PART I - COVER SHEET

INTRODUCTION TO Swirlds Hashgraph Consensus Algorithm

**TEACHING METHOD:** Self Study / Presentation / Demonstration-Performance

**REFERENCES:**

What is Asynchronous Byzantine Fault Tolerance

https://hashgraph.org/discussion/11/what-is-asynchronous-byzantine-fault-tolerance

Videos - The Five Consensus Algorithms #1, #2, #3, #4, and # 5 - Dr. Leemon Baird

Videos - Hashgraph Detailed Examples - December 2016 - Dr Leemon Baird

Tech Report - Hashgraph Detailed Examples - December 2016 - Dr. Leemon Baird

Tech Report - The Swirlds Hashgraph Consensus Algorithm: Fair, Fast, Byzantine Fault Tolerance

**COGNITIVE OBJECTIVE:** The objective of the presentation is for the student to comprehend the Swirlds Hashgraph Consensus Algorithm and how it compares to other types of consensus algorithms

**COGNITIVE SAMPLES OF BEHAVIOR:**

Define consensus

Define the 5 types of consensus algorithms

Identify Asynchronous Byzantine Fault Tolerance

Identify the goal of the Swirlds Hashgraph Consensus Algorithm

Identify the properties of a good cryptographic hash

Identify gossip protocol

Identify the symbols that make up the hashgraph and what they represent

Define hashgraph

Identify a hashgraph event

Identify hashgraph transaction

Identify an honest member

Identify the 3 procedures in the algorithm

Define a hashgraph transaction

Define fairness

Define gossip

Define gossip about gossip

Define Virtual Voting

Identify the divideRounds Procedure

Identify the decideFame Procedure

Identify the finalOrder Procedure

Define round created

Define round received

Define virtual voting

Identify a hashgraph witness

Define a hashgraph famous witness

Identify event seeing

Identify event voting

Identify event vote counting

Identify event strongly seeing

Explain the difference between round received and round created

Describe when in the algorithm that the principles of seeing and strongly seeing are used

Identify Supermajority

Explain the difference between an event timestamp and a hashgraph consensus algorithm timestamp

**AFFECTIVE OBJECTIVE:** The objective of this lesson is for each student to value the impact that the Swirlds Hashgraph Consensus Algorithm has on the world

**AFFECTIVE SAMPLES OF BEHAVIOR:**

Voluntarily complete the pre-examination prior to starting the course

Complete the examination and engage with peers in conversations to answer all questions to 100%

Voluntarily become a Hedera Hashgraph account holder and become familiar with services built on top of the SWIRLDS Consensus Algorithm by Hedera

**ORGANIZATIONAL PATTERN:** Topical

**STRATEGY:** Encourage participants to review the reference material and to complete the Part III Evaluation prior to the presentation. During the presentation review hashgraph concepts and followed by a demonstration through the algorithm as presented in SWIRLDS Tech Report SWIRLDS-TR-2016-12. At the conclusion of the demonstration pass a new evaluation to each student and have them complete it each student is allowed 3 instructor assists during the evaluation. After the evaluation, conduct a guided student self-evaluation / self grading of the exam and encourage students provide questions to any terms,

concepts or processes that were unclear.  As an option allow students to retake the exam with no instructor assists.

**INSTRUCTOR NOTES:**

Presentation Time without evaluation 1 hour

Presentation Time with evaluation 3 hours

The same process could be followed on a one-to-one instructor / student guided lesson using the principles of presentation, demonstration, supervised performance and supervised evaluation teaching process.