(a) Can latency be eliminated completely? Explain why.

It is not possible to completely removed latency, due to data having to be sent over a network.

There can be many reasons why, such as Transmission delay, which is the amount of time required to push all bits of a packet into the wire, Propagation delays due to speed of communications link or speed of light delays, Queuing and processing at routers, or Transcoding delays due to algorithms that manipulate data, such as compression.

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

A picture containing graphical user interface

Description automatically generatedLatency can cause issues with desync, as seen in the example below.

Player 1 shoots at player 2 and sees player 2 take damage on their side. However, player 2 moved out of the way on their side, and the server determines that player 2 moved first before player 1 fired.

Because the server determines that Player 2 did not get hit, Player 2 takes no damage on Player 1’s view, despite being hit.

(c) 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 is an example of an optimistic compensation technique.

The dumb client sends its current state on its update to the server, and immediately renders that state, instead of double checking with the server. This is an optimistic compensation technique as it hopes to deal with the possibility of inconsistency later on, rather than impose strict locks.

Client-side prediction is an example of an optimistic simulation. It is very similar to the Dumb client. The client sends out inputs to server, but also apply them immediately locally to update your own state.

The server can override player input if simulation on server side has a constraint player doesn’t know about yet. When you receive update from server, check if it differs from local state. If the state is different, correct to the local state.