

Gifted Education Fund: Off-school Advanced Learning Programmes

Programme No. 2022-11 (For secondary students)

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| Title of Programme | Coding, Cryptography and FinTech (CCF) Skills Education for Gifted Students |
| Programme Provider | Department of Electrical Engineering, City University of Hong Kong |
| Theme | STEM-related Mentorship Programme; Self-initiated Research Study |
| Maximum No. of Participants and Class Level in the 2022/23 School Year | 40 students (Secondary 3-5) |
| Pre-requisite | <ul style="list-style-type: none">● Applicants should demonstrate great interest and outstanding performance in mathematics, and should be experienced in at least one text-based computer programming language such as Python, C/C++, Swift, Java, JavaScript, etc.● They should also show eagerness to learn FinTech, cryptography, blockchain, etc. |
| Programme Delivery Period | From May 2023 to January 2024 (9 months) (tentative) |
| Medium of Instruction | Course Material: English Class teaching/ Discussion: English supplemented with Cantonese |
| Objectives | <ul style="list-style-type: none">● To increase the awareness of gifted students on the importance and diverse applications of cryptography in the contemporary world;● To provide gifted students with the foundation of the mathematical concepts used in cryptography, financial technology (FinTech) and security programming, and for development of relevant applications;● To equip students with engineering skills and experiences through practicals and projects of blockchain systems development. Students will acquire the knowledge of blockchain platforms and smart contract development and deployment.● To develop the coding abilities of students in solving authentic problems related to FinTech and other blockchain related fields;● To provide an opportunity for students to demonstrate their creativity and talents by presenting their designs to representatives of technology companies and other participants in a large-scale event; and● To nurture positive values and attitudes among the students such as perseverance to overcome problems, the ethics of deploying and using FinTech, the socio-economic implication of innovation and technology, etc. |

Programme Outline

This programme aims to equip the gifted students with essential knowledge and skills related to cryptography and FinTech. Major topics such as blockchain, smart contracts, and digital assets will be covered. Relevant foundation mathematics will be introduced and coding tasks are offered wherever appropriate. Students are required to complete an individual mentorship research project by the end of the programme. The programme will also develop positive values and attitudes essential for future growth and development of the students.

The programme consists of five phases.

Phase 1: Foundational guest lectures (12 hours in total)

- Lectures to be delivered by academics and experienced industry experts with relevant experiences.
- Students will acquire foundation knowledge related to cryptography, FinTech, blockchain, socio-economic implication, environmental, social and governance (ESG), trust and value, etc. and relevant applications/issues in real practices.

Phase 2: Progressive study of Cryptography and Learning Basic Sage Programming (20 hours in total)

- Lectures and laboratory sessions
- Students will learn the code management skills, Sage programming and common types of cryptography such as classical, public key and secret key, and hashing in this phase of the programme. A powerful open-source mathematics software, viz. SageMath (or Sage for simplicity) and hardware for cryptography, will be used for programming tasks to encipher and decipher data.


Phase 3: Basic theory of Blockchain: Consensus Mechanism, Data Structure and Digital Signature (12 hours in total)

- Lectures and laboratory sessions
- Students will learn the history and theories of blockchain, consensus mechanisms in blockchain technology such as the Proof of Work (PoW), Proof of Stake (PoS), Practical Byzantine Fault Tolerance (PBFT), and data structures including Merkle Root, Merkle Tree and Merkle Patricia Trie.

Phase 4: Applications of Blockchain: Cryptocurrency, Private Blockchain, Smart Contract and NFT; Hands-on Smart Contract Programming (12 hours in total)

- Lectures and laboratory sessions
- An overview and practicals on cryptocurrencies (public blockchain), private blockchain and smart contract and its standards (i.e. NFT) will be provided. Through lectures and practicals, students will learn how to set up crypto wallets, develop and deploy smart contracts on blockchain.

Phase 5: FinTech Project under Mentorship and Support, Presentation, Competition and Exhibition (2 months for project; 1 day for presentation, competition and exhibition)

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| | <ul style="list-style-type: none"> • Students will complete a FinTech/blockchain project in this phase. They will meet their mentors regularly to update their work progress and seek advice/support from their mentors whenever necessary. • Students will prepare and attend an exhibition at City University of Hong Kong, and showcase their talents and achievements through presentation of their designs and sharing of their learning experiences with parents, teachers, instructors, mentors and other guest participants. • A project competition will be held during the exhibition. Students' designs and presentations will be judged by a panel consisting of representatives from major technology companies. • Each student is also required to submit a summary report to document and review his/ her learning journey, with emphasis on the individual FinTech/blockchain project developed. The summary reports from students will be compiled as a proceeding for online dissemination. |
| Admission Fee | Free of charge |
| Application Method | <p>Application form can be downloaded from the following webpage:</p> <p>https://www.edb.gov.hk/en/curriculum-development/curriculum-area/gifted/ge_fund/gef/programme/current.html</p>  <p>Please complete the application form and send the scanned copy by email to eegefp@cityu.edu.hk, AND then the original copy by post on or before <u>21 Apr 2023</u> to the following address:</p> <p>Department of Electrical Engineering City University of Hong Kong Tat Chee Avenue Kowloon Tong (Attn: Dr Ray CHEUNG Chak-Chung)</p> |
| Documents to be Submitted along with the Application | <ul style="list-style-type: none"> • Evidence of Other Learning Experiences (if any) |
| Enquiry | <p>Dr. Ray CHEUNG Chak-Chung Associate Professor Department of Electrical Engineering City University of Hong Kong</p> <p>Tel No.: 3442 9849 Email: r.cheung@cityu.edu.hk</p> |
| Date of Announcement of Result | By early May 2023 (tentative) |