Odesa I. I. Mechnykov National University.

Public discussion.

Proposals to educational and professional program "122. Computer Science".

Authors:

- Roman Kravchenko, CEO 482.solutions
- Leonid Khatskevych, CBDO 482.solutions

April 2023

Table of content.

Preamble.

In a rapidly evolving technological landscape, it is of paramount importance for educational institutions to adapt their curricula to ensure that students are equipped with the knowledge and skills necessary to thrive in their future careers. To this end and within public discussion, we present a series of proposals aimed at modernizing and enhancing the educational and professional program "122. Computer Science"[1] at Odesa I. I. Mechnykov National University.

Recognizing the growing significance of financial technologies (FinTech) and emerging technologies such as Web3 and Blockchain, our proposed changes seek to provide students with a comprehensive understanding of these critical domains. By incorporating these technologies into the existing curriculum, we aim to create a dynamic and future-oriented learning environment that prepares students for the challenges and opportunities of the modern digital world.

The proposals outlined in this document cover various aspects of curriculum development, including the introduction of new courses, the organization of hands-on projects, industry collaborations, interdisciplinary cooperation, and faculty development. By implementing these changes, we believe that the "122. Computer Science" program will empower students to excel in their chosen fields and contribute to the continued growth and innovation of the technology sector.

We invite all stakeholders to review the proposed changes and provide their valuable feedback, as we collectively strive to create a world-class educational experience for the students at Odesa I. I. Mechnykov National University.

Introduction to the new technology era (new “whole scheme of things”).

The transition from one era to another often involves the development of new technologies or the convergence of existing technologies, which drive further innovation and societal transformation.

Each era of technological evolution has built upon the advancements of the previous era, leading to more sophisticated, interconnected, and efficient systems.

[1] https://onu.edu.ua/uk/structure/faculty/fmfit/spetsialnosti-ta-spetsializatsii

Further one of the possible approaches to describe technological evolution.

1. Analogue, industrial pre-information technologies.

This era is characterized by mechanical and analog systems used for communication, computation, and production. The industrial revolution, which began in the late 18th century, marked a major shift from manual labor to mechanized production. Key technologies during this period include:

- Steam engines: These machines provided the power for factories, railways, and ships, enabling mass production and transportation.
- Telegraph: Invented in the early 19th century, the telegraph revolutionized long-distance communication by allowing messages to be sent quickly over long distances using electrical signals.
- Mechanical calculators: These devices were used for various calculations, such as arithmetic and trigonometry, and were the predecessors to modern computers.

2. Post-industrial information technologies.

This era is marked by the development of digital and electronic technologies, which significantly changed the way information was processed, stored, and transmitted. Key milestones in this period include:

- Electronic computers: The development of electronic computers, such as ENIAC and UNIVAC, allowed for faster and more complex calculations than their mechanical predecessors.
- Transistors: These replaced vacuum tubes in electronic devices, making them smaller, faster, and more reliable.
- Magnetic storage: Devices like magnetic tape and hard disk drives enabled the efficient storage and retrieval of digital information.

3. Communication technologies:

During this period, advancements in communication technologies transformed the way people interacted with each other, both personally and professionally. Some important developments include:

- Television: The widespread adoption of television provided a new medium for entertainment, news, and advertising.

- Satellite communication: The launch of communication satellites enabled global communication and the expansion of television and radio broadcasting.
- Mobile phones: The invention of mobile phones revolutionized personal communication, allowing people to stay connected anytime, anywhere.

4. Information and communication technologies (ICT):

This era is characterized by the convergence of information technology and communication technology, which allowed for the rapid exchange of information and facilitated global connectivity. Notable developments in ICT include:

- Internet ("Internet of Information"): The development and widespread adoption of the internet enabled the sharing of information and resources on a global scale.
- World Wide Web ("Internet of Content"): Invented by Tim Berners-Lee, the World Wide Web provided a user-friendly interface to access the internet, leading to its mass adoption.
- Email and instant messaging: These communication tools allowed for real-time exchange of messages and information between individuals and organizations.

5. Transactional technologies.

In this era (**today we are here**), we see the rise of technologies that enable secure, decentralized, and efficient transactions. These technologies have the potential to transform various industries, including finance, supply/value chain, and governance. Key advancements in this era include:

- DLT, Blockchain, and distributed networks ("Internet of Value"): A decentralized, distributed ledger technology that enables secure, transparent, and tamper-proof transactions without relying on a central authority.
- Cryptoassets: Digital or Cryptoassets that use cryptography for security and operate on blockchain technology, such as Bitcoin protocol and Ethereum virtual machine.
- Smart contracts: Self-executing contracts with the terms of the agreement directly written into code, which can be automatically enforced and executed on a blockchain.

The rationale for relevance and motivation.

Studying FinTech and Blockchain technologies is crucial for computer science students today due to the increasing demand for professionals with expertise in these areas, the disruptive potential of these technologies, and the valuable skills that students will develop in the process. By incorporating FinTech and Blockchain into their education, students will be better prepared for a rapidly evolving job market and will have the knowledge and skills needed to succeed in various industries.

1. Industry growth and demand for professionals.

According to the LinkedIn report, Blockchain has been one of the fastest-growing skills in the job market, with a significant increase in demand for professionals with expertise in this area. Leading international companies like IBM, J.P. Morgan, Microsoft, and Accenture are actively recruiting professionals with FinTech and Blockchain expertise to help them develop and implement innovative solutions in various industries, such as finance, supply/value chain, and healthcare.

2. Disruptive potential.

FinTech and Blockchain technologies have the potential to disrupt traditional financial systems and business models. By studying these technologies, computer science students will gain a solid understanding of the innovative solutions that are shaping the future of finance, payments, and other industries, giving them a competitive edge in the job market.

3. Interdisciplinary approach.

FinTech and Blockchain technologies intersect various disciplines, including computer science, finance, economics, and law. By studying these technologies, students will develop a well-rounded understanding of the different aspects involved in their implementation and regulation, making them more versatile professionals.

4. Problem-solving and critical thinking skills.

FinTech and Blockchain technologies involve complex algorithms, cryptography, and data structures. Studying these technologies will help students develop strong problem-solving and critical thinking skills, which are essential qualities for successful computer science professionals.

5. Decentralization and security.

Blockchain's decentralized nature offers enhanced security and transparency compared to traditional centralized systems. By studying Blockchain, students will learn about the principles of decentralization and how it can be used to create secure and transparent systems across various industries.

6. Practical applications.

FinTech and Blockchain technologies have numerous real-world applications, such as digital currencies, smart contracts, decentralized finance (DeFi), and supply/value chain management. Studying these technologies will enable students to develop practical skills that they can apply in their future careers.

Map of key competencies.

1. Digital institutions and FinTech.
    - Key terms and concepts of the neo-institutionalist theory.
    - Markets, hierarchies, networks, and transaction costs.
    - Value management and transactions.
    - Digital ownership rights.
    - Governance and DAO (Decentralized Autonomous Organization).
    - Digital asset management.
    - FinTech and Value management machine.
2. FinTech and Blockchain Fundamentals.
    - From Web 1.0 to Web 3.0. The emergence of blockchain technology.
    - FinTech and Blockchain fundamentals within transaction costs theory.
    - Web3 and Distributed ledger technology.
    - Cryptography as an inherent mechanism of the BMS (blockchain management system).
    - Blockchain technology for transaction management.
    - Introduction to Blockchain management systems.

- Value storage and transfer.
    i. Bitcoin protocol basics.
    ii. Smart contracts and Ethereum basics.
- Tokenization: Token management, Token taxonomy and standards.
- Blockchain Layers: L1/L2.

3. Value Chain management mechanisms.
    - Decentralized Identity and Access Management (DIAM).
    - Verifiable credentials (VCs).
    - Inventory and asset management.
    - Origin, Provenance, Traceability based on Blockchain.
    - Document, Contract and Transaction management with Smart Contracts.
    - Tokenization and digital assets.
    - Blockchain for risk management.
4. Interoperability and integration.
    - Interoperability and Integration of Blockchain with third-party systems.
    - Digital twins of the physical world: Blockchain and IoT.
    - Autonomous organisations: combined values of Blockchain and Artificial Intelligence (AI).
5. Compliance and Security.
    - Regulatory policies, compliance and legal aspects of Blockchain.
    - Data standardization and unification.
    - Data Privacy, Security, and Ethics.
6. Guide to FinTech and Blockchain solutions implementation.
    - Industrial Blockchain frameworks, platforms and solutions.
    - Criteria for evaluating Blockchain platforms and solutions for industrial applications.
    - Assessing the cost, scalability, security, and other factors when choosing a blockchain solution.
    - Case studies of Blockchain technology implementations.
    - Challenges of implementing Blockchain technology.

- Future trends and developments in FinTech and Blockchain.

7. Blockchain application for Sustainability and Climate action.
    - Blockchain for Public Goods, Environmental Impact and Sustainability.
    - Blockchain for Measurement, Reporting, and Verification (MRV).
    - Blockchain for Life Cycle Assessment (LCA).
    - ESG impact of Blockchain technology.

директор Балашов І.В.