



# SMART CONTRACT AUDIT

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PREPARED FOR

**SNOWFALL PROTOCOL**



# INTRODUCTION

Auditing Firm	InterFi Network
Client Firm	Snowfall Protocol
Methodology	Automated Analysis, Manual Code Review
Language	Solidity
Contract	0x8AA19e10d52817CAcBA5eE066eFF38330c900223
Blockchain	Binance Smart Chain
Centralization	Active ownership
Commit	1cfaf066edc78aa7e16c6669cd96fec2927871f1
Website	<a href="http://snowfallprotocol.io/">http://snowfallprotocol.io/</a>
Telegram	<a href="https://t.me/+OwObSKk35XtmM2Zk/">https://t.me/+OwObSKk35XtmM2Zk/</a>
Twitter	<a href="https://twitter.com/Snowfallcoin/">https://twitter.com/Snowfallcoin/</a>
Discord	<a href="https://discord.gg/wbbhh49w/">https://discord.gg/wbbhh49w/</a>
Report Date	September 25, 2022

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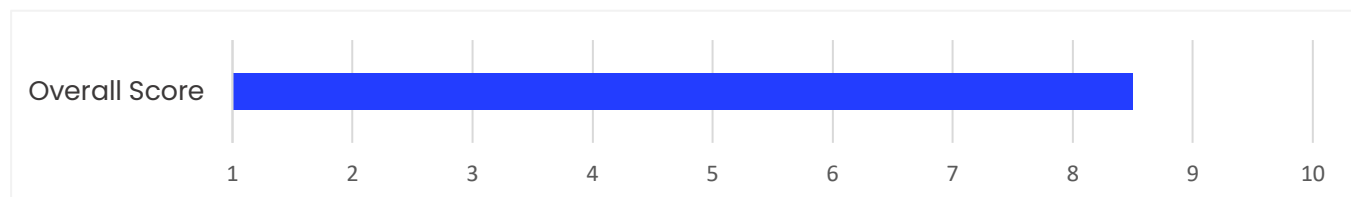


## EXECUTIVE SUMMARY

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 <span style="color: red;">●</span>	Major <span style="color: orange;">●</span>	Medium <span style="color: yellow;">●</span>	Minor <span style="color: green;">●</span>	Unknown <span style="color: brown;">●</span>
Open	0	0	1	2	1
Acknowledged	0	1	1	3	0
Resolved	0	0	0	0	0
<b>Noteworthy Privileges</b>	Set Pair and Router, Set Fees				

Snowfall Protocol's smart contract source codes have achieved the following score: **8.5**



**i** 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.

**i** 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 Snowfall Protocol 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:

- SnowfallProtocol.sol

**i** 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	
<a href="https://bscscan.com/address/0x8AA19e10d52817CAcBA5eE066eFF38330c900223#code">https://bscscan.com/address/0x8AA19e10d52817CAcBA5eE066eFF38330c900223#code</a>	
Contract Name	SnowfallProtocol
Compiler Version	0.8.17
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

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

## AUDIT

- 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
- Simulations are performed to identify centralized exploits causing contract and/or trade locks.
- 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	<ul style="list-style-type: none"><li>○ Token Supply Manipulation</li><li>○ Access Control and Authorization</li><li>○ Assets Manipulation</li><li>○ Ownership Control</li><li>○ Liquidity Access</li><li>○ Stop and Pause Trading</li><li>○ Ownable Library Verification</li></ul>
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Common Contract Vulnerabilities	<ul style="list-style-type: none"> <li>○ Integer Overflow</li> <li>○ Lack of Arbitrary limits</li> <li>○ Incorrect Inheritance Order</li> <li>○ Typographical Errors</li> <li>○ Requirement Violation</li> <li>○ Gas Optimization</li> <li>○ Coding Style Violations</li> <li>○ Re-entrancy</li> <li>○ Third-Party Dependencies</li> <li>○ Potential Sandwich Attacks</li> <li>○ Irrelevant Codes</li> <li>○ Divide before multiply</li> <li>○ Conformance to Solidity Naming Guides</li> <li>○ Compiler Specific Warnings</li> <li>○ Language Specific Warnings</li> </ul>
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## REPORT

- The auditing team provides a preliminary report specifying all the checks which have been performed and the findings thereof.
- The client's development team reviews the report and makes amendments to solidity codes.
- The auditing team provides the final comprehensive report with open and unresolved issues.

## PUBLISH






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

 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:

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

- The client can lower centralization-related risks by implementing below mentioned practices:
- Privileged role's private key must be carefully secured to avoid any potential hack.
- Privileged role should be shared by multi-signature (multi-sig) wallets.
- Authorized privilege can be locked in a contract, user voting, or community DAO can be introduced to unlock the privilege.
- Renouncing the contract ownership, and privileged roles.
- 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

```

| **IBEP20** | Interface | |||
|  L | totalSupply | External ! | |NO ! |
|  L | balanceOf | External ! | |NO ! |
|  L | transfer | External ! |  |NO ! |
|  L | allowance | External ! | |NO ! |
|  L | approve | External ! |  |NO ! |
|  L | transferFrom | External ! |  |NO ! |
|||||
| **Context** | Implementation | |||
|  L | _msgSender | Internal  | | |
|  L | _msgData | Internal  | | |
|||||
| **Ownable** | Implementation | Context |||
|  L | <Constructor> | Public ! |  |NO ! |
|  L | owner | Public ! | |NO ! |
|  L | renounceOwnership | Public ! |  | onlyOwner |
|  L | transferOwnership | Public ! |  | onlyOwner |
|||||
| **IPancakeFactory** | Interface | |||
|  L | feeTo | External ! | |NO ! |
|  L | feeToSetter | External ! | |NO ! |

```



```

| L | getPair | External ! | |NO ! |
| L | allPairs | External ! | |NO ! |
| L | allPairsLength | External ! | |NO ! |
| L | createPair | External ! | ● |NO ! |
| L | setFeeTo | External ! | ● |NO ! |
| L | setFeeToSetter | External ! | ● |NO ! |
|||||
| **IPancakePair** | Interface | |||
| L | name | External ! | |NO ! |
| L | symbol | External ! | |NO ! |
| L | decimals | External ! | |NO ! |
| L | totalSupply | External ! | |NO ! |
| L | balanceOf | External ! | |NO ! |
| L | allowance | External ! | |NO ! |
| L | approve | External ! | ● |NO ! |
| L | transfer | External ! | ● |NO ! |
| L | transferFrom | External ! | ● |NO ! |
| L | DOMAIN_SEPARATOR | External ! | |NO ! |
| L | PERMIT_TYPEHASH | External ! | |NO ! |
| L | nonces | External ! | |NO ! |
| L | permit | External ! | ● |NO ! |
| L | MINIMUM_LIQUIDITY | External ! | |NO ! |
| L | factory | External ! | |NO ! |
| L | token0 | External ! | |NO ! |
| L | token1 | External ! | |NO ! |
| L | getReserves | External ! | |NO ! |
| L | price0CumulativeLast | External ! | |NO ! |
| L | price1CumulativeLast | External ! | |NO ! |
| L | kLast | External ! | |NO ! |
| L | mint | External ! | ● |NO ! |
| L | burn | External ! | ● |NO ! |

```



```

|  | swap | External ! |  | NO ! |
|  | skim | External ! |  | NO ! |
|  | sync | External ! |  | NO ! |
|  | initialize | External ! |  | NO ! |

```

```

|||||

```

```

| **IPancakeRouter01** | 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 ! |

```

```

|||||

```

```

| **IPancakeRouter02** | Interface | IPancakeRouter01 |||

```

```

|  | removeLiquidityETHSupportingFeeOnTransferTokens | External ! |  | NO ! |
|  | removeLiquidityETHWithPermitSupportingFeeOnTransferTokens | External ! |  | NO ! |
|  | swapExactTokensForTokensSupportingFeeOnTransferTokens | External ! |  | NO ! |
|  | swapExactETHForTokensSupportingFeeOnTransferTokens | External ! |  | NO ! |

```



```
| L | swapExactTokensForETHSupportingFeeOnTransferTokens | External ! | ● | NO ! |
|||||
```

```
| **SnowfallProtocol** | Implementation | Context, IBEP20, Ownable |||
```

```
| L | <Constructor> | Public ! | ● | NO ! |
```

```
| L | name | Public ! | | NO ! |
```

```
| L | symbol | Public ! | | NO ! |
```

```
| L | decimals | Public ! | | NO ! |
```

```
| L | totalSupply | Public ! | | NO ! |
```

```
| L | balanceOf | Public ! | | NO ! |
```

```
| L | transfer | Public ! | ● | NO ! |
```

```
| L | allowance | Public ! | | NO ! |
```

```
| L | approve | Public ! | ● | NO ! |
```

```
| L | transferFrom | Public ! | ● | NO ! |
```

```
| L | increaseAllowance | Public ! | ● | NO ! |
```

```
| L | decreaseAllowance | Public ! | ● | NO ! |
```

```
| L | isExcludedFromReward | Public ! | | NO ! |
```

```
| L | totalFees | Public ! | | NO ! |
```

```
| L | deliver | Public ! | ● | NO ! |
```

```
| L | reflectionFromToken | Public ! | | NO ! |
```

```
| L | tokenFromReflection | Public ! | | NO ! |
```

```
| L | excludeFromReward | Public ! | ● | onlyOwner |
```

```
| L | includeInReward | External ! | ● | onlyOwner |
```

```
| L | excludeFromFee | Public ! | ● | onlyOwner |
```

```
| L | includeInFee | Public ! | ● | onlyOwner |
```

```
| L | setMinTokenNumberToSell | Public ! | ● | onlyOwner |
```

```
| L | setSwapAndLiquifyEnabled | Public ! | ● | onlyOwner |
```

```
| L | setReflectionFees | External ! | ● | onlyOwner |
```

```
| L | setmarketWallet | External ! | ● | onlyOwner |
```

```
| L | setRoute | External ! | ● | onlyOwner |
```

```
| L | withdrawBNB | External ! | ● | onlyOwner |
```

```
| L | withdrawToken | External ! | ● | onlyOwner |
```



```

|  L | <Receive Ether> | External ! | 🚫 | NO ! |
|  L | totalFeePerTx | Internal 🚫 | | |
|  L | _reflectFee | Private 🚫 | 🔴 | |
|  L | _getRate | Private 🚫 | | |
|  L | _getCurrentSupply | Private 🚫 | | |
|  L | _takeLiquidityPoolFee | Internal 🚫 | 🔴 | |
|  L | _takeMarketFee | Internal 🚫 | 🔴 | |
|  L | _takeBurnFee | Internal 🚫 | 🔴 | |
|  L | removeAllFee | Private 🚫 | 🔴 | |
|  L | setBuyFee | Private 🚫 | 🔴 | |
|  L | setSellFee | Private 🚫 | 🔴 | |
|  L | setNormalFee | Private 🚫 | 🔴 | |
|  L | setBuyFeePercent | External ! | 🔴 | onlyOwner |
|  L | setSellFeePercent | External ! | 🔴 | onlyOwner |
|  L | setNormalFeePercent | External ! | 🔴 | onlyOwner |
|  L | isExcludedFromFee | Public ! | NO ! |
|  L | _approve | Private 🚫 | 🔴 | |
|  L | _transfer | Private 🚫 | 🔴 | |
|  L | _tokenTransfer | Private 🚫 | 🔴 | |
|  L | _transferStandard | Private 🚫 | 🔴 | |
|  L | _transferToExcluded | Private 🚫 | 🔴 | |
|  L | _transferFromExcluded | Private 🚫 | 🔴 | |
|  L | _transferBothExcluded | Private 🚫 | 🔴 | |
|  L | swapAndLiquify | Private 🚫 | 🔴 | |
|||||
| **Utils** | Library | |||
|  L | swapTokensForEth | Internal 🚫 | 🔴 | |
|  L | swapETHForTokens | Internal 🚫 | 🔴 | |
|  L | addLiquidity | Internal 🚫 | 🔴 | |
|||||
| **SafeMath** | Library | |||

```

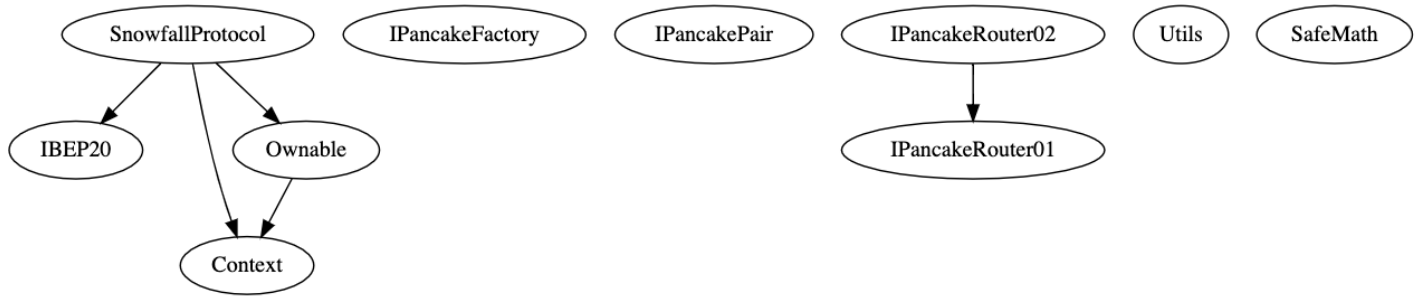


	⌞		add		Internal	🔒				
	⌞		sub		Internal	🔒				
	⌞		sub		Internal	🔒				
	⌞		mul		Internal	🔒				
	⌞		div		Internal	🔒				
	⌞		div		Internal	🔒				
	⌞		mod		Internal	🔒				
	⌞		mod		Internal	🔒				

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# INHERITANCE GRAPH



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## MANUAL REVIEW

Identifier	Definition	Severity
CEN-01	Centralization privileges of Snowfall Protocol	Major 🟡

Centralized privileges are listed below:

excludeFromReward()  
includeInReward()  
excludeFromFee()  
includeInFee()  
setMinTokenNumberToSell()  
setSwapAndLiquifyEnabled()  
setReflectionFees()  
setmarketWallet()  
setRoute()  
withdrawBNB()  
withdrawToken()  
setBuyFeePercent()  
setSellFeePercent()  
setNormalFeePercent()

## RECOMMENDATION

Deployer and/or contract owner private keys are secured carefully. Please refer to PAGE-09 CENTRALIZED PRIVILEGES for a detailed understanding.



Identifier	Definition	Severity
CEN-02	Initial asset distribution	Medium ●

All of the initially minted assets are sent to the contract deployer when deploying the contract. This can be an issue as the deployer and/or contract owner can distribute tokens without consulting the community.

```
uint256 private _tTotal = 1 * 1e9 ether; // 30 trillion total supply
emit Transfer(address(0), owner(), _tTotal);
```

## RECOMMENDATION

Deployer and/or contract owner private keys are secured carefully. Please refer to PAGE-09 CENTRALIZED PRIVILEGES for a detailed understanding. The community should be consulted during the initial asset distribution process.



Identifier	Definition	Severity
CEN-04	Privileged role receiving LP tokens	Minor <span style="color: green;">●</span>

Smart contract function `addLiquidity()` sends liquidity to `owner()`

```

    // add the liquidity
    pancakeRouter.addLiquidityETH{value : ethAmount}(
        address(this),
        tokenAmount,
        0, // slippage is unavoidable
        0, // slippage is unavoidable
        owner,
        block.timestamp + 300
    );
}

```

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## RECOMMENDATION

Send LP tokens to dead address or unreachable address.



Identifier	Definition	Severity
CEN-06	Privileged role modifying pair and router	Medium ●


Privileged role can call `setRoute()`

```
function setRoute(IPancakeRouter02 _router, address _pair) external onlyOwner {  
    pancakeRouter = _router;  
    pancakePair = _pair;  
}
```

## RECOMMENDATION

The current trading pair, e.g., Pancakeswap or Uniswap pair should not be removed from automated market makers.



Identifier	Definition	Severity
LOG-01	Lack of arbitrary limits	Minor 

Below mentioned functions are set without any arbitrary limits.


`setMinTokenNumberToSell()`

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## RECOMMENDATION

These functions should be provided arbitrary limits, e.g., put a **require** check that allows maximum tax change up to 25%.



Identifier	Definition	Severity
LOG-02	Potential sandwich attack	Minor 


Potential sandwich attack happens when an attacker observes a transaction swapping tokens or adding liquidity without setting restrictions on slippage or minimum output amount. The attacker can manipulate the exchange rate by front-running a transaction to purchase assets and make profits by back-running a transaction to sell assets. Below mentioned functions are called without setting restrictions on slippage or minimum output:

```
addLiquidity()
swapETHForTokens()
```

## RECOMMENDATION

These functions should be provided reasonable minimum output amounts, instead of zero. Read more: <https://coinmarketcap.com/alexandria/article/what-are-sandwich-attacks-in-defi-and-how-can-you-avoid-them>



Identifier	Definition	Severity
COD-02	Timestamp manipulation via <code>block.timestamp</code> Avoid using <code>block.number</code> as timestamp	Minor 


Be aware that the timestamp of the block can be manipulated by a miner. When the contract uses the timestamp to seed a random number, the miner can actually post a timestamp within 15 seconds of the block being validated, effectively allowing the miner to precompute an option more favorable to their chances, this is a critical exploit for contracts calculating random numbers, e.g., lottery.

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## RECOMMENDATION

To maintain block integrity, follow 15 seconds rule, and scale time dependent events accordingly.



Identifier	Definition	Severity
COD-10	Third Party Dependencies	Minor 

Smart contract is interacting with third party protocols e.g., Pancakeswap, Uniswap. The scope of the audit treats third party entities as black boxes and assumes their functional correctness. However, in the real world, third parties can be compromised, and exploited. Moreover, upgrades in third parties can create severe impacts, e.g., increased transactional fees, deprecation of previous routers, etc.

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## RECOMMENDATION

Inspect third party dependencies regularly, and mitigate severe impacts whenever necessary.





Identifier	Definition	Severity
COM-01	Fix pragma	Unknown 🟤

Fix compiler pragma.

`pragma solidity ^0.8.17` can be written as `pragma solidity 0.8.17`

Remove ABIEncoderV2 pragma directive.

`pragma experimental ABIEncoderV2`

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## RECOMMENDATION

Avoid using ^ while declaring the pragma. Remove ABIEncoderV2 pragma directive.



Identifier	Definition	Severity
COM-04	Typographical Error	

Function `setRoute()` should be `setRouter()`.

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## RECOMMENDATION

Fix typographical errors.



## DISCLAIMERS

InterFi Network provides the easy-to-understand audit of solidity source codes (commonly known as smart contracts).

The smart contract for this particular audit was analyzed for common contract vulnerabilities, and centralization exploits. This audit report makes no statements or warranties on the security of the code. This audit report does not provide any warranty or guarantee regarding the absolute bug-free nature of the smart contract analyzed, nor do they provide any indication of the client's business, business model or legal compliance. This audit report does not extend to the compiler layer, any other areas beyond the programming language, or other programming aspects that could present security risks. Cryptographic tokens are emergent technologies, they carry high levels of technical risks and uncertainty. You agree that your access and/or use, including but not limited to any services, reports, and materials, will be at your sole risk on an as-is, where-is, and as-available basis. This audit report could include false positives, false negatives, and other unpredictable results.

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## ABOUT INTERFI NETWORK

InterFi Network provides intelligent blockchain solutions. We provide solidity development, testing, and auditing services. We have developed 150+ solidity codes, audited 1000+ smart contracts, and analyzed 500,000+ code lines. We have worked on major public blockchains e.g., Ethereum, Binance, Cronos, Doge, Polygon, Avalanche, Metis, Fantom, Bitcoin Cash, Velas, Oasis, etc.

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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