spain Carmen Santo – Senior associate in the M&A department of Uría Menéndez and consultant for the Sydney office of Gilbert + Tobin	
12:45 – 13:45	Lunch
THE STATE OF THE ETHICS	
13:45 – 14:45	**Ethical considerations of New technologies**
Danilo Petranovich - Director of the Abigail Adams Institute in Cambridge,	
THE CASE	
14:45 – 16:15	**Understanding web3 opportunities for companies**
Luis Ignacio Vicente - Strategic Advisor of PONS IP José Luis Núñez – Global head of blockchain and web 3 at the Telefónica Group	

THE STATE OF THE ART | Web3 and the Internet of Value: Challenges in Interoperability

During this session, Thomas Hardjono will lead the discussion on the advent of Web3 and the Internet of Value has ushered in a new era of decentralized ecosystems. However, one of the significant challenges faced in this domain is interoperability. With multiple blockchains, cryptocurrencies, and decentralized applications (DApps) emerging, ensuring seamless communication and exchange of value between these different systems becomes crucial. Interoperability hurdles include the need for standardized protocols, cross-chain communication solutions, and consensus mechanisms that enable efficient and secure transfers of assets and data. Overcoming these challenges will be instrumental in realizing the full potential of Web3 and enabling the widespread adoption of decentralized technologies.

THE STATE OF THE LAW | Regulation by Design for Web3 and generative AI

During this session, Robert Mahari will lead the opinion on the art to law dimension. Regarding the Web3 space, it becomes especially important how regulatory objectives may be integrated into the technical design of decentralized systems. But also the same claims can be applied to generative IA. You should consider than the regulator's ultimate aim is minimise or eliminate as much as possible specific risks in different sectors to provide a confident environment to citizens and consumers to enjoy products and services and companies to make business. If companies (and responsibility) are diluted in decentralised environments and new players play a role in the value chain, how should regulators grapple with these risks? What regulatory approaches appear more promising and how do we balance consumer protection with innovation in the web3 paradigm? How we can deal with this topic after massive adoption of generative AI based solutions?

Also, during this session, Alfredo Muñoz and Carmen Santo will lead the discussion on the decentralized ecosystems, the issue of intellectual property (IP) rights has emerged, prompting exploration of protection methods through blockchain-based solutions. Central Bank Digital Currencies (CBDCs) and the Markets in Crypto-Assets Regulation (MICA) in Europe have addressed the legalities surrounding digital assets. NFTs, DAOs, and other Web3 components offer opportunities for innovation, but their legal constraints include copyright, licensing, and securities regulations. Smart contracts present legal concerns such as ambiguous terms and liability in automated environments. Tokenized assets enable fractional ownership and liquidity, but require a clear legal framework for compliance, investor protection, and asset authenticity.

THE STATE OF THE ETHICS | Ethical considerations of web3, IA and Quantum

Danilo Petranovich aims to provide a comprehensive overview of ethical motivation in business behavior. The lecture will begin by addressing the common tendency among practitioners to adopt a specific interpretation of Adam Smith's model as a guide for business practices. This initial model will be briefly explained to set the stage for the alternative approach proposed.

Danilo will then introduce Dr. Manuel Guillen's work, which serves as the foundation for an alternative model of work ethics. This model is based on philosophical and economic sources that trace back to the roots of the Western tradition. It is described as robust and comprehensive, offering a more expanded and complex understanding of motivations

compared to existing models. Importantly, Dr. Guillen's model is said to align more closely with the reality of the human person, providing valuable guidance for flourishing in the modern world.

THE CASE | Understanding web3 opportunities for companies

After exploring the comprehensive scope of the Web3 concept, it is crucial to examine real-world applications that are already leveraging its benefits. Luis Ignacio Vicente del Olmo and José Luis Núñez will delve into the discussion on how decentralized approaches can address and solve significant challenges across various domains.

The objective is not simply to identify specific applications or services, but rather to understand how each implementation of technology and concepts under the Web3 umbrella can translate into a competitive advantage. By analyzing these examples, we can gain insights into the unique ways in which decentralized approaches are revolutionizing industries and reshaping traditional business models. These applications showcase the transformative potential of Web3, highlighting how it enables greater transparency, trust, and efficiency, while empowering users and fostering innovation.

By examining the problems that decentralized approaches can solve, we can identify the key pain points in different sectors, such as finance, supply chain, governance, healthcare, and more. Decentralization has the potential to address issues related to intermediaries, data privacy, security, scalability, and access to financial services, among others. Understanding these challenges and how Web3 solutions tackle them provides a foundation for envisioning the broader impact and opportunities presented by decentralized technologies.

DAY 2: Artificial Intelligence – July 25th

PRE-READINGS

The following list of resources will help you understand the main concepts behind web3 and, more importantly, how thought leaders in technology, innovation and also the digital economy are addressing this trend. The list is clustered by subtopic within web3, with each cluster trying to include factual and descriptive must-reads that serve as a reference for learning about the topic, but also some controversial insights on concepts such as decentralisation or the economic dynamics behind them.

The basics
ESSENTIAL READINGS: Cardiff Case: https://www.judiciary.uk/wp-content/uploads/2022/07/bridges-swp-judgment-Final03-09-19-1-1.pdf https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2021)698792 "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig. "Superintelligence: Paths, Dangers, Strategies" by Nick Bostrom. "The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our World" by Pedro Domingos. "AI Superpowers: China, Silicon Valley, and the New World Order" by Kai-Fu Lee. "Human Compatible: Artificial Intelligence and the Problem of Control" by Stuart Russell.
ARTICLES, ESSAYS AND POSTS: "Life 3.0: Being Human in the Age of Artificial Intelligence" by Max Tegmark. "The Singularity is Near: When Humans Transcend Biology" by Ray Kurzweil. "Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville. "Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy" by Cathy O'Neil.
PODCAST: "AI Alignment Podcast" by The Future of Life Institute. "Data Skeptic" by Kyle Polich. "The AI Alignment Podcast" by The Center for Human-Compatible AI. "TWiML & AI (This Week in Machine Learning & Artificial Intelligence)" by Sam Charrington. "AI in Business" by Dan Faggella.

SCHEDULE

THE STATE OF THE ART	
9:00 – 9:15	**Day welcoming**
9:15 – 10:30	**Understanding AI and its challenges and opportunities**
Gabriel López - Microsoft	
10:30 – 11:00	Coffee break
THE STATE OF THE LAW	
11:00 – 13:00	**Legal & Regulatory implications of AI**
Cristina Mesa – Garrigues & Carlos Muñoz Ferrandis – Hugging Face.	
13:00 – 14:45	Lunch
THE CASE	
14:45 – 17:00	**AI & Utilities**
Kalyan Veeramachaneni – MIT & Beatriz Crisóstomo and Marta Luengo – Iberdrola.	

THE STATE OF THE ART | Understanding AI and its challenges and opportunities

Gabriel López is leading the session about understanding AI and its challenges and opportunities. The session begins with a discussion of the fundamental concepts of artificial intelligence, including machine learning, neural networks, and natural language processing. Participants will explore how AI has evolved over time and how it is impacting various industries and aspects of our lives.

Challenges associated with AI implementation, such as data privacy, bias, and ethical concerns, will be addressed. The session will delve into the potential of AI to revolutionize industries and create new business models. It will also explore how AI can improve efficiency, reduce costs, and create novel opportunities for innovation.

Set of questions based on the case NO: CO/4085/2018 and the AI Act– Please do not distribute with the suggested responses.

Summary

The claimant is Edward Bridges, who brought a judicial review challenge against the use of Automated Facial Recognition technology by the South Wales Police. The case was heard by the High Court of Justice in 2019 and the claim was dismissed.

The claimant appealed to the Court of Appeal, which allowed the appeal in part in 2020 and found that the use of AFR by the police was unlawful in certain respects.

Questions

- **What are the main differences between automated facial recognition technology (AFR) and traditional CCTV in terms of data protection and privacy rights?**
- **What are the benefits and risks of using AFR for law enforcement purposes?**
- **What is the EU AI Act?**
- **Why is FRT considered sensitive under the EU AI Act?**

THE STATE OF THE LAW | Legal & Regulatory implications of AI

During this session, Cristina Mesa and Carlos Muñoz Ferrandis will lead the discussion on the legal and regulatory implications of AI. They will focus on the challenges that arise when AI technologies intersect with existing laws and regulations. The session will explore topics like data protection, intellectual property rights, liability, and transparency in AI decision-making processes.

Participants will also examine how regulators can integrate their objectives into the technical design of AI systems, akin to the approach discussed in the Day 1 session about Web3. The session will address the balance between consumer protection and innovation in the context of

AI technologies. Additionally, the speakers will consider how generative AI solutions, which create new content autonomously, impact legal frameworks.

THE CASE | AI & Utilities

Kalyan Veeramachaneni, Beatriz Crisóstomo, and Marta Luengo will present Case 2 Analysis, focusing on AI and utilities. The session will showcase real-world examples of how AI is being applied in the utility sector to solve problems and enhance operations.

Participants will gain insights into how AI is used for optimizing energy distribution, predicting maintenance needs, and improving resource management. The discussion will also cover the challenges faced in integrating AI solutions into traditional utility systems, such as regulatory approval and data security.

The speakers will highlight the opportunities that AI presents for utilities to transform their operations, enhance customer experiences, and contribute to a more sustainable energy future.

Participants will have the opportunity to engage with the speakers and discuss the practical applications and implications of AI in the utility industry.

DAY 3: Quantum Computing – July 26th

PRE-READINGS

The basics
ESSENTIAL READINGS: https://www.ibm.com/downloads/cas/J25G35OK https://issuu.com/quantumdelta.nl/docs/eqta_-_english_version Evidence of Quantum Utility before fault tolerance – see IBM blog and references therein https://research.ibm.com/blog/utility-toward-useful-quantum
ARTICLES, ESSAYS AND POSTS: 1. National Quantum Initiative - National Quantum Initiative 2. The Quantum Economic Development Consortium (QED-C) - QED-C | The Quantum Economic Development Consortium (quantumconsortium.org) 3. National Institute of Standards and Technology (NIST), Post-Quantum Cryptography (PQC) - Post-Quantum Cryptography | CSRC (nist.gov) 4. IBM, Quantum Machine Learning - Quantum Machine Learning | IBM Research 5. Quantum Computing Companies - 81 Quantum Computing Companies: An Ultimate 2023 List (thequantuminsider.com) 6. Export Controls - To Restrict, or Not to Restrict, That Is the Quantum Question - Lawfare (lawfareblog.com) 7. Quantum Computing Ethical Risks - Quantum computing ethical risks | Deloitte Insights
PODCAST: "The Quantum Computing Podcast" by Oxford Quantum Circuits. "Quantum Week" by Ali Almheiri.

SCHEDULE

THE STATE OF THE ART	
9:00 – 9:15	**Day welcoming**
9:15 – 10:30	**Concepts and Potential of Quantum Computing (QC)**
Luis Ignacio Vicente – PONS IP Esperanza Cuenca-Gómez - Multiverse Carlos Kuchovsky – QCentroid Borja Peropadre - IBM Francisco Castro – IONQ José Luis Amat Reinoso - UCM	
10:30 – 11:00	Coffee break
THE STATE OF THE LAW	
11:00 – 12:45	**Legal Implications of QC**
Francisco Castro – IONQ José Luis Amat Reinoso - UCM	
13:00 – 14:45	Lunch
THE CASE	
14:45 – 16:30	**New QC companies**
Esperanza Cuenca-Gómez - Multiverse Carlos Kuchovsky – QCentroid Borja Peropadre - IBM	
16:30 – 17:00 **Wrap Up & Closing Remarks**	
Esperanza Cuenca-Gómez - Multiverse Carlos Kuchovsky – QCentroid Borja Peropadre – IBM Luis Ignacio Vicente – PONS IP	
17:00 – 17:15 **Closing & Feedback**	
Luis Ignacio Vicente – PONS IP José Luis Amat Reinoso - UCM	

THE STATE OF THE ART | Concepts and Potential of Quantum Computing (QC)

Luis Ignacio Vicente del Olmo, Carlos Kuchovsky, and Esperanza Cuenca-Gómez introduce the concepts and potential of quantum computing. They provide an overview of quantum computing, highlighting its fundamental principles, such as superposition and entanglement, and explain how these principles enable the processing of complex calculations with exceptional speed and efficiency. They also discuss the transformative potential of quantum computing in various fields, including cryptography, optimization, drug discovery, and materials science.

Borja Peropadre delves deeper into the principles underlying quantum computing. He explains quantum bits or qubits, quantum gates, and quantum algorithms. He elucidates how quantum systems differ from classical systems and the computational advantages offered by quantum computers. Through examples and illustrations, he helps the audience grasp the fundamental concepts of quantum computing.

Francisco Castro explores the diverse applications and potential of quantum computing in different industries. He showcases real-world use cases where quantum computing has the potential to revolutionize fields such as finance, healthcare, logistics, and artificial intelligence. He discusses how quantum computing can enhance optimization problems, accelerate machine learning algorithms, and enable breakthroughs in molecular simulations and quantum chemistry.

THE STATE OF THE LAW | Legal Implications of QC

José Luis Amat, Francisco Castro, Esperanza Cuenca-Gómez (Assistant), Carlos Kuchovsky (Assistant), and Borja Peropadre (Assistant) address the regulatory considerations surrounding quantum computing. They discuss the legal and ethical challenges associated with quantum technologies, including data privacy, cybersecurity, export control, and intellectual property rights. They explore the need for regulatory frameworks that balance innovation and societal concerns, ensuring responsible and secure adoption of quantum computing.

1. **Export Control**:
   What considerations do you think should be taken into account regarding the export control of quantum computing technologies and related knowledge? What could be the implications of insufficient or excessive control on the worldwide development and adoption of quantum computing? Should export considerations be unilateral or multilateral?

2. **Security and Privacy of Information**:
   What implications do you think breaking encryption algorithms would have in areas such as e-commerce, banking, healthcare, and personal data protection? Will post-quantum cryptography (PQC) standards be effective?

3. **Protection of Intellectual Property**:
   In what ways do you think the advancement of quantum computing could facilitate the violation of patents and copyrights? Given the challenges various patent offices are having dealing with the difficulties in this technology, will courts and agencies be effective places to adjudicate IP disputes?

4. **Cryptography and Regulation**:
   What concerns may arise when regulating the use and distribution of quantum cryptography technologies?

5. **Ethics and Responsibility**:
   What are some ethical and responsibility concerns associated with the development of quantum computing? In what situations do you think it could be used inappropriately or maliciously? What is the role of the government and of non-governmental entities to push for ethical considerations as the technology matures?

Privacy and security challenges

State of the Law: José Luis Amat, Francisco Castro, Esperanza Cuenca-Gómez (Assistant), Carlos Kuchovsky (Assistant), and Borja Peropadre (Assistant) examine the privacy and security challenges posed by quantum computing. They discuss the potential vulnerabilities of classical encryption algorithms to quantum attacks, such as Shor's algorithm. They explore the development of quantum-resistant cryptographic protocols and the need for robust security measures to protect sensitive data in the era of quantum computing.

Intellectual property implications and considerations

State of the Law: José Luis Amat, Francisco Castro, Esperanza Cuenca-Gómez (Assistant), Carlos Kuchovsky (Assistant), and Borja Peropadre (Assistant) address the intellectual property implications and considerations in the field of quantum computing. They discuss the patent landscape, patentability criteria for quantum inventions, and the challenges in protecting quantum technologies. They also explore the collaborative aspects of quantum research and the importance of fostering an environment that promotes innovation and knowledge sharing.

Questions:

1. Export Control:
   What considerations do you think should be taken into account regarding the export control of quantum computing technologies and related knowledge? What could be the implications of insufficient or excessive control on the worldwide development and adoption of quantum computing? Should export considerations be unilateral or multilateral?

2. Security and Privacy of Information:
   What implications do you think breaking encryption algorithms would have in areas such as e-commerce, banking, healthcare, and personal data protection? Will post-quantum cryptography (PQC) standards be effective?

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   In what ways do you think the advancement of quantum computing could facilitate the violation of patents and copyrights? Given the challenges various patent offices are having dealing with the difficulties in this technology, will courts and agencies be effective places to adjudicate IP disputes?

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5. Ethics and Responsibility:
   What are some ethical and responsibility concerns associated with the development of quantum computing? In what situations do you think it could be used inappropriately or maliciously? What is the role of the government and of non-governmental entities to push for ethical considerations as the technology matures?

THE CASE | New QC companies

The quantum ecosystem: overview

The Case: Luis Ignacio Vicente del Olmo provides an overview of the quantum computing ecosystem. He highlights the key players, including startups, research institutions, and industry leaders, contributing to the advancement of quantum technologies. He discusses the collaborative efforts, investment trends, and strategic partnerships shaping the quantum ecosystem.

Qcentroid

The Case: Carlos Kuchovsky presents the case of Qcentroid, a quantum computing company specializing in quantum algorithms for optimization problems. He explains the unique approach and algorithms developed by Qcentroid and how they address critical optimization challenges across industries such as logistics, supply chain management, and resource allocation.

Multiverse Computing

The Case: Esperanza Cuenca-Gómez discusses the case of Multiverse Computing, a company focused on quantum simulation and quantum chemistry. She explains how Multiverse Computing leverages quantum computing to simulate complex quantum systems, accelerating the discovery of new materials, drugs, and chemical processes. She highlights the potential impact of their work in advancing scientific research and development.

IonQ

The Case: Francisco Castro explores the case of IonQ, a leading quantum computing hardware company. He discusses IonQ's groundbreaking technology and its efforts to build scalable and reliable quantum computers. He explains how IonQ's hardware advancements contribute to the overall progress of quantum computing and pave the way for practical quantum applications.

IBM

The Case: Borja Peropadre presents the case of IBM, a key player in the quantum computing industry. He discusses IBM's quantum computing platform, IBM Quantum, and its cloud-based access to quantum hardware and software tools. He highlights IBM's contributions to quantum research, open-source initiatives, and collaborations with academia and industry partners.

Implications for the legal field and potential benefits for legal professionals

José Luis Amat, Carlos Kuchovsky, and Esperanza Cuenca-Gómez discuss the implications of quantum computing for the legal field and the potential benefits it offers to legal professionals. They explore the emerging legal challenges and opportunities arising from the adoption of quantum technologies, such as the need for specialized legal expertise, the impact on intellectual property rights, and the ethical considerations in the use of quantum algorithms and AI systems.

Recap of the key themes and takeaways from the program

Luis Ignacio Vicente del Olmo summarizes the key themes and takeaways from the program, emphasizing the transformative power of quantum computing, the legal and regulatory considerations, and the case studies of innovative quantum companies.

Luis Ignacio Vicente del Olmo invites participants to provide feedback and evaluate the program, ensuring continuous improvement and addressing any questions or concerns they may have.

DAY 4 – ADDITIONAL TO THE WAIQ COURSE - MIT NANO LAB VISIT – July 27th

SCHEDULE

MIT NANO LAB VISIT	
10:00 – 10:15	**Day welcoming**
10:15 – 13:30	**MIT Nano Lab Visit**

- Discussion on nanotechnology and its potential impact on emerging Technologies.
- Q&A session with MIT Nano Lab experts.