Lab 9

**Question 1**

Use an example (e.g., shooting round corners/fire-proof problem) to  illustrate how latency is related to consistency? Use diagrams if appropriate.

* In online multiplayer shooters, a player may shoot at an opponent who is hiding behind cover such as a wall
* **Latency:** Latency refers to the delay between a player's action (e.g., shooting) and the effect of that action being visible to other players.
* **Consistency:** Consistency refers to ensuring that all players experience the game world in a similar manner, despite differences in network conditions or device capabilities.
* **Illustration:** Suppose Player A shoots at Player B, who is behind cover. Due to latency, Player A's action reaches the server with a delay. If the server confirms the hit before Player B's client receives updated information about their position, Player B may appear to be hit despite being behind cover. This inconsistency arises due to the delay in transmitting and processing information caused by latency.

**Question 2**

There are two categories of techniques for consistency management: optimistic and conservative. Which category do the following techniques belong to dumb client and client-side prediction. Describe the dumb client and client-side prediction.

* **Dumb Client:** This technique belongs to the conservative category.
  + **Description:** In the dumb client approach, the client (player's device) is passive and does not perform any prediction or interpolation. It solely relies on the server for updates on game state and actions.
* **Client-Side Prediction:** This technique belongs to the optimistic category.
  + **Description:** Client-side prediction involves the client predicting the outcome of its actions without waiting for confirmation from the server. For example, when a player moves their character, the client predicts the new position immediately and starts moving the character. The server later confirms or corrects the prediction.

**Question 3**

Cheating in online games is the action of pretending to comply with the rules of the game, while secretly subverting them to gain an unfair advantage over an opponent. Describe two ways of cheating. Please include details of how each cheating works and a mechanism to prevent it.

**1) Wall Hacks**

**How It Works**

Cheaters modify the game client software to render walls and other obstacles transparent, allowing them to see opponents hiding behind them

**Mechanism to Prevent It**

Implement server-side checks to validate player actions and restrict the information sent to the client. Additionally, use anti-cheat software that detects unauthorized modifications to the game client and punishes offending players accordingly

**2) Distributed Denial of Service (DDoS) Attack**

**How It Works**

Attackers use botnets or networks of compromised computers to send a massive volume of requests to the game server, consuming its bandwidth and processing capacity

**Mechanism to Prevent It**

Implement robust network security measures, such as firewalls, intrusion detection systems, and rate limiting, to detect and mitigate DDoS attacks. Additionally, utilize content delivery networks (CDNs) to distribute traffic and absorb DDoS attacks before they reach the game server