InterFi
NETWORK

SMART CONTRACT AUDIT

interfinetwork

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PREPARED FOR

BIOKRIPT CONTRACTS

(ORDERBOOK, FACTORY, ROUTER)

INTERFI SMART CONTRACT AUDIT

INTRODUCTION

Auditing Firm	InterFi Network
Client Firm	BioKript
Methodology	Automated Analysis, Manual Code Review
Language	Solidity
Orderbook#	0x64a558A83ae8Db655f32e76ef414963167bB7759
Factory#	0x795802CB01A7Be4BE2f7f114B232A83B3ADce64a
Router#	0x07263092a333aB419F805545C9F230774113c28a
Blockchain	Binance Smart Chain
Centralization	Active ownership
Website	https://www.biokript.com/
Telegram	https://t.me/biokript/
Twitter	https://twitter.com/biokript/
Instagram	https://www.instagram.com/biokript/
Report Date	June 12, 2023
Update	February 04, 2024

ℹ️ Verify the authenticity of this report on our website: https://www.github.com/interfinetwork

EXECUTIVE SUMMARY

InterFi has performed the automated and manual analysis of solidity codes. Solidity codes were reviewed for common contract vulnerabilities and centralized exploits. Here's a quick audit summary:

Status	Critical 🔴	Major 🟠	Medium 🟡	Minor 🟢	Unknown 🟤
Open	0	0	0	1	0
Acknowledged	0	1	0	2	1
Resolved	0	1	2	2	0
Noteworthy Privileges	Review PAGE 27 for centralized privileges and access control				

ℹ️   Please note that smart contracts deployed on blockchains aren't resistant to exploits, vulnerabilities and/or hacks. Blockchain and cryptography assets utilize new and emerging technologies. These technologies present a high level of ongoing risks. For a detailed understanding of risk severity, source code vulnerability, and audit limitations, kindly review the audit report thoroughly.

ℹ️   Please note that centralization privileges regardless of their inherited risk status - constitute an elevated impact on smart contract safety and security.

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SCOPE OF WORK

InterFi was consulted by BioKript to conduct the smart contract audit of their solidity source codes. The audit scope of work is strictly limited to mentioned solidity file(s) only:

o   OrderbookAggregatorV3.sol

o   BiokriptFactory.sol

o   BiokriptRouter.sol

ℹ️ If source codes are not deployed on the main net, they can be modified or altered before main-net deployment. Verify the contract's deployment status below:

Public Contract Link	
https://bscscan.com/address/0x64a558a83ae8db655f32e76ef414963167bb7759#code	
Contract Name	OrderbookAggregatorV3
Compiler Version	0.8.18
License	MIT

Public Contract Link	
https://bscscan.com/address/0x795802cb01a7be4be2f7f114b232a83b3adce64a#code	
Contract Name	BiokriptFactory
Compiler Version	0.8.18
License	MIT

Public Contract Link	
https://bscscan.com/address/0x07263092a333ab419f805545c9f230774113c28a#code	
Contract Name	BiokriptRouter
Compiler Version	0.8.18
License	MIT

AUDIT METHODOLOGY

Smart contract audits are conducted using a set of standards and procedures. Mutual collaboration is essential to performing an effective smart contract audit. Here's a brief overview of InterFi's auditing process and methodology:

CONNECT

o   The onboarding team gathers source codes, and specifications to make sure we understand the size, and scope of the smart contract audit.

AUDIT

o   Automated analysis is performed to identify common contract vulnerabilities. We may use the following third-party frameworks and dependencies to perform the automated analysis:

  ▪   Remix IDE Developer Tool

  ▪   Open Zeppelin Code Analyzer

  ▪   SWC Vulnerabilities Registry

  ▪   DEX Dependencies, e.g., Pancakeswap, Uniswap

o   Simulations are performed to identify centralized exploits causing contract and/or trade locks.

o   A manual line-by-line analysis is performed to identify contract issues and centralized privileges. We may inspect below mentioned common contract vulnerabilities, and centralized exploits:

Centralized Exploits	o Token Supply Manipulation
	o Access Control and Authorization
	o Assets Manipulation
	o Ownership Control
	o Liquidity Access
	o Stop and Pause Trading
	o Ownable Library Verification

Common Contract Vulnerabilities	- Integer Overflow - Lack of Arbitrary limits - Incorrect Inheritance Order - Typographical Errors - Requirement Violation - Gas Optimization - Coding Style Violations - Re-entrancy - Third-Party Dependencies - Potential Sandwich Attacks - Irrelevant Codes - Divide before multiply - Conformance to Solidity Naming Guides - Compiler Specific Warnings - Language Specific Warnings

REPORT

o The auditing team provides a preliminary report specifying all the checks which have been performed and the findings thereof.

o The client's development team reviews the report and makes amendments to solidity codes.

o The auditing team provides the final comprehensive report with open and unresolved issues.

PUBLISH

o The client may use the audit report internally or disclose it publicly.

ℹ️ It is important to note that there is no pass or fail in the audit, it is recommended to view the audit as an unbiased assessment of the safety of solidity codes.

RISK CATEGORIES

Smart contracts are generally designed to hold, approve, and transfer tokens. This makes them very tempting attack targets. A successful external attack may allow the external attacker to directly exploit. A successful centralization-related exploit may allow the privileged role to directly exploit. All risks which are identified in the audit report are categorized here for the reader to review:

Risk Type	Definition
Critical 🔴	These risks could be exploited easily and can lead to asset loss, data loss, asset, or data manipulation. They should be fixed right away.
Major 🟠	These risks are hard to exploit but very important to fix, they carry an elevated risk of smart contract manipulation, which can lead to high-risk severity.
Medium 🟡	These risks should be fixed, as they carry an inherent risk of future exploits, and hacks which may or may not impact the smart contract execution. Low-risk re-entrancy-related vulnerabilities should be fixed to deter exploits.
Minor 🟢	These risks do not pose a considerable risk to the contract or those who interact with it. They are code-style violations and deviations from standard practices. They should be highlighted and fixed nonetheless.
Unknown 🟤	These risks pose uncertain severity to the contract or those who interact with it. They should be fixed immediately to mitigate the risk uncertainty.

All statuses which are identified in the audit report are categorized here for the reader to review:

Status Type	Definition
Open	Risks are open.
Acknowledged	Risks are acknowledged, but not fixed.
Resolved	Risks are acknowledged and fixed.

CENTRALIZED PRIVILEGES

Centralization risk is the most common cause of cryptography asset loss. When a smart contract has a privileged role, the risk related to centralization is elevated.

There are some well-intended reasons have privileged roles, such as:

o   Privileged roles can be granted the power to `pause()` the contract in case of an external attack.

o   Privileged roles can use functions like, `include()`, and `exclude()` to add or remove wallets from fees, swap checks, and transaction limits. This is useful to run a presale and to list on an exchange.

Authorizing privileged roles to externally-owned-account (EOA) is dangerous. Lately, centralization-related losses are increasing in frequency and magnitude.

o   The client can lower centralization-related risks by implementing below mentioned practices:

o   Privileged role's private key must be carefully secured to avoid any potential hack.

o   Privileged role should be shared by multi-signature (multi-sig) wallets.

o   Authorized privilege can be locked in a contract, user voting, or community DAO can be introduced to unlock the privilege.

o   Renouncing the contract ownership, and privileged roles.

o   Remove functions with elevated centralization risk.

🛈   Understand the project's initial asset distribution. Assets in the liquidity pair should be locked. Assets outside the liquidity pair should be locked with a release schedule.

AUTOMATED ANALYSIS

Symbol	Definition
🛑	Function modifies state
💵	Function is payable
🔒	Function is internal
🔓	Function is private
❗	Function is important

`OrderbookAggregatorV3`

| **OwnableUpgradeable** | Implementation | Initializable, ContextUpgradeable |||

| ∟ | __Ownable_init | Internal 🔒 | 🛑 | onlyInitializing |

| ∟ | __Ownable_init_unchained | Internal 🔒 | 🛑 | onlyInitializing |

| ∟ | owner | Public ❗ | |NO❗ |

| ∟ | _checkOwner | Internal 🔒 | | |

| ∟ | renounceOwnership | Public ❗ | 🛑 | onlyOwner |

| ∟ | transferOwnership | Public ❗ | 🛑 | onlyOwner |

| ∟ | _transferOwnership | Internal 🔒 | 🛑 | |

||||||

| **Initializable** | Implementation | |||

| ∟ | _disableInitializers | Internal 🔒 | 🛑 | |

| ∟ | _getInitializedVersion | Internal 🔒 | | |

| ∟ | _isInitializing | Internal 🔒 | | |

||||||

| **ReentrancyGuardUpgradeable** | Implementation | Initializable |||

| ∟ | __ReentrancyGuard_init | Internal 🔒 | 🛑 | onlyInitializing |

| ∟ | __ReentrancyGuard_init_unchained | Internal 🔒 | 🛑 | onlyInitializing |

| └ | _nonReentrantBefore | Private 🔐 | 🔴 | |

| └ | _nonReentrantAfter | Private 🔐 | 🔴 | |

| └ | _reentrancyGuardEntered | Internal 🔒 | | |

||||||
| **IERC20Upgradeable** | Interface | |||

| └ | totalSupply | External ❗ | |NO❗ |

| └ | balanceOf | External ❗ | |NO❗ |

| └ | transfer | External ❗ | 🔴 |NO❗ |

| └ | allowance | External ❗ | |NO❗ |

| └ | approve | External ❗ | 🔴 |NO❗ |

| └ | transferFrom | External ❗ | 🔴 |NO❗ |

||||||
| **AddressUpgradeable** | Library | |||

| └ | isContract | Internal 🔒 | | |

| └ | sendValue | Internal 🔒 | 🔴 | |

| └ | functionCall | Internal 🔒 | 🔴 | |

| └ | functionCall | Internal 🔒 | 🔴 | |

| └ | functionCallWithValue | Internal 🔒 | 🔴 | |

| └ | functionCallWithValue | Internal 🔒 | 🔴 | |

| └ | functionStaticCall | Internal 🔒 | | |

| └ | functionStaticCall | Internal 🔒 | | |

| └ | functionDelegateCall | Internal 🔒 | 🔴 | |

| └ | functionDelegateCall | Internal 🔒 | 🔴 | |

| └ | verifyCallResultFromTarget | Internal 🔒 | | |

| └ | verifyCallResult | Internal 🔒 | | |

| └ | _revert | Private 🔐 | | |

||||||
| **ContextUpgradeable** | Implementation | Initializable |||

| └ | __Context_init | Internal 🔒 | 🔴 | onlyInitializing |

| └ | __Context_init_unchained | Internal 🔒 | 🔴 | onlyInitializing |

| └ | _msgSender | Internal 🔒 | | |

| └ | _msgData | Internal 🔒 | | |

||||||
| **SafeMathUpgradeable** | Library | |||

| └ | tryAdd | Internal 🔒 | | |

| └ | trySub | Internal 🔒 | | |

| └ | tryMul | Internal 🔒 | | |

| └ | tryDiv | Internal 🔒 | | |

| └ | tryMod | Internal 🔒 | | |

| └ | add | Internal 🔒 | | |

| └ | sub | Internal 🔒 | | |

| └ | mul | Internal 🔒 | | |

| └ | div | Internal 🔒 | | |

| └ | mod | Internal 🔒 | | |

| └ | sub | Internal 🔒 | | |

| └ | div | Internal 🔒 | | |

| └ | mod | Internal 🔒 | | |

||||||
| **IUniswapV2Factory** | Interface | |||

| └ | feeTo | External ❗ | |NO❗ |

| └ | feeToSetter | External ❗ | |NO❗ |

| └ | getPair | External ❗ | |NO❗ |

| └ | allPairs | External ❗ | |NO❗ |

| └ | allPairsLength | External ❗ | |NO❗ |

| └ | createPair | External ❗ | 🔴 |NO❗ |

| └ | setFeeTo | External ❗ | 🔴 |NO❗ |

| [└] | setFeeToSetter | External ❗ | 🔴 |NO❗ |

||||||

| **IUniswapV2Pair** | Interface | |||

| [└] | name | External ❗ | |NO❗ |

| [└] | symbol | External ❗ | |NO❗ |

| [└] | decimals | External ❗ | |NO❗ |

| [└] | totalSupply | External ❗ | |NO❗ |

| [└] | balanceOf | External ❗ | |NO❗ |

| [└] | allowance | External ❗ | |NO❗ |

| [└] | approve | External ❗ | 🔴 |NO❗ |

| [└] | transfer | External ❗ | 🔴 |NO❗ |

| [└] | transferFrom | External ❗ | 🔴 |NO❗ |

| [└] | DOMAIN_SEPARATOR | External ❗ | |NO❗ |

| [└] | PERMIT_TYPEHASH | External ❗ | |NO❗ |

| [└] | nonces | External ❗ | |NO❗ |

| [└] | permit | External ❗ | 🔴 |NO❗ |

| [└] | MINIMUM_LIQUIDITY | External ❗ | |NO❗ |

| [└] | factory | External ❗ | |NO❗ |

| [└] | token0 | External ❗ | |NO❗ |

| [└] | token1 | External ❗ | |NO❗ |

| [└] | getReserves | External ❗ | |NO❗ |

| [└] | price0CumulativeLast | External ❗ | |NO❗ |

| [└] | price1CumulativeLast | External ❗ | |NO❗ |

| [└] | kLast | External ❗ | |NO❗ |

| [└] | mint | External ❗ | 🔴 |NO❗ |

| [└] | burn | External ❗ | 🔴 |NO❗ |

| [└] | swap | External ❗ | 🔴 |NO❗ |

| [└] | skim | External ❗ | 🔴 |NO❗ |

| └ | sync | External ❗ | 🔴 |NO❗ |

| └ | initialize | External ❗ | 🔴 |NO❗ |

||||||

| **IUniswapV2Router01** | Interface | |||

| └ | factory | External ❗ | |NO❗ |

| └ | WETH | External ❗ | |NO❗ |

| └ | addLiquidity | External ❗ | 🔴 |NO❗ |

| └ | addLiquidityETH | External ❗ | 💵 |NO❗ |

| └ | removeLiquidity | External ❗ | 🔴 |NO❗ |

| └ | removeLiquidityETH | External ❗ | 🔴 |NO❗ |

| └ | removeLiquidityWithPermit | External ❗ | 🔴 |NO❗ |

| └ | removeLiquidityETHWithPermit | External ❗ | 🔴 |NO❗ |

| └ | swapExactTokensForTokens | External ❗ | 🔴 |NO❗ |

| └ | swapTokensForExactTokens | External ❗ | 🔴 |NO❗ |

| └ | swapExactETHForTokens | External ❗ | 💵 |NO❗ |

| └ | swapTokensForExactETH | External ❗ | 🔴 |NO❗ |

| └ | swapExactTokensForETH | External ❗ | 🔴 |NO❗ |

| └ | swapETHForExactTokens | External ❗ | 💵 |NO❗ |

| └ | quote | External ❗ | |NO❗ |

| └ | getAmountOut | External ❗ | |NO❗ |

| └ | getAmountIn | External ❗ | |NO❗ |

| └ | getAmountsOut | External ❗ | |NO❗ |

| └ | getAmountsIn | External ❗ | |NO❗ |

||||||

| **IUniswapV2Router02** | Interface | IUniswapV2Router01 |||

| └ | removeLiquidityETHSupportingFeeOnTransferTokens | External ❗ | 🔴 |NO❗ |

| └ | removeLiquidityETHWithPermitSupportingFeeOnTransferTokens | External ❗ | 🔴 |NO❗ |

| └ | swapExactTokensForTokensSupportingFeeOnTransferTokens | External ❗ | 🔴 |NO❗ |

| └ | swapExactETHForTokensSupportingFeeOnTransferTokens | External ❗ | 💵 |NO❗ |

| └ | swapExactTokensForETHSupportingFeeOnTransferTokens | External ❗ | 🔴 |NO❗ |

| | | | | |

| **IWETH** | Interface | |||

| └ | deposit | External ❗ | 💵 |NO❗ |

| └ | transfer | External ❗ | 🔴 |NO❗ |

| └ | withdraw | External ❗ | 🔴 |NO❗ |

| | | | | |

| **IWETH2** | Interface | IWETH |||

| └ | balanceOf | External ❗ | |NO❗ |

| | | | | |

| **OrderbookAggregatorV3** | Implementation | Initializable, OwnableUpgradeable, ReentrancyGuardUpgradeable |||

| └ | <Receive Ether> | External ❗ | 💵 |NO❗ |

| └ | <Constructor> | Public ❗ | 🔴 |NO❗ |

| └ | initialize | Public ❗ | 🔴 | initializer |

| └ | placeMarketOrder | External ❗ | 💵 | nonReentrant |

| └ | placeOrder | External ❗ | 💵 | nonReentrant |

| └ | cancelOrder | External ❗ | 🔴 | nonReentrant |

| └ | proceedOrder | External ❗ | 🔴 | isAuthorized nonReentrant |

| └ | depositETH | Public ❗ | 💵 |NO❗ |

| └ | withdrawETH | External ❗ | 🔴 | nonReentrant |

| └ | _processOrder | Private 🔐 | 🔴 | |

| └ | getOrderDetail | Public ❗ | |NO❗ |

| └ | getStatus | Public ❗ | |NO❗ |

| └ | updateOrderFee | External ❗ | 🔴 | onlyOwner |

| └ | sweepFeeTokens | External ❗ | 🔴 | onlyOwner |

| └ | sweepFeeETH | External ❗ | 🔴 | onlyOwner |

| ∟ | updateServerKey | External ❗ | 🔴 | onlyOwner |

| ∟ | updateFeeReceiver | External ❗ | 🔴 | onlyOwner |

| ∟ | updateWETHAddress | External ❗ | 🔴 | onlyOwner |

| ∟ | setRouterStatus | External ❗ | 🔴 | onlyOwner |

BiokriptFactory

| **BiokriptERC20** | Implementation | IBiokriptERC20 |||

| ∟ | <Constructor> | Public ❗ | 🔴 |NO❗ |

| ∟ | _mint | Internal 🔒 | 🔴 | |

| ∟ | _burn | Internal 🔒 | 🔴 | |

| ∟ | _approve | Private 🔐 | 🔴 | |

| ∟ | _transfer | Private 🔐 | 🔴 | |

| ∟ | approve | External ❗ | 🔴 |NO❗ |

| ∟ | transfer | External ❗ | 🔴 |NO❗ |

| ∟ | transferFrom | External ❗ | 🔴 |NO❗ |

| ∟ | permit | External ❗ | 🔴 |NO❗ |

||||||

| **BiokriptFactory** | Implementation | |||

| ∟ | <Constructor> | Public ❗ | 🔴 |NO❗ |

| ∟ | allPairsLength | External ❗ | |NO❗ |

| ∟ | createPair | External ❗ | 🔴 |NO❗ |

| ∟ | setFeeTo | External ❗ | 🔴 |NO❗ |

| ∟ | setFeeToSetter | External ❗ | 🔴 |NO❗ |

||||||

| **BiokriptPair** | Implementation | BiokriptERC20 |||

| ∟ | getReserves | Public ❗ | |NO❗ |

| ∟ | _safeTransfer | Private 🔐 | 🔴 | |

| ∟ | <Constructor> | Public ❗ | 🔴 |NO❗ |

	└	initialize	External ❗	🛑		NO❗
└	_update	Private 🔐	🛑		
└	_mintFee	Private 🔐	🛑		
└	mint	External ❗	🛑		lock
└	burn	External ❗	🛑		lock
└	swap	External ❗	🛑		lock
└	skim	External ❗	🛑		lock
└	sync	External ❗	🛑		lock
IBiokriptCallee	Interface			
└	biokriptCall	External ❗	🛑		NO❗
IBiokriptERC20	Interface			
└	name	External ❗			NO❗
└	symbol	External ❗			NO❗
└	decimals	External ❗			NO❗
└	totalSupply	External ❗			NO❗
└	balanceOf	External ❗			NO❗
└	allowance	External ❗			NO❗
└	approve	External ❗	🛑		NO❗
└	transfer	External ❗	🛑		NO❗
└	transferFrom	External ❗	🛑		NO❗
└	DOMAIN_SEPARATOR	External ❗			NO❗
└	PERMIT_TYPEHASH	External ❗			NO❗
└	nonces	External ❗			NO❗
└	permit	External ❗	🛑		NO❗
IBiokriptFactory	Interface			

| └ | feeTo | External ❗ | |NO❗ |

| └ | feeToSetter | External ❗ | |NO❗ |

| └ | getPair | External ❗ | |NO❗ |

| └ | allPairs | External ❗ | |NO❗ |

| └ | allPairsLength | External ❗ | |NO❗ |

| └ | createPair | External ❗ | 🔴 |NO❗ |

| └ | setFeeTo | External ❗ | 🔴 |NO❗ |

| └ | setFeeToSetter | External ❗ | 🔴 |NO❗ |

||||||

| **IBiokriptPair** | Interface | |||

| └ | name | External ❗ | |NO❗ |

| └ | symbol | External ❗ | |NO❗ |

| └ | decimals | External ❗ | |NO❗ |

| └ | totalSupply | External ❗ | |NO❗ |

| └ | balanceOf | External ❗ | |NO❗ |

| └ | allowance | External ❗ | |NO❗ |

| └ | approve | External ❗ | 🔴 |NO❗ |

| └ | transfer | External ❗ | 🔴 |NO❗ |

| └ | transferFrom | External ❗ | 🔴 |NO❗ |

| └ | DOMAIN_SEPARATOR | External ❗ | |NO❗ |

| └ | PERMIT_TYPEHASH | External ❗ | |NO❗ |

| └ | nonces | External ❗ | |NO❗ |

| └ | permit | External ❗ | 🔴 |NO❗ |

| └ | MINIMUM_LIQUIDITY | External ❗ | |NO❗ |

| └ | factory | External ❗ | |NO❗ |

| └ | token0 | External ❗ | |NO❗ |

| └ | token1 | External ❗ | |NO❗ |

| └ | getReserves | External ❗ | |NO❗ |

| └ | price0CumulativeLast | External ❗ | |NO❗ |

| └ | price1CumulativeLast | External ❗ | |NO❗ |

| └ | kLast | External ❗ | |NO❗ |

| └ | mint | External ❗ | 🔴 |NO❗ |

| └ | burn | External ❗ | 🔴 |NO❗ |

| └ | swap | External ❗ | 🔴 |NO❗ |

| └ | skim | External ❗ | 🔴 |NO❗ |

| └ | sync | External ❗ | 🔴 |NO❗ |

| └ | initialize | External ❗ | 🔴 |NO❗ |

||||||

| **IERC20** | Interface | |||

| └ | name | External ❗ | |NO❗ |

| └ | symbol | External ❗ | |NO❗ |

| └ | decimals | External ❗ | |NO❗ |

| └ | totalSupply | External ❗ | |NO❗ |

| └ | balanceOf | External ❗ | |NO❗ |

| └ | allowance | External ❗ | |NO❗ |

| └ | approve | External ❗ | 🔴 |NO❗ |

| └ | transfer | External ❗ | 🔴 |NO❗ |

| └ | transferFrom | External ❗ | 🔴 |NO❗ |

||||||

| **Math** | Library | |||

| └ | min | Internal 🔒 | | |

| └ | sqrt | Internal 🔒 | | |

||||||

| **SafeMath** | Library | |||

| └ | add | Internal 🔒 | | |

| └ | sub | Internal 🔒 | | |

| ∟ | mul | Internal 🔒 | | |

||||||

| **UQ112x112** | Library | ||

| ∟ | encode | Internal 🔒 | | |

| ∟ | uqdiv | Internal 🔒 | | |


```
BiokriptRouter
```

| **BiokriptRouter** | Implementation | IBiokriptRouter |||

| ∟ | <Constructor> | Public ❗ | 🔴 |NO❗ |

| ∟ | <Receive Ether> | External ❗ | 💵 |NO❗ |

| ∟ | _addLiquidity | Internal 🔒 | 🔴 | |

| ∟ | addLiquidity | External ❗ | 🔴 | ensure |

| ∟ | addLiquidityETH | External ❗ | 💵 | ensure |

| ∟ | removeLiquidity | Public ❗ | 🔴 | ensure |

| ∟ | removeLiquidityETH | Public ❗ | 🔴 | ensure |

| ∟ | removeLiquidityWithPermit | External ❗ | 🔴 |NO❗ |

| ∟ | removeLiquidityETHWithPermit | External ❗ | 🔴 |NO❗ |

| ∟ | removeLiquidityETHSupportingFeeOnTransferTokens | Public ❗ | 🔴 | ensure |

| ∟ | removeLiquidityETHWithPermitSupportingFeeOnTransferTokens | External ❗ | 🔴 |NO❗ |

| ∟ | _swap | Internal 🔒 | 🔴 | |

| ∟ | swapExactTokensForTokens | External ❗ | 🔴 | ensure |

| ∟ | swapTokensForExactTokens | External ❗ | 🔴 | ensure |

| ∟ | swapExactETHForTokens | External ❗ | 💵 | ensure |

| ∟ | swapTokensForExactETH | External ❗ | 🔴 | ensure |

| ∟ | swapExactTokensForETH | External ❗ | 🔴 | ensure |

| ∟ | swapETHForExactTokens | External ❗ | 💵 | ensure |

| ∟ | _swapSupportingFeeOnTransferTokens | Internal 🔒 | 🔴 | |

| ∟ | swapExactTokensForTokensSupportingFeeOnTransferTokens | External ❗ | 🔴 | ensure |

| └ | swapExactETHForTokensSupportingFeeOnTransferTokens | External ❗ | 💵 | ensure |

| └ | swapExactTokensForETHSupportingFeeOnTransferTokens | External ❗ | 🔴 | ensure |

| └ | quote | Public ❗ | |NO❗ |

| └ | getAmountOut | Public ❗ | |NO❗ |

| └ | getAmountIn | Public ❗ | |NO❗ |

| └ | getAmountsOut | Public ❗ | |NO❗ |

| └ | getAmountsIn | Public ❗ | |NO❗ |

| └ | addWhitelistedTokens | External ❗ | 🔴 |NO❗ |

| └ | removeWhitelistedTokens | External ❗ | 🔴 |NO❗ |

| └ | transferOwnership | External ❗ | 🔴 |NO❗ |

||||||

| **IBiokriptFactory** | Interface | |||

| └ | feeTo | External ❗ | |NO❗ |

| └ | feeToSetter | External ❗ | |NO❗ |

| └ | getPair | External ❗ | |NO❗ |

| └ | allPairs | External ❗ | |NO❗ |

| └ | allPairsLength | External ❗ | |NO❗ |

| └ | createPair | External ❗ | 🔴 |NO❗ |

| └ | setFeeTo | External ❗ | 🔴 |NO❗ |

| └ | setFeeToSetter | External ❗ | 🔴 |NO❗ |

||||||

| **IBiokriptPair** | Interface | |||

| └ | name | External ❗ | |NO❗ |

| └ | symbol | External ❗ | |NO❗ |

| └ | decimals | External ❗ | |NO❗ |

| └ | totalSupply | External ❗ | |NO❗ |

| └ | balanceOf | External ❗ | |NO❗ |

| └ | allowance | External ❗ | |NO❗ |

| └ | approve | External ❗ | 🔴 |NO❗ |

| └ | transfer | External ❗ | 🔴 |NO❗ |

| └ | transferFrom | External ❗ | 🔴 |NO❗ |

| └ | DOMAIN_SEPARATOR | External ❗ | |NO❗ |

| └ | PERMIT_TYPEHASH | External ❗ | |NO❗ |

| └ | nonces | External ❗ | |NO❗ |

| └ | permit | External ❗ | 🔴 |NO❗ |

| └ | MINIMUM_LIQUIDITY | External ❗ | |NO❗ |

| └ | factory | External ❗ | |NO❗ |

| └ | token0 | External ❗ | |NO❗ |

| └ | token1 | External ❗ | |NO❗ |

| └ | getReserves | External ❗ | |NO❗ |

| └ | price0CumulativeLast | External ❗ | |NO❗ |

| └ | price1CumulativeLast | External ❗ | |NO❗ |

| └ | kLast | External ❗ | |NO❗ |

| └ | mint | External ❗ | 🔴 |NO❗ |

| └ | burn | External ❗ | 🔴 |NO❗ |

| └ | swap | External ❗ | 🔴 |NO❗ |

| └ | skim | External ❗ | 🔴 |NO❗ |

| └ | sync | External ❗ | 🔴 |NO❗ |

| └ | initialize | External ❗ | 🔴 |NO❗ |

||||||

| **IBiokriptRouter** | Interface | |||

| └ | factory | External ❗ | |NO❗ |

| └ | WETH | External ❗ | |NO❗ |

| └ | addLiquidity | External ❗ | 🔴 |NO❗ |

| └ | addLiquidityETH | External ❗ | 💲 |NO❗ |

| └ | removeLiquidity | External ❗ | 🔴 |NO❗ |

| └ | removeLiquidityETH | External ❗ | 🔴 |NO❗ |

| └ | removeLiquidityWithPermit | External ❗ | 🔴 |NO❗ |

| └ | removeLiquidityETHWithPermit | External ❗ | 🔴 |NO❗ |

| └ | removeLiquidityETHSupportingFeeOnTransferTokens | External ❗ | 🔴 |NO❗ |

| └ | removeLiquidityETHWithPermitSupportingFeeOnTransferTokens | External ❗ | 🔴 |NO❗ |

| └ | swapExactTokensForTokens | External ❗ | 🔴 |NO❗ |

| └ | swapTokensForExactTokens | External ❗ | 🔴 |NO❗ |

| └ | swapExactETHForTokens | External ❗ | 💵 |NO❗ |

| └ | swapTokensForExactETH | External ❗ | 🔴 |NO❗ |

| └ | swapExactTokensForETH | External ❗ | 🔴 |NO❗ |

| └ | swapETHForExactTokens | External ❗ | 💵 |NO❗ |

| └ | swapExactTokensForTokensSupportingFeeOnTransferTokens | External ❗ | 🔴 |NO❗ |

| └ | swapExactETHForTokensSupportingFeeOnTransferTokens | External ❗ | 💵 |NO❗ |

| └ | swapExactTokensForETHSupportingFeeOnTransferTokens | External ❗ | 🔴 |NO❗ |

| └ | quote | External ❗ | |NO❗ |

| └ | getAmountOut | External ❗ | |NO❗ |

| └ | getAmountIn | External ❗ | |NO❗ |

| └ | getAmountsOut | External ❗ | |NO❗ |

| └ | getAmountsIn | External ❗ | |NO❗ |

| | | | | |

| **IERC20** | Interface | |||

| └ | name | External ❗ | |NO❗ |

| └ | symbol | External ❗ | |NO❗ |

| └ | decimals | External ❗ | |NO❗ |

| └ | totalSupply | External ❗ | |NO❗ |

| └ | balanceOf | External ❗ | |NO❗ |

| └ | allowance | External ❗ | |NO❗ |

| └ | approve | External ❗ | 🔴 |NO❗ |

| └ | transfer | External ❗ | 🛑 |NO❗ |

| └ | transferFrom | External ❗ | 🛑 |NO❗ |

||||||

| **IWETH** | Interface | |||

| └ | deposit | External ❗ | 💵 |NO❗ |

| └ | transfer | External ❗ | 🛑 |NO❗ |

| └ | withdraw | External ❗ | 🛑 |NO❗ |

||||||

| **BiokriptLibrary** | Library | |||

| └ | sortTokens | Internal 🔒 | | |

| └ | pairFor | Internal 🔒 | | |

| └ | getReserves | Internal 🔒 | | |

| └ | quote | Internal 🔒 | | |

| └ | getAmountOut | Internal 🔒 | | |

| └ | getAmountIn | Internal 🔒 | | |

| └ | getAmountsOut | Internal 🔒 | | |

| └ | getAmountsIn | Internal 🔒 | | |

||||||

| **SafeMath** | Library | |||

| └ | add | Internal 🔒 | | |

| └ | sub | Internal 🔒 | | |

| └ | mul | Internal 🔒 | | |

||||||

| **TransferHelper** | Library | |||

| └ | safeApprove | Internal 🔒 | 🛑 | |

| └ | safeTransfer | Internal 🔒 | 🛑 | |

| └ | safeTransferFrom | Internal 🔒 | 🛑 | |

| └ | safeTransferETH | Internal 🔒 | 🛑 | |

INHERITANCE GRAPH

OrderbookAggregatorV3

BiokriptFactory
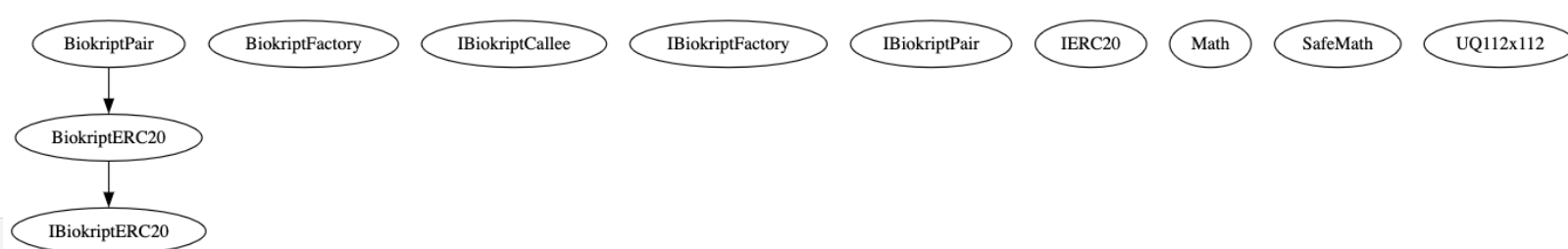
BiokriptRouter

MANUAL REVIEW

Identifier	Definition	Severity
CEN-01	Centralized privileges	
CEN-02	Privileged role changes `orderFee()`	Major 🟠
CEN-03	Privileged role whitelists address to allow `_addLiquidity` call	
CEN-07	Authorizations and access controls	

OrderbookAggregatorV3

`onlyOwner` centralized privileges are listed below:

```
transferOwnership()
updateOrderFee()
sweepFeeTokens()
sweepFeeETH()
updateServerKey()
updateFeeReceiver()
updateWETHAddress()
setRouterStatus()
```

`isAuthorized` access control is provided to:

```
proceedOrder()
```

BiokriptRouter

`onlyOwner` centralized privileges are listed below:

```
addWhitelistedTokens()
removeWhitelistedTokens()
transferOwnership()
```

BiokriptFactory

`feeToSetter` access control is provided to:

`setFeeTo()`
`setFeeToSetter()`

`factory` access control is provided to:

`initialize()`

RECOMMENDATION

Deployers, contract owners, administrators, access controlled, and all other privileged roles' private-keys/access-keys/admin-keys should be secured carefully. These entities can have a single point of failure that compromises the security of the project. Manage centralized and privileged roles carefully, review PAGE 09 for more information.

ACKNOWLEDGEMENT

BioKript team has confirmed that privileged roles are used as intended. It is recommended to:

Implement multi-signature wallets: Require multiple signatures from different parties to execute certain sensitive functions within contracts. This spreads control and reduces the risk of a single party having complete authority.

Use a decentralized governance model: Implement a governance model that enables token holders or other stakeholders to participate in decision-making processes. This can include voting on contract upgrades, parameter changes, or any other critical decisions that impact the contract's functioning.

Identifier	Definition	Severity
CEN-05	Circuit breaker mechanism	

Smart contracts do not have any circuit breaker mechanism to pause or stop the contract's functions in case of a bug or vulnerability. This could potentially result in funds being locked in the contract or malicious activities being carried out until the bug or vulnerability is fixed.

RECOMMENDATION

Add *OpenZeppelin* pausable library to achieve circuit breaker mechanism to pause or stop the contract's functions in case of a bug or vulnerability.

Identifier	Definition	Severity
CEN-09	Use of proxy and upgradeable contracts in `OrderbookAggregatorV3`	Major 🟠

`OrderbookAggregatorV3` contract `upgradeable` contracts which are implemented behind a `proxy` address `0x1841b37a9CC606d9fe027f626c963Ff66eFc57CB`.

```
contract OrderbookAggregatorV3 is
    Initializable,
    OwnableUpgradeable,
    ReentrancyGuardUpgradeable
{
    using SafeMathUpgradeable for uint256;
```

RECOMMENDATION

Test and validate current contract thoroughly before deployment. Future contract upgradeability negatively elevates centralization risk. Integrate proxy only when necessary. While **proxy** contracts are great for robust deployments while maintaining the **upgradeable** flexibility, proxy codes are prone to new security or logical issues that may compromise the project.

RESOLUTION

BioKript project uses contract upgradability to push new implementation without disrupting existing contracts and their associated data. This allows project to fix bugs, add new features, and improve contract security over time, while minimizing the impact on users and their assets.

NOTE

BioKript project has `_disableInitializers` in **upgradeable** implementation to add a safety measure that prevents initializer functions from being called more than once, reducing the risk of unintended behavior or vulnerabilities.

Identifier	Definition	Severity
LOG-01	Lack of appropriate arbitrary boundaries	Minor 🟢

Below mentioned function is set without any arbitrary boundaries:

`updateOrderFee()`

RECOMMENDATION

This function should be provided appropriate upper boundary.

RESOLUTION

BioKript project team has added input boundaries to mentioned function.

Identifier	Definition	Severity
LOG-02	Use of `delegatecall` in **OrderbookAggregatorV3**	Minor 🟢

`delegatecall` is present within **upgradeable** contracts, an attacker could potentially utilize this functions to destroy the logic implementation or execute custom logic.

RECOMMENDATION

Verify the user input and do not allow contract to perform `delegatecall` calls to untrusted contracts. Use of `delegatecall` in the contract is not recommended, as managing the storage layout in multiple contracts during logic upgrade can be disruptive.

ACKNOWLEDGEMENT

BioKript team has acknowledged this finding and agreed to keep as-is. `delegatecall` is required within **upgradeable** contracts only.

Identifier	Definition	Severity
LOG-03	Re-entrancy	Medium 🟡

Below mentioned functions are used without re-entrancy guard:

depositETH()
withdrawETH()

Below mentioned functions should be verified for Checks Effects Interactions:

proceedOrder() - Interaction with external contract IERC20Upgradeable(_currentOrder.path[0]) before updating the status of the order _currentOrder.status = OrderStatus.FILLED;. This may allow for potential re-entrancy attacks if the called contract has malicious code. It is recommended to move the external interaction to the end of the function and add nonReentrant modifier.

_processOrder() – Interaction with external contract. It is recommended to move the external interaction to the end of the function and add nonReentrant modifier.

RECOMMENDATION

Use Checks Effects Interactions pattern when handing over the flow to an external entity and/or guard functions against re-entrancy attacks. Re-entrancy guard is used to prevent re-entrant calls. Learn more: https://consensys.github.io/smart-contract-best-practices/attacks/reentrancy/

RESOLUTION

BioKript team has added nonReentrant modifiers to depositETH(), proceedOrder() and withdrawETH().

Below mentioned functions are used with re-entrancy guard:

```
placeMarketOrder()
placeOrder()
cancelOrder()
withdrawETH()
withdrawETH()
proceedOrder()
```

Simple lock – unlock re-entrancy check is used in **BiokriptFatory.**

Identifier	Definition	Severity
COD-02	Miner manipulation via `block.timestamp, block.number`	Minor 🟢
LOG-02	Potential front-running	

Be aware that the timestamp of the block can be manipulated by a miner. Front-running attack potential exists in all contracts, since miners or other users can see transactions before they're confirmed and act on them accordingly.

RECOMMENDATION

Use commit-reveal or similar scheme to hide transactions until validated.

ACKNOWLEDGEMENT

BioKript team acknowledged that this is a problem inherent in most EVM based blockchains. Front-running, and somewhat miner manipulation is impossible to deter.

Identifier	Definition	Severity
COD-05	Note regarding `keccak256` secure hashing	

Note that the `keccak256` function is not collision-resistant, and therefore there is a possibility of two different messages producing the same hash. Generating strong random input data, and properly securing and managing keys is recommended for fortification of `keccak256`.

COMMENT

BioKript team comments that the keccak256 collision has little effect on the functionality as it's related to signed data, except for the storage layout that can be solved by creating test files to check storage slot collisions. `keccak256` function is widely adapted in cryptography, and its use is relatively safe.

Identifier	Definition	Severity
COD-06	Possible signature replay attack	Minor 🟢

`permit()` function follows the EIP-2612 standard which is good as it allows for gasless transactions, however **ecrecover** must be implemented properly prevent possible signature replay attacks.

NOTE

Checks are set in `permit()` function to validate signature.

```
require(
    recoveredAddress != address(0) && recoveredAddress == owner,
    "Biokript: INVALID_SIGNATURE"
```

Identifier	Definition	Severity
COD-08	Inadequate checks in **OrderbookAggregatorV3**	Medium 🟡

In `placeMarketOrder()` and `placeOrder()` functions, tokens are transferred from the user to the contract without any checks for allowance or balance of the user.

In `cancelOrder()` function, it doesn't check if the contract has enough ETH to transfer.

In `depositETH()` function, it doesn't check if the message value is greater than zero.

In `withdrawETH()` function, it directly transfers ETH to the user without checking if the contract has enough ETH to transfer.

In `_processOrder()` function, it doesn't check if the BioKript pair (base, quote) exists, if it doesn't exist the transaction will fail.

RESOLUTION

BioKript project team has added checks to mentioned functions.

Identifier	Definition	Severity
COD-10	Direct and indirect dependencies in all contracts	Unknown 🔴

Smart contracts and addresses are interacting with market makers, decentralized applications, *OpenZeppelin* and *Uniswap,*, Math libraries, etc. The scope of the audit treats these entities as black boxes and assumes their functional correctness. However, in the real world, these entities can be compromised, and exploited. Moreover, upgrades in these entities can create severe impacts, e.g., increased transactional fees, deprecation of previous routers, logical and functional flaws, introduction of bugs, etc.

All unknown and/or out-of-scope instances, calls, interactions and dependencies are presumed correct for this assessment.

RECOMMENDATION

Inspect dependencies regularly, and mitigate severe impacts whenever necessary.

ACKNOWLEDGEMENT

BioKript team will inspect dependencies periodically, and push contract updates in `OrderbookAggregatorV3` as required.

Identifier	Definition	Severity
COD-12	Lack of event-driven architecture	Minor 🟢

Smart contract uses function calls to update state, which can make it difficult to track and analyze changes to the contract over time.

RECOMMENDATION

Use events to track state changes. Events improve transparency and provide a more granular view of contract activity.

RESOLUTION

BioKript project team has added events to most of the functions to track state changes.

Identifier	Definition	Severity
COM-01	Multiple pragma directives	

Various compilers and floating pragma are used across all contracts.

RECOMMENDATION

Pragma should be fixed to the version that you're indenting to deploy your contracts with.

RESOLUTION

BioKript project team has deployed smart contracts with stable compiler.

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InterFi Network is built by engineers, developers, UI experts, and blockchain enthusiasts. Our team currently consists of 4 core members, and 6+ casual contributors.

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