

**Course Name: Blockchain and its Applications (NOC25\_CS08)**

**Assignment 6 - Week 6 (Jan 2025)**

**TYPE OF QUESTION: MCQ/MSQ**

**Number of questions: 10**

**Total mark: 10 X 1 = 10**

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**QUESTION 1**

What is/are the primary distinction between crash faults and Byzantine faults?

- a. Crash faults involve deliberate malicious behavior
- b. Byzantine faults involve deliberate malicious behavior
- c. Crash faults require at least  $3F + 1$  node for consensus (here,  $F$  is the number of crash faults)
- d. Byzantine faults can never partition the network

**Answer: (b)**

**Detailed solution:**

Byzantine faults involve nodes behaving maliciously, whereas crash faults occur when nodes fail passively.

**QUESTION 2**

Suppose you execute your tasks distributedly from four different systems at four different locations. To maintain the consensus among the systems, you are using the BFT model. You found that one system is permanently failed due to a hardware fault and another system is compromised by an attacker. Does your system correctly work at all?

- a. No
- b. Yes, with the remaining nodes
- c. Yes, with all the nodes
- d. Yes, but with reduced efficiency

**Answer: (a)**

**Detailed solution:**

We need at least  $3F+1=3(1)+1=3F + 1 = 3(1) + 1 = 4$  systems to tolerate 1 Byzantine fault. Since one system has permanently failed (crash fault), the remaining systems cannot maintain consensus.



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## **QUESTION 3**

In Paxos, what will a proposer do if it receives a promise containing an already accepted value?

- a. Use the previously accepted value with the highest ID
- b. Propose a completely new value
- c. Abort the consensus
- d. Ignore the promise and continue

**Answer: (a)**

### **Detailed solution:**

The proposer will use the value with the highest ID. Refer to week 6 lecture notes.

## **QUESTION 4**

Which of the following is/are true regarding the permissioned blockchain model?

- a. Users are anonymous
- b. Transactions are publicly visible to everyone
- c. Users are authenticated through a Membership Service Provider (MSP)
- d. Security and consensus are required

**Answer: (c) and (d)**

### **Detailed solution:**

In the permissioned blockchain model, users are authenticated through MSP and users know each other. But security and consensus are still required. The transactions are only visible to authorized participants.

## **QUESTION 5**

In the Paxos algorithm, a majority of promises ensure:

- a. Agreement on the ID, value
- b. Liveness of the system
- c. Safety against conflicting proposals
- d. Disagreement on the ID, value

**Answer: (c)**

### **Detailed solution:**

A majority of promises in Paxos ensure safety by preventing conflicting proposals from proceeding

### **QUESTION 6**

If there are 3 faulty nodes, at least how many nodes are needed to reach consensus in the Byzantine Fault Tolerance (BFT) system?

- a. 4
- b. 8
- c. 7
- d. 10

**Answer: (d)**

**Detailed solution:**

$f = 3$  Total nodes required  $= 3f + 1 = 9 + 1 = 10$

### **QUESTION 7**

Which of the following is/are true regarding a consensus when there is one good commander, one good lieutenant, and one faulty lieutenant in a Byzantine Generals Problem.

- a. Consensus is always possible
- b. Consensus is not possible because the faulty lieutenant can mislead
- c. Consensus is not possible because the commander can mislead
- d. Consensus will be possible if there are additional good lieutenants

**Answer: (b), (d)**

**Detailed solution:**

One fault. Total nodes required  $= 3f + 1 = 3 + 1 = 4$ . But we have 3 nodes. In this case, the faulty lieutenant can mislead. The consensus is possible if we have additional good lieutenants.



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## **QUESTION 8**

What is/are the purpose of Multi-Paxos?

- a. To have a termination guarantee
- b. To execute smart contracts on multiple blockchains
- c. To reach a consensus for a series of values
- d. To prioritize liveness over safety

**Answer: (c)**

### **Detailed solution:**

Multi-Paxos extends Paxos to achieve consensus over a series of values. There is no termination guarantee.

## **QUESTION 9**

Which of the following is/are false regarding classic Paxos?

- a. It requires a majority of acceptors to proceed
- b. It achieves consensus on ID and not the value
- c. It achieves consensus on the value and not ID
- d. It can work with Byzantine faults

**Answer: (b), (d)**

### **Detailed solution:**

Paxos is designed to handle only crash faults. Also, the consensus is reached on the value, not on ID.

## **QUESTION 10**

In Paxos, which of the following is/are true about the roles of nodes?

- a. A node cannot play more than one role
- b. A proposer node cannot become a learner
- c. A node can play one or more than one role
- d. An acceptor node cannot become a learner

**Answer: (c)**

### **Detailed solution:**

In Paxos, a node can play more than one role at the same time.



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