A Contract-Stackelberg Framework for Mitigating Timing Games in Proof-of-Stake Blockchain Networks

This table presents key parameters with their corresponding values used in the study's experimental setup. These parameters define the characteristics of validators and the simulation environment, mirroring realistic scenarios to validate the proposed framework. The values serve as benchmarks for testing the efficacy of the Contract-Stackelberg approach in addressing timing games in PoS networks.

TABLE I: Parameter-Value Pairs for Experiment Setup

Parameter	**Description**	**Value**
n_H	Number of high-type validators	50
n_M	Number of medium-type validators	80
n_L	Number of low-type validators	80
ε_H	Effort level of high-type validators	0.8
ε_M	Effort level of medium-type validators	0.65
ε_L	Effort level of low-type validators	0.5
s_H	Stake of high-type validators (tokens)	15,000
s_M	Stake of medium-type validators (tokens)	10,000
s_L	Stake of low-type validators (tokens)	5,000
t_{max}	Maximum block submission time (seconds)	12
$R_{i,\text{block}}$	Revenue from block rewards	Based on historical data
$R_{i,\text{fees}}$	Revenue from transaction fees	Based on historical data
$R_{i,\text{incentives}}$	Additional incentives	Varied for effectiveness
α	Return rate on stakes	0.05 (5%)
β	Maximum penalty rate	0.1 (10%)
σ	Effort sensitivity constant	2
λ_H, λ_M, λ_L	Probabilities of being high, medium, or low-capability	0.4, 0.3, 0.3

Setting θ_i values: Given the validator types $i \in \{H, M, L\}$, we define their respective revenue-generating capabilities as follows:

- θ_H for high-type validators,
- θ_M for medium-type validators,
- θ_L for low-type validators.

Assuming without loss of generality that $\theta_H > \theta_M > \theta_L$, reflecting the increased revenue-generating capability and associated with higher effort and stake levels.