Problem 2

Q1:

Gas is a fundamental concept in blockchain networks, particularly in Ethereum. It refers to the unit of measurement for the computational effort required to execute operations or transactions on the blockchain. Gas serves multiple purposes, including:

1. Resource Allocation: Gas ensures that computational resources are allocated fairly among users of the network. Since blockchains have limited computational capacity, users must pay for the resources they consume.
2. Prevention of Spam and DoS Attacks: By requiring users to pay for computational resources, gas discourages spam transactions and denial-of-service (DoS) attacks that could otherwise congest the network.
3. Economic Incentive: Miners or validators who process transactions and add blocks to the blockchain are compensated with gas fees. This creates an economic incentive for them to participate in network maintenance.

The main purpose of EIP-1559 is to improve the user experience, reduce transaction fees, and make fee estimation more predictable. When the network exceeds the target per-block gas usage, the base fee increases slightly and when capacity is below the target, it decreases slightly. Because these base fee changes are constrained, the maximum difference in base fee from block to block is predictable.

Q2：

var 1 – X

var 2 – slot 0

var 3 – X

var 4 – slot 1

var 5 – slot 1

var 6 – slot 1

var 7 – slot 2

var 8 – slot 3

|  |  |
| --- | --- |
| slot 0 | var 2(32) |
| slot 1 | var 6(2), var5(8), var 4(20) |
| slot 2 | var 7(20) |
| slot 3 | Var 8(32) |

Q3：Impermanent loss is a phenomenon that occurs in Automated Market Makers (AMMs), which are decentralized exchanges that use algorithmic pricing models to facilitate trading without the need for traditional order books. Impermanent loss arises from the dynamic nature of liquidity provision in AMMs, particularly in liquidity pools where users contribute assets to facilitate trades.

The issue of impermanent loss arises due to the price volatility of assets in the liquidity pool. When a user provides liquidity to an AMM, they typically deposit an equal value of two assets into a liquidity pool. For example, if a user provides liquidity to a pool for trading Ethereum (ETH) and a stablecoin like USDT, they would deposit an equivalent value of both assets.

However, as trades occur within the AMM, the prices of the assets in the liquidity pool may change. If the price of one asset increases relative to the other, the liquidity provider's share of each asset in the pool will shift. This means that when the liquidity provider decides to withdraw their assets from the pool, they may receive a different proportion of each asset compared to what they originally deposited. This difference in asset proportions results in impermanent loss.

The term "impermanent" is used because this loss is not realized until the liquidity provider withdraws their assets from the pool. If the prices of the assets revert back to their original ratio, the impermanent loss disappears. However, if the price imbalance persists, the loss becomes permanent.

Here's an illustrative example:

Suppose a liquidity provider deposits $10,000 worth of ETH and $10,000 worth of USDT into an ETH-USDT liquidity pool in an AMM. The ratio of ETH to USDT in the pool is initially 1:1.

After some time, there is high demand for ETH, causing its price to increase. As a result, the price of ETH in the liquidity pool rises relative to USDT. Now, the ratio of ETH to USDT in the pool might become 2:1, meaning there is more ETH than USDT in the pool.

When the liquidity provider decides to withdraw their assets from the pool, they might find that they receive more ETH and fewer USDT than they initially deposited. If they were to convert the received assets back to their original proportions, they would find that they have less value compared to if they had simply held onto their original assets without providing liquidity.

This difference in the value of assets received compared to if the liquidity provider had held onto their original assets is the impermanent loss. It's called "impermanent" because it is dependent on the changing prices of the assets in the liquidity pool and may disappear if the prices revert back to their original ratio.