

SMART CONTRACT CODE REVIEW AND SECURITY ANALYSIS REPORT



Customer: Algebra Finance
Date: December 15th, 2021



This document may contain confidential information about IT systems and the intellectual property of the Customer as well as information about potential vulnerabilities and methods of their exploitation.

The report containing confidential information can be used internally by the Customer, or it can be disclosed publicly after all vulnerabilities are fixed — upon a decision of the Customer.

Document

Name	Smart Contract Code Review and Security Analysis Report for Algebra Finance.		
Approved by	Andrew Matiukhin CTO Hacken OU		
Туре	Decentralized exchange		
Platform	Ethereum / Solidity		
Methods	Architecture Review, Functional Testing, Computer-Aided Verification, Manual Review		
Repository	https://github.com/cryptoalgebra/Algebra		
Commit	7ceaaf3315213a1abc22d9d010cb5900e841d143		
Technical	YES		
Documentation			
JS tests	YES		
Website	algebra.finance		
Timeline	22 NOVEMBER 2021 - 13 DECEMBER 2021		
Changelog	07 DECEMBER 2021 - INITIAL AUDIT		
	13 DECEMBER 2021 - SECOND REVIEW		
	15 DECEMBER 2021 - THIRD REVIEW		

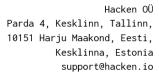




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Introduction

Hacken OÜ (Consultant) was contracted by Client (Customer) to conduct a Smart Contract Code Review and Security Analysis. This report presents the findings of the security assessment of the Customer's smart contract and its code review conducted between November 22^{nd} , 2021 - December 7^{th} , 2021.

Second review conducted on December 13th, 2021.

Third review conducted on December 15th, 2021.

Scope

The scope of the project is smart contracts in the repository:

Repository:

https://github.com/cryptoalgebra/Algebra

Commit:

7ceaaf3315213a1abc22d9d010cb5900e841d143

Technical Documentation: Yes

(https://drive.google.com/file/d/1EYtf4YPniPtk7B8f2XsozlGZ9BaAdyMV/view)

JS tests: Yes

https://github.com/cryptoalgebra/Algebra/tree/v0.1/src/core/test
https://github.com/cryptoalgebra/Algebra/tree/v0.1/src/tokenomics/tes

- Contracts:
 - core/contracts/libraries\AdaptiveFee.sol core/contracts/libraries\DataStorage.sol core/contracts/libraries\PriceMovementMath.sol core/contracts/libraries\TickManager.sol core/contracts/libraries\TickTable.sol core/contracts/libraries\TokenDeltaMath.sol core/contracts/AlgebraFactory.sol core/contracts/AlgebraPool.sol core/contracts/AlgebraPoolDeployer.sol core/contracts/DataStorageOperator.sol tokenomics/contracts/AlgebraFarming.sol tokenomics/contracts/AlgebraVirtualPool.sol tokenomics/contracts/VirtualPoolDeployer.sol tokenomics/contracts/libraries/RewardMath.sol tokenomics/contracts/AlgebraTokenStaking.sol tokenomics/contracts/libraries/FreezableToken.sol



We have scanned this smart contract for commonly known and more specific vulnerabilities. Here are some of the commonly known vulnerabilities that are considered:

Category	Check Item
Code review	Reentrancy
	Ownership Takeover
	Timestamp Dependence
	Gas Limit and Loops
	DoS with (Unexpected) Throw
	DoS with Block Gas Limit
	 Transaction-Ordering Dependence
	Style guide violation
	Costly Loop
	ERC20 API violation
	Unchecked external call
	Unchecked math
	Unsafe type inference
	Implicit visibility level
	Deployment Consistency
	Repository Consistency
	Data Consistency
Functional review	
runctional review	Business Logics Review
	Functionality Checks
	Access Control & Authorization
	Escrow manipulation
	Token Supply manipulation
	Assets integrity
	 User Balances manipulation
	 Data Consistency manipulation
	Kill-Switch Mechanism
	Operation Trails & Event Generation



Executive Summary

According to the assessment, the Customer's smart contracts are well-secured.

Insecure	Poor secured	Secured	Well-secured
		You ar	re here

Our team performed an analysis of code functionality, manual audit, and automated checks with Mythril and Slither. All issues found during automated analysis were manually reviewed, and important vulnerabilities are presented in the Audit overview section. All found issues can be found in the Audit overview section.

As a result of the audit, security engineers found 1 medium and 2 low severity issues.

After the second review security engineers received a commit with updated bootstrap scripts to compile, build and execute tests. Therefore medium issue was closed and there are still 2 low severity issues left.

After the third review security engineers found that **all issues** were addressed.



Severity Definitions

Risk Level	Description		
Critical	Critical vulnerabilities are usually straightforward to exploit and can lead to assets loss or data manipulations.		
High	High-level vulnerabilities are difficult to exploit; however, they also have a significant impact on smart contract execution, e.g., public access to crucial functions		
Medium	Medium-level vulnerabilities are important to fix; however, they can't lead to assets loss or data manipulations.		
Low	Low-level vulnerabilities are mostly related to outdated, unused, etc. code snippets that can't have a significant impact on execution		



Audit overview

■ ■ ■ Critical

No critical issues were found.

High

No high severity issues were found.

■ ■ Medium

Some tests are failed

143 out of 851 tests of the "core" module, as well as 13 out of 26 tests of the "tokenomics" module, are failed. Those tests are cover the checks for gas fees, contract size for the core, and the problem to create a fixture loader for the tokenomics tests.

Recommendation: Please make sure your tests are up to date and successful or update contracts accordingly.

Status: Fixed

Low

Missing events access control

Updating the factory address in the AlgebraPoolDeployer should emit an event for better trackability off-chain.

Contracts: AlgebraPoolDeployer.sol, AlgebraFarming.sol

Function: AlgebraPoolDeployer.setFactory, AlgebraFarming.setIncentiveMaker

Recommendation: Please make sure that changes of important addresses in contracts emit events.

Status: Fixed

2. State variables that could be declared immutable

Constant state variables that are initialized in the constructor should be declared immutable to save gas.

Contracts: AlgebraVirtualPool.sol

Variables: desiredEndTimestamp, desiredStartTimestamp

Recommendation: Add the **immutable** attributes to state variables that never change and are initialized in the constructor.

Status: Fixed



Conclusion

Smart contracts within the scope were manually reviewed and analyzed with static analysis tools.

The audit report contains all found security vulnerabilities and other issues in the reviewed code.

As a result of the audit, security engineers found 1 medium and 2 low severity issues.

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Disclaimers

Hacken Disclaimer

The smart contracts given for audit have been analyzed in accordance with the best industry practices at the date of this report, in relation to cybersecurity vulnerabilities and issues in smart contract source code, the details of which are disclosed in this report (Source Code); the Source Code compilation, deployment, and functionality (performing the intended functions).

The audit makes no statements or warranties on the security of the code. It also cannot be considered as a sufficient assessment regarding the utility and safety of the code, bug-free status, or any other statements of the contract. While we have done our best in conducting the analysis and producing this report, it is important to note that you should not rely on this report only — we recommend proceeding with several independent audits and a public bug bounty program to ensure the security of smart contracts.

Technical Disclaimer

Smart contracts are deployed and executed on a blockchain platform. The platform, its programming language, and other software related to the smart contract can have vulnerabilities that can lead to hacks. Thus, the audit can't guarantee the explicit security of the audited smart contracts.