Knight Foundation School of Computing and Information Sciences

Course Title: Fundamentals of Blockchain Technologies **Date:** 11/18/2019

Course Number: CIS 4731

Number of Credits: 3

Subject Area: Computer Information Systems	**Subject Area Coordinator: Gr**egory Reis **email:** gmuradre@fiu.edu
Catalog Description: Introduction to blockchain key concepts such as proof-of-work, mining, distributed consensus, and its applications including crypto-currencies, smart contracts, and supply chain monitoring.	
Textbook: Imran Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition (ISBN-13: 978-1788839044) Arvind Narayanan, et al., Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, 2016. ISBN: 978-0-691-17169-2	
References: Stanford CS251 Bitcoin and Cryptocurrencies	
Prerequisites Courses: COP 3530	
Co-requisite Courses: None	

Type: Elective for CS (Systems group)

Prerequisites Topics:

1. Functions
2. Hashing
3. Basic number theory
4. Graphs
5. Tree data structures

Course Outcomes:

1. Understand the principles of blockchain technologies and distributed consensus
2. Be familiar with crypto-currency technologies
3. Understand proof-of-work and mining strategies
4. Understand proof-of-stake
5. Understand smart contracts and how blockchains establish trust for economic activities
6. Be exposed to how blockchain can enhance security and privacy of computer systems.

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Relationship between Course Outcomes and Program Outcomes

BS in CS: Program Outcomes	Course Outcomes
a) Demonstrate proficiency in the foundation areas of Computer Science including mathematics, discrete structures, logic and the theory of algorithms	2,3
b) Demonstrate proficiency in various areas of Computer Science including data structures and algorithms, concepts of programming languages and computer systems.	1, 2, 3, 4, 5, 6
c) Demonstrate proficiency in problem solving and application of software engineering techniques	
d) Demonstrate mastery of at least one modern programming language and proficiency in at least one other.	
e) Demonstrate understanding of the social and ethical concerns of the practicing computer scientist.	
f) Demonstrate the ability to work cooperatively in teams.	
g) Demonstrate effective communication skills.	

Assessment Plan for the Course & how Data in the Course are used to assess Program Outcomes

Student and Instructor Course Outcome Surveys are administered at the conclusion of each offering, and are evaluated as described in the School's Assessment Plan: https://abet.cs.fiu.edu/csassessment/

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Outline

Topic	Number of Lecture Hours	Outcome
1. Introduction to Blockchain 1.1. Peer to peer networks 1.2. Cryptography 1.3. Digital Signature 1.4. Nodes 1.5. Hashing	10	1, 2
2. Overview of Consensus protocols 2.1. Byzantine fault and Byzantine Generals Problem 2.2. Practical Byzantine fault tolerance 2.3. Nakamoto Consensus	10	1, 5
3. Proof of Work and Mining Strategies 3.1. Analysis of the Blockchain protocol in Asynchronous networks 3.2. Scalable BlockDAG protocols	2.5	3
4. Proof of Stake 4.1. Algorand Byzantine Agreement	2.5	1, 4
5. Blockchain in Business 5.1. Blockchain in Marketing 5.2. Blockchain in Supply Chain 5.3. Smart Contracts and Accounting	7.5	5, 6
6. Cryptocurrency Technology 6.1. Trading cryptocurrencies 6.2. Mining attacks and security issues 6.3. Value evaluation of cryptocurrencies	7.5	2, 6

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Course Outcomes Emphasized in Laboratory Projects / Assignments

Outcome	Number of Weeks
Programming Assignment addressing consensus algorithms	3
Programming Assignment addressing trade using bitcoins	3
Programming Assignment addressing smart contracts	3
Homework addressing Hashing and Cryptography	2
Homework addressing Proof of work and Proof of stake	2
Homework addressing blockchain protocols for e-commerce	2

Oral and Written Communications

Written Reports		Oral Presentations	
Number Required	Approx. Number of pages	Number Required	Approx. Time for each
3	2	0	0

Approximate Number of Credit Hours Devoted to Fundamental CS Topics[1]

Fundamental CS Area	Core Hours	Advanced Hours
CN – Computational Science	0	1
DS – Discrete Structures	0	1
IS – Intelligent Systems	0	0.5

Theoretical Contents

Topic	Class time
Algorithm Analysis	5
Probability Theory	2

Problem Analysis Experiences

Blockchain applications and performance analysis of consensus algorithms

Solution Design Experiences

None

[1] See Appendix A in *Computer Science Curricula 2013.* Final Report of the IEEE and ACM Joint Task Force, available at: https://www.acm.org/binaries/content/assets/education/cs2013_web_final.pdf