



Security Assessment SUIHEROES

Vital Block **Verified** on September 8th, 2023

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PREPARED FOR:
SUIHEROES



INTRODUCTION

Auditing Firm	 VITAL BLOCK SECURITY
Client Firm	 SUIHEROES
Methodology	Automated Analysis, Manual Code Review
Language	Move
Contract Address	0xca7ba1c8700a67145c4b700c900cb9bb137ef2e2a9e59cb63b7a71136c57ab4b
Source Code Light	Verified
Code File	Coinflip.Move
Centralization	Active ownership
Compiler Version	v0.8.18+commit.87f61d96
Blockchain	 SUI NETWORK
Website	https://suiheroes.com/coinflip
Discord	https://discord.com/invite/7p69hGAFwg
Twitter	https://twitter.com/Suiheroes_io
Doc	https://medium.com/@suiheroes
Prelim Report Date	September 8 th 2023
Final Report Date	September 8 th 2023

  Verify the authenticity of this report on our GitHub Repo: <https://www.github.com/vital-block>

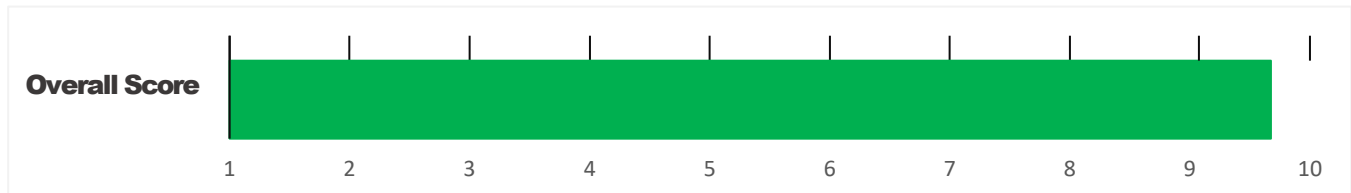


EXECUTIVE SUMMARY

Vital Block Security has performed the automated and manual analysis of the COINFLIP Move code. The code was reviewed for common contract vulnerabilities and centralized exploits. Here's a quick audit summary:

Status	Critical ! 🔴	Major " 🟡	Medium # 🟡	Minor \$ 🟢	Unknown % 🟤
Open	0	0	1	3	0
Acknowledged	0	0	1	0	2
Resolved	0	0	1	3	0
Noteworthy onlyOwner Privileges	Set Taxes and Ratios, Airdrop, Set Protection Settings, Set Reward Properties, Set Reflector Settings, Set Swap Settings, Set Pair and Router				

COINFLIP Smart contract has achieved the following score: **97.0**



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

Vital Block was consulted by SUIHEROES to conduct the smart contract audit of its. Move source code. The audit scope of work is strictly limited to mentioned .Sol file only:

O.SUIHEROES.sol



External contracts and/or interfaces dependencies are not checked due to being out of scope.

Verify audited contract's contract address and deployed link below:

Public Contract Address

<https://suiscan.xyz/mainnet/object/0xca7ba1c8700a67145c4b700c900cb9bb137ef2e2a9e59cb63b7a71136c57ab4b>

Contract Name

Coinflip.move

Package

Suiheroes Coinflip



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 Vital Block

Security 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">○ Token Supply Manipulation○ Access Control and Authorization○ Assets Manipulation○ Ownership Control○ Liquidity Access○ Stop and Pause Trading○ 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

- **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 the 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

```

**COINFLIP** | Interface | |||
| L | totalSupply | External | ! | NO |
| L | decimals | External | ! | NO |
| L | symbol | External | ! | NO |
| L | name | External | ! | NO |
| L | getOwner | External | NO |
| L | balanceOf | External | ! | NO |
| L | transfer | External | " ! ! | NO |
| L | allowance | External | ! | NO |
| L | approve | External | " ! ! | NO |
| L | transferFrom | External | " | NO |
|||||
**IFactoryV2** | Interface | |||
| L | getPair | External | NO | |
| L | createPair | External | " | NO |
|||||
**IV2Pair** | Interface | |||
| L | factory | External | NO | |
| L | getReserves | External | NO |
| L | sync | External | " | NO |

```

|||||

| ****IRouter01**** | Interface | |||

| L | factory | External ¶ | |NO¶|

| L | Sol | External ¶ | |NO¶|

| L | addLiquiditySUI | External ¶ | # |NO¶|

| L | addLiquidity | External ¶ | " |NO¶|

| L | swapExactETorTokens | External ¶ | # |NO¶|

| L | getAmountsOut | External ¶ | |NO¶|

| L | getAmountsIn | External ¶ | |NO¶|

|||||

| ****IRouter02**** | Interface | IRouter01 |||

| L | swapExactTokensForSUISupportingFeeOnTransferTokens | External ¶ | " |NO¶|

| L | swapExactSUIForTokensSupportingFeeOnTransferTokens | External ¶ | # |NO¶|

| L | swapExactTokensForTokensSupportingFeeOnTransferTokens | External ¶ | " ! 🚫 |NO¶|

| L | swapExactTokensForTokens | External ¶ | " |NO¶|

|||||

| ****Protections**** | Interface | |||

| L | checkUser | External ¶ | " ! 🚫 |NO¶|

| L | setLaunch | External ¶ | " |NO¶|

| L | setLpPair | External ¶ | " |NO¶|

| L | SUI | External ¶ | " |NO¶|

| L | removeSniper | External ¶ | " |NO¶|

|||||

| ****Cashier**** | Interface | |||

| L | setRewardsProperties | External ¶ | " |NO¶|

| L | tally | External ¶ | " |NO¶|

| L | load | External ¶ | # |NO¶|

| L | cashout | External ¶ | " |NO¶|

| L | giveMeWelfarePlease | External ¶ | " |NO¶|

| L | getTotalDistributed | External ¶ | |NO¶|

| L | getUserInfo | External ¶ | |NO¶|

| L | getUserRealizedRewards | External ¶ | |NO¶|



```

| L | getPendingRewards | External | | | NO |
| L | initialize | External | | " | NO |
| L | getCurrentReward | External | | | NO |
|||||
| **MOVE** | Implementation | SafeMath | |
| L | <Constructor> | Public | | # | NO |
| L | transferOwner | External | | " | onlyOwner |
| L | renounceOwnership | External | | " | NO |
| L | setOperator | Public | | " | NO |
| L | renounceOriginalDeployer | External | | " | NO |
| L | <Receive SUI> | External | | # | NO |
| L | totalSupply | External | | | NO |
| L | decimals | External | | | NO |
| L | symbol | External | | | NO |
| L | name | External | | | NO |
| L | getOwner | External | | ! | NO |
| L | balanceOf | Public | | ! | NO |
| L | allowance | External | | ! | NO |
| L | approve | External | | " ! | NO |
| L | _approve | Internal | $ | " | NO |
| L | approveContractContingency | Public | | " ! | onlyOwner |
| L | transfer | External | | " | NO |
| L | transferFrom | External | | " | NO |
| L | setNewRouter | External | | " | onlyOwner |
| L | setLpPair | External | | " | onlyOwner |
| L | setInitializers | External | | " | onlyOwner |
| L | isExcludedFromFees | External | | | NO |
| L | isExcludedFromDividends | External | | | NO |
| L | isExcludedFromProtection | External | | | NO |
| L | setDividendExcluded | Public | | " | onlyOwner |
| L | setExcludedFromFees | Public | | " | onlyOwner |

```



BTV-01 POSSIBLE OVERFLOW

Category	Severity ●	Location	Status
Suboptimal	Minor	Contract/Coinflip.move	Resolved

Description

In **GamePool**, the following equation is used inside an unchecked block

```
entry withdraw<Ty0: drop>(Arg0: &mut GamePool<Ty0>, Arg1: u64, Arg2: &mut TxContext) {
B0:
  0: CopyLoc[2](Arg2: &mut TxContext)
  1: FreezeRef
  2: Call tx_context::sender(&TxContext): address
  3: CopyLoc[0](Arg0: &mut GamePool<Ty0>)
  4: ImmBorrowFieldGeneric[0](GamePool.owner: address)
  5: ReadRef
```

Where parameters. Block **GamePool** Out Used is a this and override In is a this.
As these two are multiplied together in an unchecked block, they may overflow.

Recommendation

We recommend either checking for overflow in this case, or ensuring that the PairsIn is close enough it will never cause an overflow

BST-02 POSSIBLE OVERFLOW

Category	Severity ●	Location	Status
Status Mathematical Operations	Minor	Contract/Coinflip.move	Resolved

Description

In **PlayerData**, the following equation is used inside an unchecked block

```
CopyLoc[8](loc2: &mut PlayerData)
88: MutBorrowField[6](PlayerData.amount: u64)
89: WriteRef
90: CopyLoc[3](Arg3: u8)
91: CopyLoc[8](loc2: &mut PlayerData)
92: MutBorrowField[7](PlayerData.select: u8)
93: WriteRef
```

Recommendation

We recommend either checking for overflow in this case, or ensuring that the **PairsIn** is close enough it will never cause an overflow.

FZT-03 POSSIBLE OVERFLOW

Category	Severity ●	Location	Status
Inconsistency	Informational	Contract/Coinflip.move	Resolved

Description

In `updateForBalance`, the following equation is used inside an unchecked block






```
46: MutBorrowFieldGeneric[3](GamePool.balance: Balance<Ty0>)
47: MoveLoc[1](Arg1: Coin<Ty0>)
48: Call coin::into_balance<Ty0>(Coin<Ty0>): Balance<Ty0>
49: Call balance::join<Ty0>(&mut Balance<Ty0>, Balance<Ty0>): u64
```

The function `Balance ()` does not have the override specifier. It should be noted that since `price0 > a` function that overrides only a single interface function does not require the override specifier (see doc). However, all other instances of this in the code base contain the override specifier.

Recommendation

We recommend either checking for overflow in this case, or ensuring that the `PairsIn` is close enough it will never cause an overflow.

OPTIMIZATIONS | COINFLIP

ID	Title	Category	Status
FTV	Logarithm Refinement Optimization	Gas Optimization	Acknowledged 
FOP	Checks Can Be Performed Earlier	Gas Optimization	Acknowledged 
FDP	Unnecessary Use Of SafeMath	Gas Optimization	Acknowledged 
FWY	Struct Optimization	Gas Optimization	Acknowledged 
FGT	Unused State Variable	Gas Optimization	Acknowledged 

General Detectors

Missing Zero Address Validation

Some functions in this contract may not appropriately check for zero addresses being used.









































Attention
Required

Incorrect Solidity Version

This contract uses an unconventional or very old version of Solidity



Attention
Required

- | | |
|--|--|
|  No compiler version inconsistencies found |  No tautologies or contradictions found |
|  No unchecked call responses found |  No faulty true/false values found |
|  No vulnerable self-destruct functions found |  No innacurate divisions found |
|  No assertion vulnerabilities found |  No redundant constructor calls found |
|  No old solidity code found |  No vulnerable transfers found |
|  No external delegated calls found |  No vulnerable return values found |
|  No external call dependency found |  No uninitialized local variables found |
|  No vulnerable authentication calls found |  No default function responses found |
|  No invalid character typos found |  No missing arithmetic events found |
|  No RTL characters found |  No missing access control events found |
|  No dead code found |  No redundant true/false comparisons found |
|  No risky data allocation found |  No state variables vulnerable through function calls found |
|  No uninitialized state variables found |  No buggy low-level calls found |
|  No uninitialized storage variables found |  No expensive loops found |
|  No vulnerable initialization functions found |  No bad numeric notation practices found |
|  No risky data handling found |  No missing constant declarations found |
|  No number accuracy bug found |  No missing external function declarations found |
|  No out-of-range number vulnerability found |  No vulnerable payable functions found |
|  No map data deletion vulnerabilities found |  No vulnerable message values found |



Vulnerability Scan

REENTRANCY

✓ No reentrancy risk found

Severity Minor

Confidence Parameter Certain

✗ **Not Mintable**: A large amount of this token can not be minted by a private wallet or contract.

Vulnerability Description

Scanning Line:

```
entry live_game<Ty0: drop>(Arg0: &mut GamePool<Ty0>,
Arg1: bool, Arg2: &mut TxContext) {
B0:
  0: MoveLoc[2](Arg2: &mut TxContext)
  1: FreezeRef
  2: Call tx_context::sender(&TxContext): address
  3: CopyLoc[0](Arg0: &mut GamePool<Ty0>)
  4: ImmBorrowFieldGeneric[0](GamePool.owner: address)
  5: ReadRef
  6: Eq
  7: BrFalse(9)
B1:
  8: Branch(13)
B2:
  9: MoveLoc[0](Arg0: &mut GamePool<Ty0>)
  10: Pop
  11: LdConst[3](U64: 04000000..)
  12: Abort
```

Identifier	Definition	Severity
CEN-02	Initial asset distribution	Minor 

```
13: MoveLoc[1](Arg1: u16)
14: MoveLoc[0](Arg0: &mut GamePool<Ty0>)
15: MutBorrowFieldGeneric[1](GamePool.fee: u16)
16: WriteRef
17: Ret
```

Description:

Floating point calculations can vary across different architectures.

Alleviation:

This exhibit was acknowledged and ultimately discarded by the **SUIHEROES** team due to low severity. We consider the exhibit fully attended to as it doesn't impose any meaningful security concerns.

RECOMMENDATION

Project stakeholders should be consulted during the initial asset distribution process.



Contract Owner Address:

0x1b2afab3bb2ee1f837a8dd7ab13ff8d2c77f446d0dc80ce8b43fb4c9c213b8bc

Audited Files

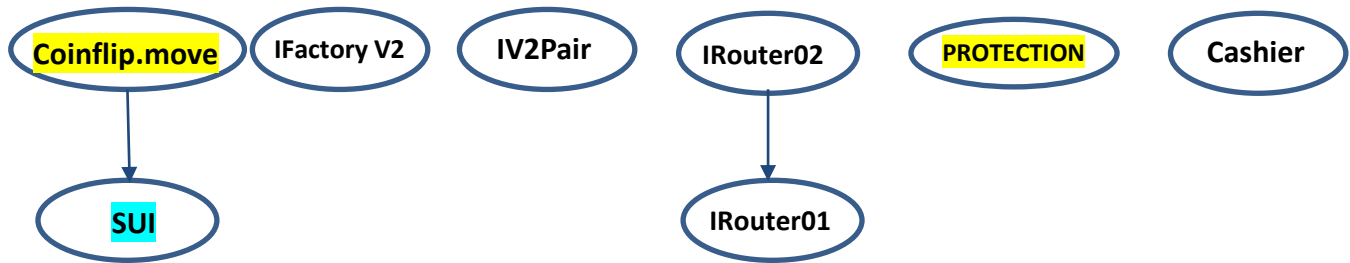
Coinflip.move

Contracts:

Contract

Coinflip::0xca7ba1c8700a67145c4b700c900cb9bb137ef2e2a9e59cb63
b7a71136c57ab4b

INHERITANCE GRAPH



Identifier	Definition	Severity
CEN-12	Centralization privileges of COINFLIP	Medium # 🟡

Vulnerability 0 : No important security issue detected.

Threat level: Low

```

176 13: LdConst[3](U64: 04000000..)
177 14: Abort
178 B3:
179 15: MoveLoc[0](Arg0: &mut GamePool<Ty0>)
180 16: MutBorrowFieldGeneric[3](GamePool.balance: Balance<Ty0>)
181 17: MoveLoc[1](Arg1: u64)
182 18: Call balance::split<Ty0>(&mut Balance<Ty0>, u64): Balance<Ty0>
183 19: CopyLoc[2](Arg2: &mut TxContext)
184 20: Call coin::from_balance<Ty0>(Balance<Ty0>, &mut TxContext): Coin<Ty0>
185 21: MoveLoc[2](Arg2: &mut TxContext)
186 22: FreezeRef
187 23: Call tx_context::sender(&TxContext): address
188 24: Call transfer::public_transfer<Coin<Ty0>>(Coin<Ty0>, address)
189 25: Ret
190 }
191 entry play<Ty0>: drop>(Arg0: &mut GamePool<Ty0>, Arg1: Coin<Ty0>, Arg2: u64, Arg3: u8, Arg4: &Clock, Arg5: &mut TxContext) {
192 B0:
193 0: CopyLoc[2](Arg2: u64)
194 1: CopyLoc[2](Arg2: u64)
195 2: CopyLoc[0](Arg0: &mut GamePool<Ty0>)
196 3: ImmBorrowFieldGeneric[1](GamePool.fee: u16)
197 4: ReadRef
198 5: CastU64
199 6: Mul
200 7: LdU64(10000)
201 8: Div
  
```

MANUAL REVIEW

Coin Flip: This page describes how the Tower game works on the SUI Heroes platform.

Rules Of The Game

Coin Flip is a game played between two players.

You can choose to create a game with another, or you can choose to flip against our automated SUIHeroesbot.

To start, each player chooses a side of the coin, either 'Heads' or 'Tails', and places a wager.

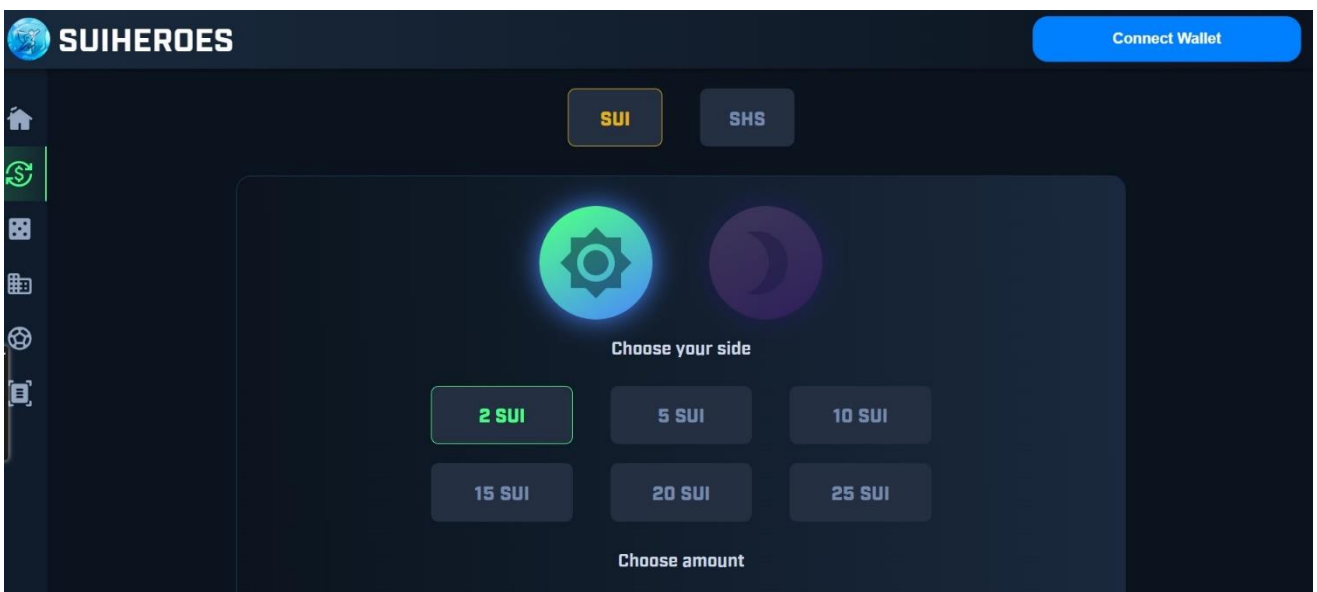
Together the players' wagers form the 'Prize Pool' or 'Pot' for the game.

Once the players' guesses and wagers are locked in, a coin is flipped and the winner is determined.

The winner receives the winner's share of the prize pool and the loser does not receive anything.



The SUIHEROES Platform Is Launching On the SUI Network





ISSUES CHECKING STATUS

Issue Description

Checking Status

1.	Compiler errors.	PASSED
2.	Race Conditions and reentrancy. Cross-Function Race Conditions.	PASSED
3.	Possible Delay In Data Delivery.	PASSED
4.	Oracle calls.	PASSED
5.	Front Running.	PASSED
6.	Move Dependency.	PASSED
7.	Integer Overflow And Underflow.	PASSED
8.	DoS with Revert.	PASSED
9.	Dos With Block Gas Limit.	PASSED
10.	Methods execution permissions.	PASSED
11.	Economy Model of the contract.	PASSED
12.	The Impact Of Exchange Rate On the sol Logic.	PASSED
13.	Private use data leaks.	PASSED
14.	Malicious Event log.	PASSED
15.	Scoping and Declarations.	PASSED
16.	Uninitialized storage pointers.	PASSED
17.	Arithmetic accuracy.	PASSED
18.	Design Logic.	PASSED
19.	Cross-Function race Conditions	PASSED
20.	Save Upon Move contract Implementation and Usage.	PASSED
21.	Fallback Function Security	PASSED



AUDIT RESULT

PASSED

Identifier	Definition	Severity
CEN-02	Initial asset distribution	Minor 

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.

```
1: CopyLoc[5](Arg5: &mut TxContext)
  52: FreezeRef
  53: Call tx_context::sender(&TxContext): address
  54: StLoc[7](loc1: address)
  55: MoveLoc[4](Arg4: &Clock)
  56: Call clock::timestamp_ms(&Clock): u64
  57: LdU64(1)
```

RECOMMENDATION

Project stakeholders should be consulted during the initial asset distribution process.



RECOMMENDATION

Deployer and/or contract owner private keys are secured carefully.

Please refer to PAGE-09 CENTRALIZED PRIVILEGES for a detailed understanding.

ALLEVIATION

The COINFLIP project team understands the centralization risk. Some functions are provided privileged access to ensure a good runtime behavior in the project



CERTIFICATE BY VITAL BLOCK SECURITY



Identifier	Definition	Severity
COD-10	Third Party Dependencies	Minor 

Smart contract is interacting with third party protocols e.g., Pancakeswap router, cashier contract, protections contract. 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.

RECOMMENDATION

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



DISCLAIMERS

Vital Block provides the easy-to-understand audit of Solidity, Move and Raw 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 VITAL BLOCK

Vital Block provides intelligent blockchain Security Solutions. We provide solidity and Raw Code Review, testing, and auditing services. We have Partnered with 15+ Crypto Launchpads, audited 50+ smart contracts, and analyzed 200,000+ code lines. We have worked on major public blockchains e.g., Ethereum, Binance, Cronos, Doge, Polygon, Avalanche, Metis, Fantom, Bitcoin Cash, Aptos, Oasis, etc.

Vital Block is Dedicated to Making Defi & Web3 A Safer Place. We are Powered by Security engineers, developers, UI experts, and blockchain enthusiasts. Our team currently consists of 5 core members, and 4+ casual contributors.

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Vital Block Dedicated to securing Public and Private Blockchain Ecosystem