SOLIDProof

*Bring trust into your projects*

**Blockchain Security | Smart Contract Audits | KYC**

MADE IN GERMANY

# Cairo Finance

# Audit

## Security Assessment
## 10. May, 2022

**For**

CAIRO
FINANCE

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| Version | Date | Description |
|---|---|---|
| 1.0 | 10. May 2022 | • Layout project<br>• Automated- /Manual-Security Testing<br>• Summary |

## Network
Binance Smart Chain (BEP20)

## Website
https://cairo.finance/

## Telegram
https://t.me/cairofinance

## Twitter
https://twitter.com/cairofinance?s=11

## Instagram
https://instagram.com/cairo.finance.official

## Youtube
https://www.youtube.com/channel/UCKqHSmte97IizdL1RtdabYw

## Description

Cairo is a Yield Optimizer with his own deflationary staking system that focuses on safety and autocompounds crypto assets for the best APYs through the Binance Smart Chain.

## Project Engagement

During the 6th of May 2022, **Cairo Finance Team** engaged Solidproof.io to audit smart contracts that they created. The engagement was technical in nature and focused on identifying security flaws in the design and implementation of the contracts. They provided Solidproof.io with access to their code repository and whitepaper.

## Logo

CAIRO
FINANCE

## Contract Link

### v1.0

- Github
    - Token
        - https://github.com/cairofinance/cairo-contracts/blob/master/contracts/token/CairoToken.sol
        - Commit: f8be3b5c866899a2604180673fbecb5dc422e4f9
    - Maximizer
        - https://github.com/cairofinance/cairo-contracts/blob/master/contracts/maximizer/CairoMaximizer.sol
        - Commit: ce4b5376654021e537ee3ef45bacd4dfaeda3bbc

## Vulnerability & Risk Level

Risk represents the probability that a certain source-threat will exploit vulnerability, and the impact of that event on the organization or system. Risk Level is computed based on CVSS version 3.0.

| Level | Value | Vulnerability | Risk (Required Action) |
|---|---|---|---|
| **Critical** | 9 - 10 | A vulnerability that can disrupt the contract functioning in a number of scenarios, or creates a risk that the contract may be broken. | Immediate action to reduce risk level. |
| **High** | 7 – 8.9 | A vulnerability that affects the desired outcome when using a contract, or provides the opportunity to use a contract in an unintended way. | Implementation of corrective actions as soon aspossible. |
| **Medium** | 4 – 6.9 | A vulnerability that could affect the desired outcome of executing the contract in a specific scenario. | Implementation of corrective actions in a certain period. |
| **Low** | 2 – 3.9 | A vulnerability that does not have a significant impact on possible scenarios for the use of the contract and is probably subjective. | Implementation of certain corrective actions or accepting the risk. |
| **Informational** | 0 – 1.9 | A vulnerability that have informational character but is not effecting any of the code. | An observation that does not determine a level of risk |

# Auditing Strategy and Techniques Applied

Throughout the review process, care was taken to evaluate the repository for security-related issues, code quality, and adherence to specification and best practices. To do so, reviewed line-by-line by our team of expert pentesters and smart contract developers, documenting any issues as there were discovered.

## Methodology

The auditing process follows a routine series of steps:

1. Code review that includes the following:
    i) Review of the specifications, sources, and instructions provided to SolidProof to make sure we understand the size, scope, and functionality of the smart contract.
    ii) Manual review of code, which is the process of reading source code line-by-line in an attempt to identify potential vulnerabilities.
    iii) Comparison to specification, which is the process of checking whether the code does what the specifications, sources, and instructions provided to SolidProof describe.

2. Testing and automated analysis that includes the following:
    i) Test coverage analysis, which is the process of determining whether the test cases are actually covering the code and how much code is exercised when we run those test cases.
    ii) Symbolic execution, which is analysing a program to determine what inputs causes each part of a program to execute.

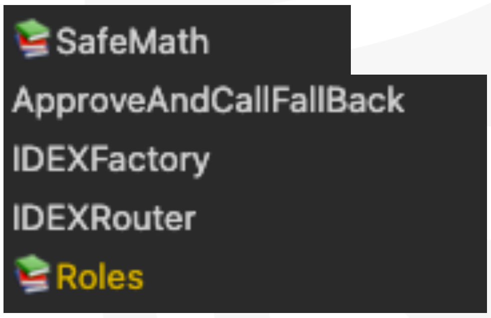
3. Best practices review, which is a review of the smart contracts to improve efficiency, effectiveness, clarify, maintainability, security, and control based on the established industry and academic practices, recommendations, and research.

4. Specific, itemized, actionable recommendations to help you take steps to secure your smart contracts.

## Used Code from other Frameworks/Smart Contracts (direct imports)

### Imported packages:

| Dependency / Import Path | Count |
|---|---|
| @openzeppelin/contracts-upgradeable/access/OwnableUpgradeable.sol | 2 |
| @openzeppelin/contracts-upgradeable/security/PausableUpgradeable.sol | 1 |



SafeMath
ApproveAndCallFallBack
IDEXFactory
IDEXRouter
Roles

## Tested Contract Files

This audit covered the following files listed below with a SHA-1 Hash.

*A file with a different Hash has been modified, intentionally or otherwise, after the security review. A different Hash could be (but not necessarily) an indication of a changed condition or potential vulnerability that was not within the scope of this review.*

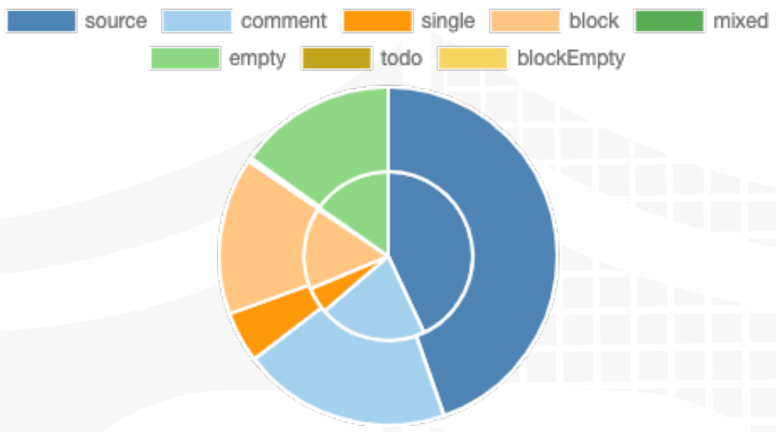
### v1.0

| File Name | SHA-1 Hash |
|---|---|
| contracts/CairoToken.sol | aaea273e2bc1eded39e373c31edccdb05ee48df1 |
| contracts/CairoMaximizer.sol | 9198b82b51fb3b4a1ffbd130dde4986dfaacec4f |

# Metrics

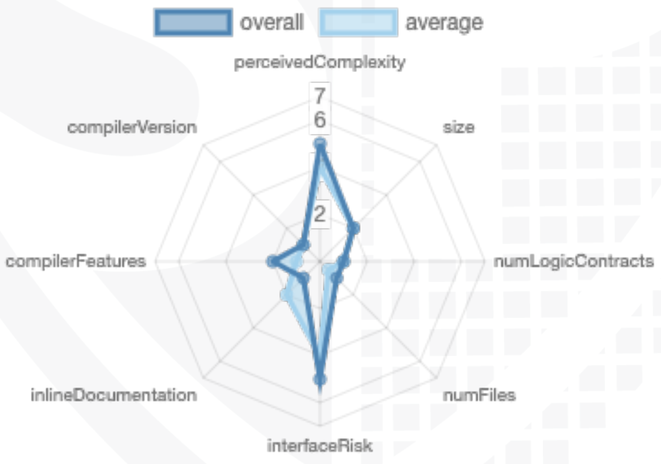
## Source Lines

### v1.0



## Risk Level

### v1.0



## Capabilities

### Components

| Version | Contracts | Libraries | Interfaces | Abstract |
|---|---|---|---|---|
| 1.0 | 2 | 2 | 4 | 0 |

### Exposed Functions

*This section lists functions that are explicitly declared public or payable. Please note that getter methods for public stateVars are not included.*

| Version | Public | Payable |
|---|---|---|
| 1.0 | 79 | 3 |

| Version | External | Internal | Private | Pure | View |
|---|---|---|---|---|---|
| 1.0 | 49 | 86 | 0 | 11 | 29 |

### State Variables

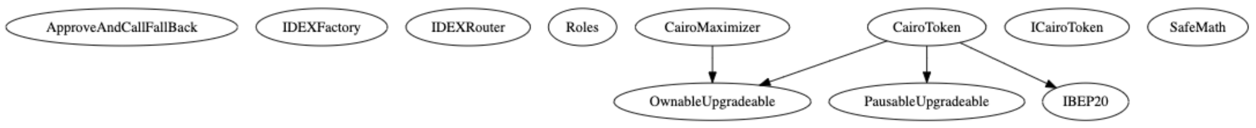
| Version | Total | Public |
|---|---|---|
| 1.0 | 45 | 18 |

### Capabilities

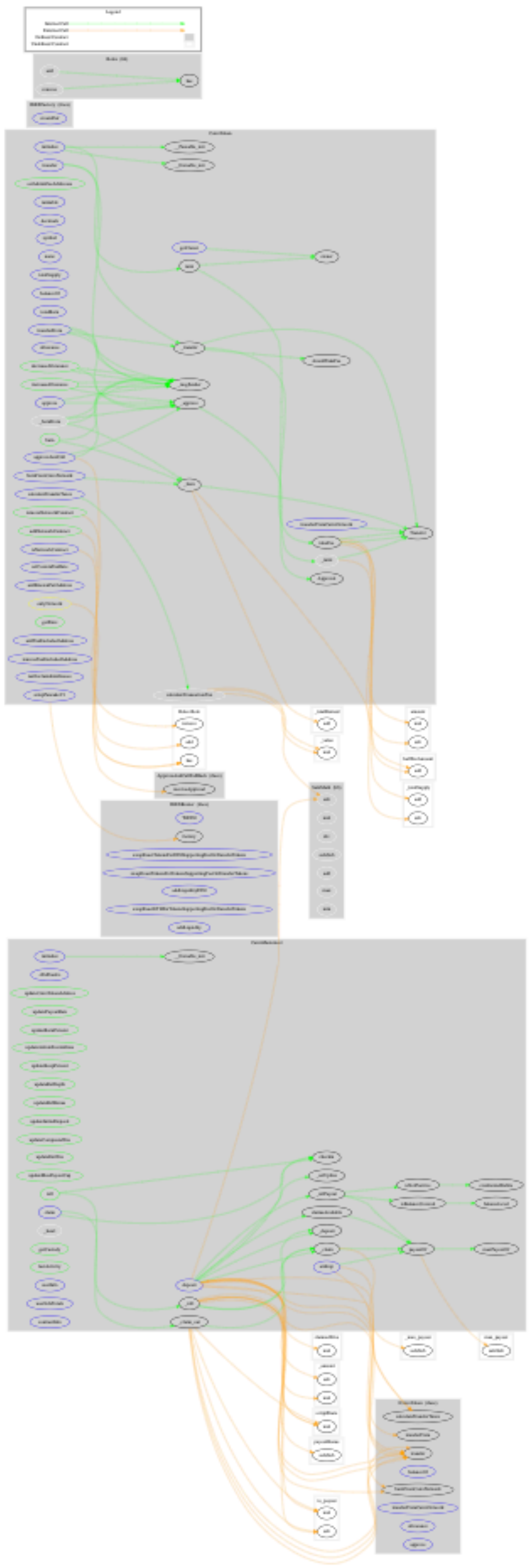
| Version | Solidity Versions observed | Experimental Features | Can Receive Funds | Uses Assembly | Has Destroyable Contracts |
|---|---|---|---|---|---|
| 1.0 | `^0.8.4` | | `yes` | | |

| Version | Transfers ETH | Low-Level Calls | DelegateCall | Uses Hash Functions | ECRecover | New/Create/Create2 |
|---|---|---|---|---|---|---|
| 1.0 | yes | | | | | |

## Inheritance Graph
### v1.0



# CallGraph
## v1.0



## Scope of Work/Verify Claims

The above token Team provided us with the files that needs to be tested (Github, Bscscan, Etherscan, files, etc.). The scope of the audit is the main contract (usual the same name as team appended with .sol).

We will verify the following claims:

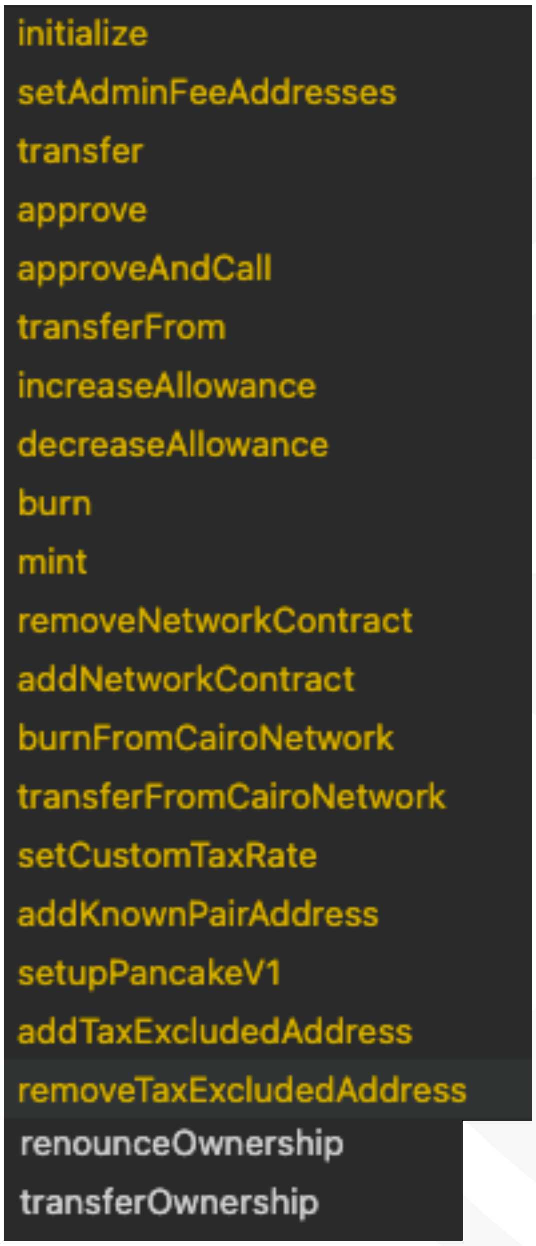
1. Correct implementation of Token standard
2. Deployer cannot mint any new tokens
3. Deployer cannot burn or lock user funds
4. Deployer cannot pause the contract
5. Overall checkup (Smart Contract Security)

## Correct implementation of Token standard

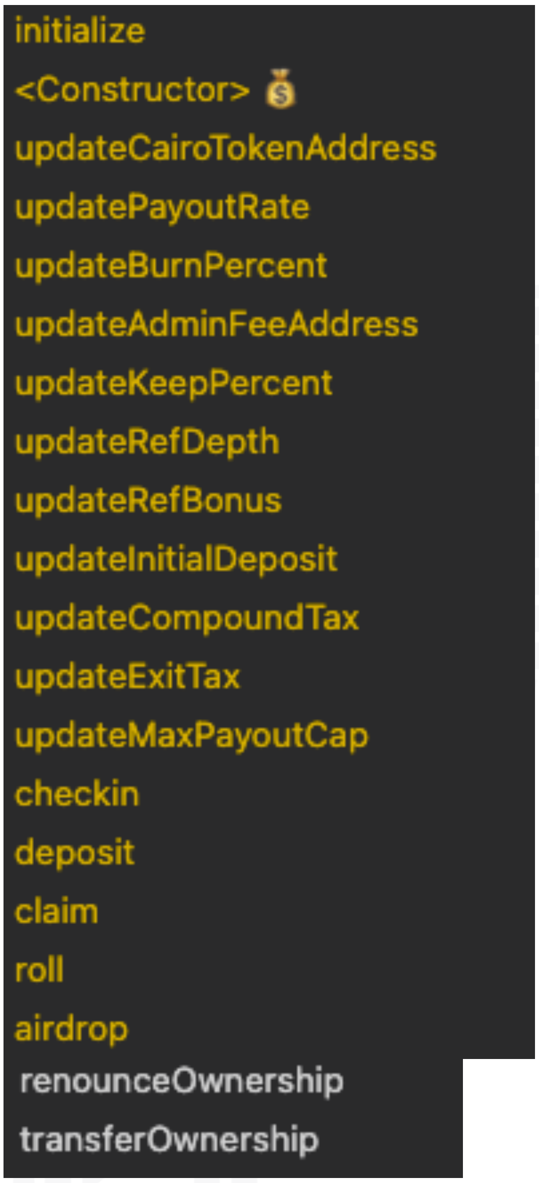
| ERC20 | | | | |
|---|---|---|---|---|
| **Function** | **Description** | **Exist** | **Tested** | **Verified** |
| TotalSupply | Provides information about the total token supply | ✓ | ✓ | ✓ |
| BalanceOf | Provides account balance of the owner's account | ✓ | ✓ | ✓ |
| Transfer | Executes transfers of a specified number of tokens to a specified address | ✓ | ✓ | ✓ |
| TransferFrom | Executes transfers of a specified number of tokens from a specified address | ✓ | ✓ | ✓ |
| Approve | Allow a spender to withdraw a set number of tokens from a specified account | ✓ | ✓ | ✓ |
| Allowance | Returns a set number of tokens from a spender to the owner | ✓ | ✓ | ✓ |

## Write functions of contract v1.0

CairoToken


initialize
setAdminFeeAddresses
transfer
approve
approveAndCall
transferFrom
increaseAllowance
decreaseAllowance
burn
mint
removeNetworkContract
addNetworkContract
burnFromCairoNetwork
transferFromCairoNetwork
setCustomTaxRate
addKnownPairAddress
setupPancakeV1
addTaxExcludedAddress
removeTaxExcludedAddress
renounceOwnership
transferOwnership

CairoMaximizer


initialize
<Constructor> 💰
updateCairoTokenAddress
updatePayoutRate
updateBurnPercent
updateAdminFeeAddress
updateKeepPercent
updateRefDepth
updateRefBonus
updateInitialDeposit
updateCompoundTax
updateExitTax
updateMaxPayoutCap
checkin
deposit
claim
roll
airdrop
renounceOwnership
transferOwnership

## Deployer cannot mint any new tokens

| Name | Exist | Tested | Status |
|---|---|---|---|
| Deployer cannot mint | ✓ | ✓ | ✓ |
| Max / Total Supply | | | 100000000 |

Comments:

### v1.0

- Owner mints new tokens in initialize function.

## Deployer cannot burn or lock user funds

| Name | Exist | Tested | Status |
|---|---|---|---|
| Deployer cannot lock | ✓ | ✓ | ✗ |
| Deployer cannot burn | ✓ | ✓ | ✗ |

Comments:

**v1.0**

- Owner can lock user funds by
    - Setting a custom tax rate for individual address to a high value
        - Owner cannot set _hasCustomTax variable per sender to false after setting it to true. That means, that the owner must set it manually back to 10 percent

- Tokens
    - can be burned by msg.sender
    - Can be burned by Cairo network without allowance from the address

## Deployer cannot pause the contract

| Name | Exist | Tested | Status |
|---|---|---|---|
| Deployer cannot pause | ✓ | ✓ | ✓ |

Comments:

**v1.0**

- Deployer implements PausableUpgradeable in the contracts to use modifiers from the library. It is possible, that the owner can pause contracts in an upgraded version of token. Do your own research here

## Overall checkup (Smart Contract Security)

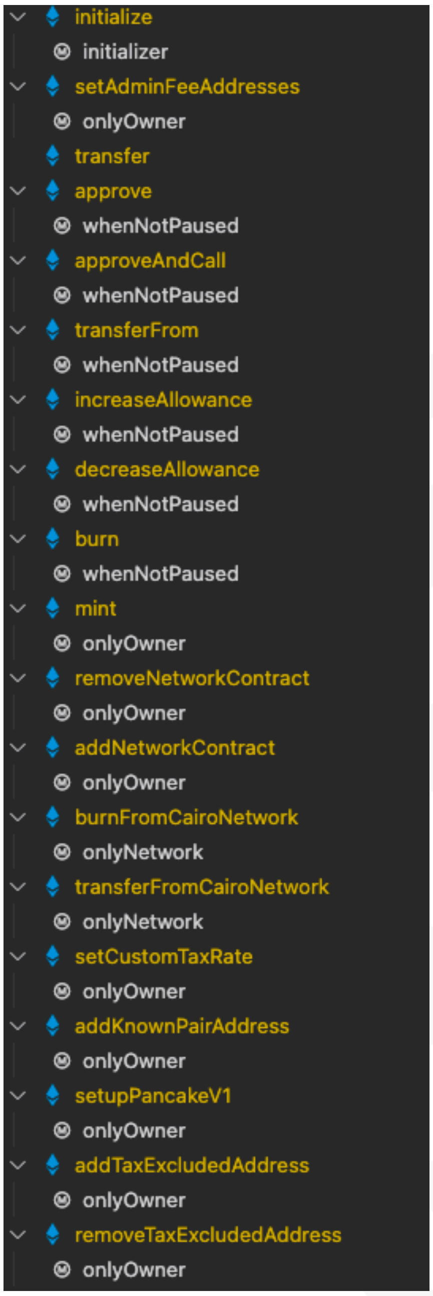
| Tested | Verified |
|---|---|
| ✓ | ✓ |

### Legend

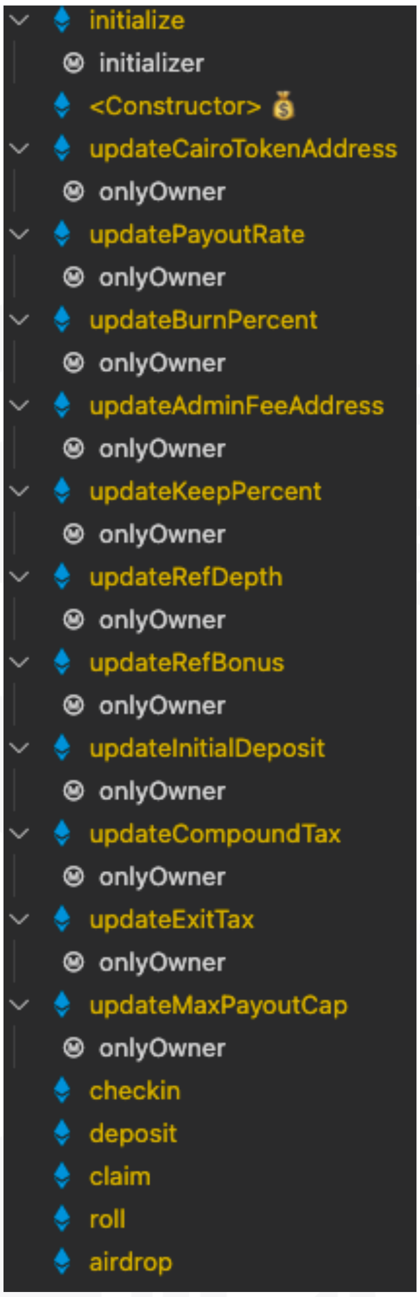
| Attribute | Symbol |
|---|---|
| Verfified / Checked | ✓ |
| Partly Verified | ⚑ |
| Unverified / Not checked | ✗ |
| Not available | – |

## Modifiers and public functions

### v1.0



```
initialize
    initializer
setAdminFeeAddresses
    onlyOwner
transfer
approve
    whenNotPaused
approveAndCall
    whenNotPaused
transferFrom
    whenNotPaused
increaseAllowance
    whenNotPaused
decreaseAllowance
    whenNotPaused
burn
    whenNotPaused
mint
    onlyOwner
removeNetworkContract
    onlyOwner
addNetworkContract
    onlyOwner
burnFromCairoNetwork
    onlyNetwork
transferFromCairoNetwork
    onlyNetwork
setCustomTaxRate
    onlyOwner
addKnownPairAddress
    onlyOwner
setupPancakeV1
    onlyOwner
addTaxExcludedAddress
    onlyOwner
removeTaxExcludedAddress
    onlyOwner
```



```
initialize
    initializer
<Constructor> 💰
updateCairoTokenAddress
    onlyOwner
updatePayoutRate
    onlyOwner
updateBurnPercent
    onlyOwner
updateAdminFeeAddress
    onlyOwner
updateKeepPercent
    onlyOwner
updateRefDepth
    onlyOwner
updateRefBonus
    onlyOwner
updateInitialDeposit
    onlyOwner
updateCompoundTax
    onlyOwner
updateExitTax
    onlyOwner
updateMaxPayoutCap
    onlyOwner
checkin
deposit
claim
roll
airdrop
```

## Comments

- *Deployer can set following state variables without any limitations*
    - CairoToken
        - _customTaxRate
    - CairoMaximizer
        - payoutRate
        - maximizerBurnPercent
        - maximizerKeepAmount
        - ref_depth
        - ref_bonus

        - minimumInitial
        - max_payout_cap

- *Deployer can enable/disable following state variables*
    - Token
        - _excluded
        - _isExcluded

- *Deployer can set following addresses*
    - CairoToken
        - router
        - pancakeV2BNBPair
        - pairs
        - networkContracts
        - allNetworkContracts
        - taxFeeSplit1
        - taxFeeSplit2

    - CairoMaximizer
        - cairoToken
        - adminFeeAddress
        - adminFeeAddress2

- *Existing Modifiers*
    - CairoToken
        - onlyNetwork

- CairoToken
    - Cairo networks can
        - transfer tokens without any allowance of the address
        - burn tokens without any allowance of the address
    - Owner can add any address to the networkContracts variable
        - All addresses are possible, not only contract addresses
    - Following functions cannot be called if contract is paused
        - Burn
        - Transfer
        - Approve
        - transferFrom
        - increaseAllowance
        - decreaseAllowance

- CairoMaximizer
    - custody.last_checkin has no functionality except of showing the time when the address interact with following functions
        - Deposit

- Claim
- Roll

**Please check if an OnlyOwner or similar restrictive modifier has been forgotten.**

## Source Units in Scope

### v1.0

| Type | File | Logic Contracts | Interfaces | Lines | nLines | nSLOC | Comment Lines | Complex. Score | Capabilities |
|---|---|---|---|---|---|---|---|---|---|
| 📝📚🔍 | contracts/CairoToken.sol | 2 | 3 | 655 | 596 | 276 | 243 | 283 | 💰🔆 |
| 📝📚🔍 | contracts/CairoMaximizer.sol | 2 | 1 | 667 | 644 | 403 | 89 | 273 | 💰📥 |
| 📝📚🔍 | **Totals** | **4** | **4** | **1322** | **1240** | **679** | **332** | **556** | 💰📥🔆 |

### Legend

| Attribute | Description |
|---|---|
| Lines | total lines of the source unit |
| nLines | normalized lines of the source unit (e.g. normalizes functions spanning multiple lines) |
| nSLOC | normalized source lines of code (only source-code lines; no comments, no blank lines) |
| Comment Lines | lines containing single or block comments |
| Complexity Score | a custom complexity score derived from code statements that are known to introduce code complexity (branches, loops, calls, external interfaces, ...) |

## Audit Results

**AUDIT PASSED**

### Critical issues

**No critical issues**

### High issues

**No high issues**

### Medium issues

**No medium issues**

### Low issues

| Issue | File | Type | Line | Description |
|---|---|---|---|---|
| #1 | CairoToken | A floating pragma is set | 3 | The current pragma Solidity directive is „“^0.8.4””. |
| #2 | CairoMaximizer | A floating pragma is set | 3 | The current pragma Solidity directive is „“^0.8.4””. |
| #3 | CairoToken | State variable visibility is not set | 135, 136, 139, 140 | It is best practice to set the visibility of state variables explicitly |
| #4 | CairoToken | Local variables shadowing | 490, 256 | Rename the local variables that shadow another component |
| #5 | CairoMaximizer | Missing Events Arithmetic | 175, 170, 184, 145, 166, 162 | Emit an event for critical parameter changes |

### Informational issues

| Issue | File | Type | Line | Description |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| #1 | CairoMaximizer | Functions that are not used | 386 | Remove unused functions |
| #2 | CairoToken | Functions that are not used | 504 | Remove unused functions |
| #3 | CairoMaximizer | Unused state variables | 93, 92 | Remove unused state variables |
| #4 | CairoMaximizer | Misspelling | See description | Change following words:<br><br>- Fuctions L187, L283<br><br>Make sure to change it everywhere else as well. |
| #5 | CairoToken | Error message is missing | 103, 88, 89, 78, 79 | Provide an error message for require statement |
| #6 | CairoMaximizer | Error message is missing | 179, 174 | Provide an error message for require statement |
| #7 | All | NatSpec documentation missing | - | If you started to comment your code, also comment all other functions, variables etc. |
| #8 | CairoToken | Wrong comment | 594 | *"Transfer between two wallets the 10% on buy/sell"* is a wrong comment. The owner is able to set custom percentage for an individual address. |

| | | | | |
|---|---|---|---|---|
| #9 | CairoToken | Fee Calculation | 592, See description | Modifiy following variable:<br><br>uint256 halfFeeAmount = amount.mul(taxPercent).div(100).div(2);<br><br>To:<br>Uint256 fee = amount.mul(taxPercent).div(100);<br>uint256 halfFee = fee.div(2);<br>Uint256 otherHalfFee = fee.sub(halfFee);<br><br>The reason is for example the fees are an odd number (33) The half of 33 is normally 16,5 but solidity will cut of the 0,5 and instead it will be 16 per half. That means, that you are only transferring 32 instead of 33. So if you are calculate the half of 33 now, you will still get 16 because of solidity, but if you are subtraction 16 from 33 you will take the rest 1 with into your first/second taxFeeSplit.<br><br>The result per taxSplit will be then:<br><br>taxFeeSplit1 = 16<br>taxFeeSplit1 = 17<br>Rest = 0<br><br>Instead of<br><br>taxFeeSplit1 = 16<br>taxFeeSplit1 = 16<br>Rest = 1<br><br>Same for<br>- adminHalfShare L237, L426, L395 |

| | | | | |
|---|---|---|---|---|
| #10 | CairoToken | Unnecessary library | See description | You mustn’t import SafeMath library into the contracts above pragma version 0.8.x anymore. It is already imported by default.<br><br>You can use raw mathematical operations instead of library functions. |
| #11 | CairoMaximizer | Unused local variable | 199, 526 | You are not using taxAmount in the deposit function. Remove the red marked text and leave the comma to solve this issue if you are not going to use that variable:<br><br>(uint256 realizedDeposit, uint256 taxAmount) = cairoToken.calculateTransferTaxes(_addr, _amount);<br><br>You can also replace the blue marked variable directly with _total_amount instead of setting _total_amount L200 to realizeDeposit<br><br>L526:<br>(uint256 _gross_payout, uint256 _max_payout, uint256 _to_payout) = payoutOf(_addr); |
| #12 | CairoMaximizer | Uninitialized variable | 97, 105 | minimumAmount will be 0, so there is no minimum deposit in deposit function |
| #13 | CairoMaximizer | Variable with no effect | 85 | Remove variable if you are not going to use it |
| #14 | CairoMaximizer | Contract that locks ether | - | You are not able to withdraw contract balance |
| #15 | CairoMaximizer | Russian comment | 477 | Translate russian comment into English<br><br>- Взгляды<br>- совместимость<br>- Пользователь в аплайне<br>- |

## Commented Code exist

There are some instances of code being commented out in the following files that should be removed:

| File | Line | Comment |
|---|---|---|
| CairoMaximizer | 312 | // require(users[_addr].upline != address(0) \|\| _addr == owner(), "No upline"); |
| | 628-630 | // assert(b > 0); // Solidity automatically throws when dividing by 0<br>// uint256 c = a / b;<br>// assert(a == b * c + a % b); // There is no case in which this doesn't hold |

### Recommendation

Remove the commented code, or address them properly.

## Audit Comments

We recommend you to use the special form of comments (NatSpec Format, Follow link for more information https://docs.soliditylang.org/en/v0.5.10/natspec-format.html) for your contracts to provide rich documentation for functions, return variables and more. This helps investors to make clear what that variables, functions etc. do.

### 10. May 2022:

- Keep it in mind that the contracts are upgradeable
- Read whole report for more information

## SWC Attacks

| ID | Title | Relationships | Status |
|---|---|---|---|
| SWC-136 | Unencrypted Private Data On-Chain | CWE-767: Access to Critical Private Variable via Public Method | PASSED |
| SWC-135 | Code With No Effects | CWE-1164: Irrelevant Code | PASSED |
| SWC-134 | Message call with hardcoded gas amount | CWE-655: Improper Initialization | PASSED |
| SWC-133 | Hash Collisions With Multiple Variable Length Arguments | CWE-294: Authentication Bypass by Capture-replay | PASSED |
| SWC-132 | Unexpected Ether balance | CWE-667: Improper Locking | PASSED |
| SWC-131 | Presence of unused variables | CWE-1164: Irrelevant Code | NOT PASSED |
| SWC-130 | Right-To-Left-Override control character (U+202E) | CWE-451: User Interface (UI) Misrepresentation of Critical Information | PASSED |
| SWC-129 | Typographical Error | CWE-480: Use of Incorrect Operator | PASSED |
| SWC-128 | DoS With Block Gas Limit | CWE-400: Uncontrolled Resource Consumption | PASSED |

| | | | |
|---|---|---|---|
| SWC-127 | Arbitrary Jump with Function Type Variable | CWE-695: Use of Low-Level Functionality | **PASSED** |
| SWC-125 | Incorrect Inheritance Order | CWE-696: Incorrect Behavior Order | **PASSED** |
| SWC-124 | Write to Arbitrary Storage Location | CWE-123: Write-what-where Condition | **PASSED** |
| SWC-123 | Requirement Violation | CWE-573: Improper Following of Specification by Caller | **PASSED** |
| SWC-122 | Lack of Proper Signature Verification | CWE-345: Insufficient Verification of Data Authenticity | **PASSED** |
| SWC-121 | Missing Protection against Signature Replay Attacks | CWE-347: Improper Verification of Cryptographic Signature | **PASSED** |
| SWC-120 | Weak Sources of Randomness from Chain Attributes | CWE-330: Use of Insufficiently Random Values | **PASSED** |
| SWC-119 | Shadowing State Variables | CWE-710: Improper Adherence to Coding Standards | **NOT PASSED** |
| SWC-118 | Incorrect Constructor Name | CWE-665: Improper Initialization | **PASSED** |
| SWC-117 | Signature Malleability | CWE-347: Improper Verification of Cryptographic Signature | **PASSED** |

| | | | |
|---|---|---|---|
| SWC-116 | Timestamp Dependence | CWE-829: Inclusion of Functionality from Untrusted Control Sphere | PASSED |
| SWC-115 | Authorization through tx.origin | CWE-477: Use of Obsolete Function | PASSED |
| SWC-114 | Transaction Order Dependence | CWE-362: Concurrent Execution using Shared Resource with Improper Synchronization ('Race Condition') | PASSED |
| SWC-113 | DoS with Failed Call | CWE-703: Improper Check or Handling of Exceptional Conditions | PASSED |
| SWC-112 | Delegatecall to Untrusted Callee | CWE-829: Inclusion of Functionality from Untrusted Control Sphere | PASSED |
| SWC-111 | Use of Deprecated Solidity Functions | CWE-477: Use of Obsolete Function | PASSED |
| SWC-110 | Assert Violation | CWE-670: Always-Incorrect Control Flow Implementation | PASSED |
| SWC-109 | Uninitialized Storage Pointer | CWE-824: Access of Uninitialized Pointer | PASSED |
| SWC-108 | State Variable Default Visibility | CWE-710: Improper Adherence to Coding Standards | NOT PASSED |
| SWC-107 | Reentrancy | CWE-841: Improper Enforcement of Behavioral Workflow | PASSED |
| SWC-106 | Unprotected SELFDESTRUCT Instruction | CWE-284: Improper Access Control | PASSED |

| | | | |
|---|---|---|---|
| SWC-105 | Unprotected Ether Withdrawal | CWE-284: Improper Access Control | **PASSED** |
| SWC-104 | Unchecked Call Return Value | CWE-252: Unchecked Return Value | **PASSED** |
| SWC-103 | Floating Pragma | CWE-664: Improper Control of a Resource Through its Lifetime | **NOT PASSED** |
| SWC-102 | Outdated Compiler Version | CWE-937: Using Components with Known Vulnerabilities | **PASSED** |
| SWC-101 | Integer Overflow and Underflow | CWE-682: Incorrect Calculation | **PASSED** |
| SWC-100 | Function Default Visibility | CWE-710: Improper Adherence to Coding Standards | **PASSED** |

Solid Proofed

**Blockchain Security | Smart Contract Audits | KYC**

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