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Welcome note

Welcome to the Cardano Foundation's blockchain education course series. We are proud to offer a series of certifications in the blockchain domain, to provide a standard training for people interested in the blockchain world.

The courses provide accurate, in-depth blockchain education with a comprehensive understanding of all aspects of the technology. This course will take you from the first generation to third generation blockchains, showing you where blockchain comes from, the innovation it brings, and how revolutionary it can be.

It delves into the theory behind all the components in blockchain, from blockchain structure, consensus algorithms and transaction models. It covers DeFi and other use cases across business verticals, along with the current regulation and legislative standards. The course examines the Cardano architecture and teaches you how to programme in Haskell and develop smart contracts.

We wanted to make this course accessible by making it available for free. The training is designed in three levels of **Associate**, **Professional**, and **Expert**. For each level, training materials have been created by Cardano Foundation. Candidates may wish to sit a standard exam to receive the CBCA, CBCP, or CBCE certification after completing each course.

Learning Path

The learning path for the Cardano Blockchain course:

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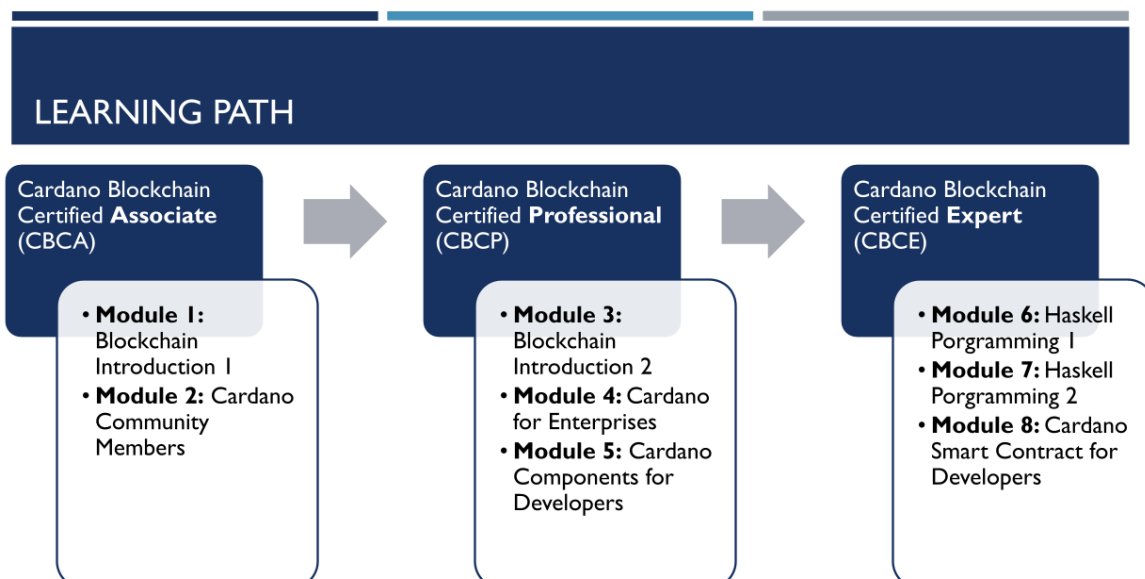
Cardano Blockchain Certified Associate (CBCA)

Overview
This course covers the fundamentals of blockchain and introduces the key concepts and terminology. It is the entry point in this series of courses. This course contains two modules - **Blockchain Introduction 1** and **Cardano Community Members**. Users may wish to gain the Associate certification by sitting an exam after completing this course. This course is a prerequisite to the other courses and modules. See [learning path](#) for more information.

Learning objectives:
- The advantages of a decentralized system.
- How to reach consensus in decentralized systems and the different consensus algorithms.
- What blockchain is and its evolution from first generation to third.
- Cryptography fundamentals, including public-key cryptography, hashes, and digital signatures.
- Blockchain components, block structure, and transaction models, such as UTxO, extended UTxO, and account based.
- Consensus algorithms.
- Blockchain layer-1 and layer-2 scaling solutions, and why they are needed.
- The architecture of Cardano.
- Using wallets and how to create and transfer blockchain tokens and NFTs.

Who should attend:
- Researchers at universities and research centers or institutions who would like to understand the fundamentals of blockchain.
- General users who have an interest in blockchain, and considering working with blockchain in the future.
- Managers looking to create value in their businesses by using blockchain technology.
- Blockchain developers and engineers who will develop web3 applications.

Pre Requisites
Before attending this course, you should be experienced using a computer. In particular, you should understand file structures and system commands on your operating systems, and be able to access data files on your operating systems. No prior knowledge or experience of blockchain is needed.

Course Outline
- General Introduction and Background
    - What is Blockchain?
    - Byzantine General Problem
    - Blockchain Generations
    - Decentralized Applications
    - Use cases

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- Cryptography fundamentals
  - Public Key Encryption
  - Hash Functions
  - Digital Signatures

- Blockchain Components and Structure
  - Transaction Models
  - Chain Features
  - Double-spending Attack
  - Block Rewards and Transaction Fees
  - Consensus Algorithms
  - Wallets

- Cardano
  - Cardano Roadmap and Eras
  - Cardano Architecture
  - Ouroboros, the Consensus Algorithm used in Cardano
  - Reward Mechanism

- Scalability
  - Introduction to Scalability
  - Layer 1 and 2 Solutions such as sharding and sidechains

- DeFi
  - What is DeFi?
  - Use cases

- Cardano Architecture
  - Cardano components
  - Eras

- Cardano Tokens and NFT
  - Ada Token Transfer and Delegation
  - Create Native Tokens
  - Create NFT

- Cardano Development Processes
  - Cardano Improvement Proposal (CIP)
  - Catalyst

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Cardano Blockchain Certified Professional (CBCP)

Overview

This course is for users who want to build on the key concepts introduced in the Cardano Blockchain Certified Associate (CBCA) course. It delves into the intricacies of blockchain theory and consensus algorithms. It looks at the current state of regulatory and legislative standards for blockchain technology. It covers how managers can apply blockchain in their businesses and how developers can deploy a blockchain node. The course contains three modules - **Blockchain Introduction 2, Cardano for Enterprises** and **Cardano Components for Developers**. Users may wish to gain the Professional certification by sitting an exam after completing this course. This course is a prerequisite to the advanced Certified Expert course and modules. See learning path for more information.

Learning objectives:

- Advanced topics on blockchain theory including different types of attacks, consensus algorithms and network growth.
- Reviewing the current regulation and legislation around blockchain.
- Advanced look at native assets and NFTs.
- The use cases of blockchain across different business verticals.
- Review the Cardano architecture
- Installing and configuring a Cardano node

Who should attend:

- Researchers at universities and research centers or institutions who would like to understand the fundamentals of blockchain.
- General users who have an interest in blockchain, and considering working with blockchain in the future.
- Managers looking to create value in their businesses by using blockchain technology.
- Blockchain developers and engineers who will develop web3 applications.

Pre Requisites

Before attending this course, you should have completed the Cardano Blockchain Certified Associate (CBCA) course or have equivalent knowledge. See learning path for more information.

Course Outline

- Blockchain Introduction 2
  - Advanced topics on blockchain theory
  - Attacks and the solutions
  - Consensus Algorithms
  - Network Growth
  - Regulation and legislative standards

- Cardano for Enterprises
  - Metadata

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- ○ Creating NFTs
- ○ Use case - supply chain, royalties, public sector, banking, charity and education

- ● Cardano Components for Developers
  - ○ Installation and configuration of a Cardano node
  - ○ Wallet backend
  - ○ Cardano-cli
  - ○ Cardano DB Sync
  - ○ Cardano GraphQL
  - ○ Cardano transaction lib
  - ○ Cardano Rosetta
  - ○ Hydra
  - ○ Stake pool setup

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Cardano Blockchain Certified Expert (CBCE)

Overview

This is an advanced course for users who want to become proficient in Haskell programming and learn how to develop smart contracts. The course contains three modules - **Haskell Programming 1 (Beginner), Haskell Programming 2 (Advanced)** and **Cardano Smart Contracts for Developers**. Users may wish to gain the Expert certification by sitting an exam after completing this course. This course is a prerequisite to the advanced Certified Expert course and modules. See learning path for more information.

Learning objectives:

- Understand functional programming and why use Haskell.
- Learn syntax, recursion and higher order functions.
- Advanced programming topics including networking, concurrency and streaming.
- Developing smart contracts in Marlowe and Plutus.
- Testing and deploying smart contracts.

Who should attend:

- Blockchain developers and engineers who will develop web3 applications.

Pre Requisites

Before attending this course, you should have programming experience, and have completed the Cardano Blockchain Certified Professional (CBCP) or have equivalent knowledge. See learning path for more information.

Course Outline

- Haskell Programming 1 (Beginner)
  - Types and Typeclasses
  - Syntax in functions
  - Recursion and Higher Order Functions, Lambdas
  - Modules
  - Monoid
  - Monads

- Haskell Programming 2 (Advanced)
  - Networking
  - Concurrency
  - Streaming
  - Type level programming
  - Template Haskell

- Cardano Smart Contract for Developers
  - Type classes
  - Monads
  - Smart Contracts - Marlowe and Plutus
  - Minting NFTs

- ○ Case studies
- ○ State machines
- ○ Testing smart contracts
- ○ Deployment & Tooling