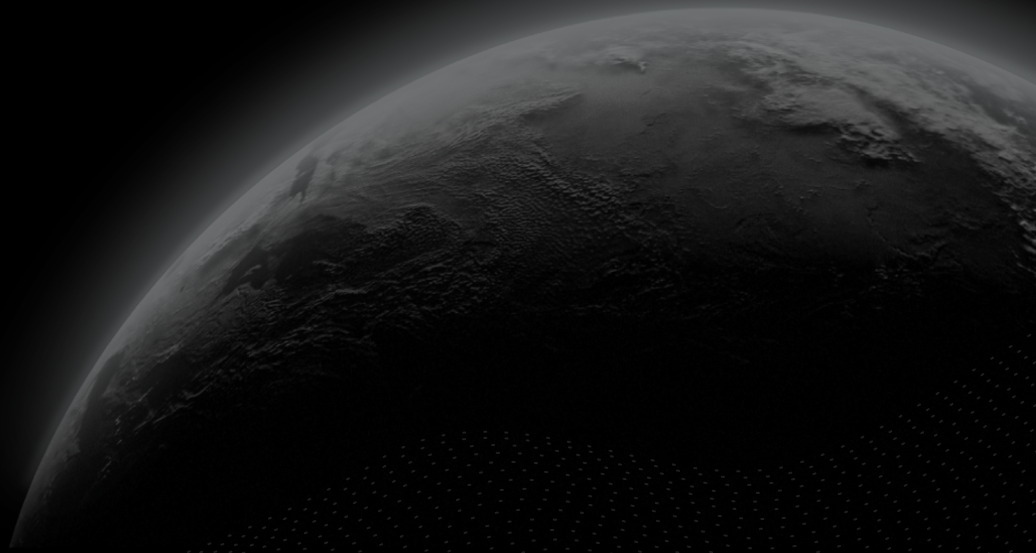




Security Assessment

# T.I.M.E. Dividend (TIME) - Polygon

CertiK Assessed on Dec 7th, 2023





CertiK Assessed on Dec 7th, 2023

## T.I.M.E. Dividend (TIME) - Polygon

The security assessment was prepared by CertiK, the leader in Web3.0 security.

### Executive Summary

TYPES DeFi	ECOSYSTEM Polygon (MATIC)	METHODS Formal Verification, Manual Review, Static Analysis
LANGUAGE Solidity	TIMELINE Delivered on 12/07/2023	KEY COMPONENTS N/A

#### CODEBASE

<https://polygonscan.com/token/0x9F42bcA1A579fC9Efc165a0244B12937e18C6A5>

[View All in Codebase Page](#)

### Vulnerability Summary



<b>0</b> Critical		Critical risks are those that impact the safe functioning of a platform and must be addressed before launch. Users should not invest in any project with outstanding critical risks.
<b>1</b> Major	1 Mitigated	Major risks can include centralization issues and logical errors. Under specific circumstances, these major risks can lead to loss of funds and/or control of the project.
<b>0</b> Medium		Medium risks may not pose a direct risk to users' funds, but they can affect the overall functioning of a platform.
<b>0</b> Minor		Minor risks can be any of the above, but on a smaller scale. They generally do not compromise the overall integrity of the project, but they may be less efficient than other solutions.
<b>0</b> Informational		Informational errors are often recommendations to improve the style of the code or certain operations to fall within industry best practices. They usually do not affect the overall functioning of the code.

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## **Disclaimer**

# CODEBASE | T.I.M.E. DIVIDEND (TIME) - POLYGON


## Repository

<https://polygonscan.com/token/0x9F42bcA1A579fCf9Efc165a0244B12937e18C6A5>

# AUDIT SCOPE | T.I.M.E. DIVIDEND (TIME) - POLYGON

1 file audited ● 1 file with Mitigated findings

---

ID	Repo	File	SHA256 Checksum
● TIM	mainnet	 contracts/TIMEDividend.sol	610663a652d489d47d40e682cd0e794827ea 6a4617b0297c9dc688bc85090d2d

## APPROACH & METHODS | T.I.M.E. DIVIDEND (TIME) - POLYGON

This report has been prepared for Internet Money to discover issues and vulnerabilities in the source code of the T.I.M.E. Dividend (TIME) - Polygon project as well as any contract dependencies that were not part of an officially recognized library. A comprehensive examination has been performed, utilizing Static Analysis, Formal Verification, and Manual Review techniques.

The auditing process pays special attention to the following considerations:

- Testing the smart contracts against both common and uncommon attack vectors.
- Assessing the codebase to ensure compliance with current best practices and industry standards.
- Ensuring contract logic meets the specifications and intentions of the client.
- Cross referencing contract structure and implementation against similar smart contracts produced by industry leaders.
- Thorough line-by-line manual review of the entire codebase by industry experts.

The security assessment resulted in findings that ranged from critical to informational. We recommend addressing these findings to ensure a high level of security standards and industry practices. We suggest recommendations that could better serve the project from the security perspective:

- Testing the smart contracts against both common and uncommon attack vectors;
- Enhance general coding practices for better structures of source codes;
- Add enough unit tests to cover the possible use cases;
- Provide more comments per each function for readability, especially contracts that are verified in public;
- Provide more transparency on privileged activities once the protocol is live.

# FINDINGS | T.I.M.E. DIVIDEND (TIME) - POLYGON



This report has been prepared to discover issues and vulnerabilities for T.I.M.E. Dividend (TIME) - Polygon . Through this audit, we have uncovered 1 issues ranging from different severity levels. Utilizing the techniques of Static Analysis, Formal Verification & Manual Review to complement rigorous manual code reviews, we discovered the following findings:

ID	Title	Category	Severity	Status
TIM-01	Initial Token Distribution	Centralization	Major	● Mitigated

## TIM-01 | INITIAL TOKEN DISTRIBUTION

Category	Severity	Location	Status
Centralization	● Major	contracts/TIMEDividend.sol: 44-49	● Mitigated

### Description

All `TIME` tokens are sent to the contract deployer when deploying the contract. This is a centralization risk because the deployer or the owner(s) of the EOAs can distribute tokens without obtaining the consensus of the community. Any compromise to the deployer account or EOAs may allow a hacker to steal and sell tokens on the market, resulting in severe damage to the project.

### Recommendation

It is recommended that the team be transparent regarding the initial token distribution process. The token distribution plan should be published in a public location that the community can access. The team should make efforts to restrict access to the private keys of the deployer account or EOAs. A multi-signature (2/3, 3/5) wallet can be used to prevent a single point of failure due to a private key compromise. Additionally, the team can lock up a portion of tokens, release them with a vesting schedule for long-term success, and deanonymize the project team with a third-party KYC provider to create greater accountability.

### Alleviation

The team has renounced the contract ownership and the breakdown of the initial token distribution is available at

Polygon: <https://polygonscan.com/token/0x9F42bcA1A579fCf9Efc165a0244B12937e18C6A5#balances>



# FORMAL VERIFICATION | T.I.M.E. DIVIDEND (TIME) - POLYGON

Formal guarantees about the behavior of smart contracts can be obtained by reasoning about properties relating to the entire contract (e.g. contract invariants) or to specific functions of the contract. Once such properties are proven to be valid, they guarantee that the contract behaves as specified by the property. As part of this audit, we applied formal verification to prove that important functions in the smart contracts adhere to their expected behaviors.

## Considered Functions And Scope

In the following, we provide a description of the properties that have been used in this audit. They are grouped according to the type of contract they apply to.

### Verification of ERC-20 Compliance

We verified properties of the public interface of those token contracts that implement the ERC-20 interface. This covers

- Functions `transfer` and `transferFrom` that are widely used for token transfers,
- functions `approve` and `allowance` that enable the owner of an account to delegate a certain subset of her tokens to another account (i.e. to grant an allowance), and
- the functions `balanceOf` and `totalSupply`, which are verified to correctly reflect the internal state of the contract.

The properties that were considered within the scope of this audit are as follows (note that overflow properties were excluded from the verification):

Property Name	Title
erc20-transferfrom-correct-amount	<code>transferFrom</code> Transfers the Correct Amount in Non-self Transfers
erc20-transferfrom-revert-to-zero	<code>transferFrom</code> Fails for Transfers To the Zero Address
erc20-approve-never-return-false	<code>approve</code> Never Returns <code>false</code>
erc20-totalsupply-correct-value	<code>totalSupply</code> Returns the Value of the Corresponding State Variable
erc20-transfer-exceed-balance	<code>transfer</code> Fails if Requested Amount Exceeds Available Balance
erc20-transferfrom-succeed-normal	<code>transferFrom</code> Succeeds on Admissible Non-self Transfers
erc20-approve-succeed-normal	<code>approve</code> Succeeds for Admissible Inputs
erc20-transfer-correct-amount	<code>transfer</code> Transfers the Correct Amount in Non-self Transfers
erc20-transfer-succeed-self	<code>transfer</code> Succeeds on Admissible Self Transfers
erc20-totalsupply-succeed-always	<code>totalSupply</code> Always Succeeds

Property Name	Title
erc20-allowance-change-state	<code>allowance</code> Does Not Change the Contract's State
erc20-transfer-never-return-false	<code>transfer</code> Never Returns <code>false</code>
erc20-transferfrom-fail-exceed-allowance	<code>transferFrom</code> Fails if the Requested Amount Exceeds the Available Allowance
erc20-approve-correct-amount	<code>approve</code> Updates the Approval Mapping Correctly
erc20-allowance-succeed-always	<code>allowance</code> Always Succeeds
erc20-balanceof-succeed-always	<code>balanceOf</code> Always Succeeds
erc20-balanceof-change-state	<code>balanceOf</code> Does Not Change the Contract's State
erc20-transferfrom-fail-exceed-balance	<code>transferFrom</code> Fails if the Requested Amount Exceeds the Available Balance
erc20-transferfrom-correct-amount-self	<code>transferFrom</code> Performs Self Transfers Correctly
erc20-approve-false	If <code>approve</code> Returns <code>false</code> , the Contract's State Is Unchanged
erc20-allowance-correct-value	<code>allowance</code> Returns Correct Value
erc20-transferfrom-never-return-false	<code>transferFrom</code> Never Returns <code>false</code>
erc20-balanceof-correct-value	<code>balanceOf</code> Returns the Correct Value
erc20-transferfrom-revert-from-zero	<code>transferFrom</code> Fails for Transfers From the Zero Address
erc20-transferfrom-false	If <code>transferFrom</code> Returns <code>false</code> , the Contract's State Is Unchanged
erc20-transfer-false	If <code>transfer</code> Returns <code>false</code> , the Contract State Is Not Changed
erc20-transfer-revert-zero	<code>transfer</code> Prevents Transfers to the Zero Address
erc20-transferfrom-succeed-self	<code>transferFrom</code> Succeeds on Admissible Self Transfers
erc20-transfer-succeed-normal	<code>transfer</code> Succeeds on Admissible Non-self Transfers
erc20-totalsupply-change-state	<code>totalSupply</code> Does Not Change the Contract's State
erc20-transfer-correct-amount-self	<code>transfer</code> Transfers the Correct Amount in Self Transfers
erc20-approve-revert-zero	<code>approve</code> Prevents Approvals For the Zero Address

Property Name	Title
erc20-transferfrom-correct-allowance	<code>transferFrom</code> Updated the Allowance Correctly

## Verification Results

In the remainder of this section, we list all contracts where formal verification of at least one property was not successful. There are several reasons why this could happen:

- False: The property is violated by the project.
- Inconclusive: The proof engine cannot prove or disprove the property due to timeouts or exceptions.
- Inapplicable: The property does not apply to the project.

### Detailed Results For Contract TIMEDividend (contracts/TIMEDividend.sol) In Commit 0x9f42bca1a579fc9efc165a0244b12937e18c6a5

#### Verification of ERC-20 Compliance

Detailed Results for Function `transferFrom`

Property Name	Final Result	Remarks
erc20-transferfrom-correct-amount	● True	
erc20-transferfrom-revert-to-zero	● True	
erc20-transferfrom-succeed-normal	● False	
erc20-transferfrom-fail-exceed-allowance	● True	
erc20-transferfrom-fail-exceed-balance	● Inconclusive	
erc20-transferfrom-correct-amount-self	● Inconclusive	
erc20-transferfrom-never-return-false	● True	
erc20-transferfrom-revert-from-zero	● True	
erc20-transferfrom-false	● True	
erc20-transferfrom-succeed-self	● False	
erc20-transferfrom-correct-allowance	● True	

Detailed Results for Function `approve`

Property Name	Final Result	Remarks
erc20-approve-never-return-false	● True	
erc20-approve-succeed-normal	● True	
erc20-approve-correct-amount	● True	
erc20-approve-false	● True	
erc20-approve-revert-zero	● True	

Detailed Results for Function `totalSupply`

Property Name	Final Result	Remarks
erc20-totalsupply-correct-value	● True	
erc20-totalsupply-succeed-always	● True	
erc20-totalsupply-change-state	● True	

Detailed Results for Function `transfer`

Property Name	Final Result	Remarks
erc20-transfer-exceed-balance	● Inconclusive	
erc20-transfer-correct-amount	● True	
erc20-transfer-succeed-self	● False	
erc20-transfer-never-return-false	● True	
erc20-transfer-false	● True	
erc20-transfer-revert-zero	● True	
erc20-transfer-succeed-normal	● False	
erc20-transfer-correct-amount-self	● Inconclusive	

Detailed Results for Function `allowance`

Property Name	Final Result	Remarks
erc20-allowance-change-state	● True	
erc20-allowance-succeed-always	● True	
erc20-allowance-correct-value	● True	

Detailed Results for Function `balanceOf`

Property Name	Final Result	Remarks
erc20-balanceof-succeed-always	● True	
erc20-balanceof-change-state	● True	
erc20-balanceof-correct-value	● True	

## APPENDIX | T.I.M.E. DIVIDEND (TIME) - POLYGON

### Finding Categories

Categories	Description
Centralization	Centralization findings detail the design choices of designating privileged roles or other centralized controls over the code.

### Checksum Calculation Method

The "Checksum" field in the "Audit Scope" section is calculated as the SHA-256 (Secure Hash Algorithm 2 with digest size of 256 bits) digest of the content of each file hosted in the listed source repository under the specified commit.

The result is hexadecimal encoded and is the same as the output of the Linux "sha256sum" command against the target file.

### Details on Formal Verification

Some Solidity smart contracts from this project have been formally verified. Each such contract was compiled into a mathematical model that reflects all its possible behaviors with respect to the property. The model takes into account the semantics of the Solidity instructions found in the contract. All verification results that we report are based on that model.

The following assumptions and simplifications apply to our model:

- Certain low-level calls and inline assembly are not supported and may lead to a contract not being formally verified.
- We model the semantics of the Solidity source code and not the semantics of the EVM bytecode in a compiled contract.

### Formalism for property specifications

All properties are expressed in a behavioral interface specification language that CertiK has developed for Solidity, which allows us to specify the behavior of each function in terms of the contract state and its parameters and return values, as well as contract properties that are maintained by every observable state transition. Observable state transitions occur when the contract's external interface is invoked and the invocation does not revert, and when the contract's Ether balance is changed by the EVM due to another contract's "self-destruct" invocation. The specification language has the usual Boolean connectives, as well as the operator `\oId` (used to denote the state of a variable before a state transition), and several types of specification clause:

Apart from the Boolean connectives and the modal operators "always" (written `[ ]`) and "eventually" (written `<>`), we use the following predicates to reason about the validity of atomic propositions. They are evaluated on the contract's state whenever a discrete time step occurs:

- `requires [cond]` - the condition `cond`, which refers to a function's parameters, return values, and contract state variables, must hold when a function is invoked in order for it to exhibit a specified behavior.
- `ensures [cond]` - the condition `cond`, which refers to a function's parameters, return values, and both `\old` and current contract state variables, is guaranteed to hold when a function returns if the corresponding requires condition held when it was invoked.
- `invariant [cond]` - the condition `cond`, which refers only to contract state variables, is guaranteed to hold at every observable contract state.
- `constraint [cond]` - the condition `cond`, which refers to both `\old` and current contract state variables, is guaranteed to hold at every observable contract state except for the initial state after construction (because there is no previous state); constraints are used to restrict how contract state can change over time.

## Description of the Analyzed ERC-20 Properties

### Properties related to function `transferFrom`

#### `erc20-transferfrom-correct-allowance`

All non-reverting invocations of `transferFrom(from, dest, amount)` that return `true` must decrease the allowance for address `msg.sender` over address `from` by the value in `amount`.

Specification:

```
ensures \result ==> allowance(\old(sender), msg.sender) == \old(allowance(sender,
msg.sender)) - \old(amount)
    || (allowance(\old(sender), msg.sender) == \old(allowance(sender,
msg.sender)) && \old(allowance(sender, msg.sender)) == type(uint256).max);
```

#### `erc20-transferfrom-correct-amount`

All invocations of `transferFrom(from, dest, amount)` that succeed and that return `true` subtract the value in `amount` from the balance of address `from` and add the same value to the balance of address `dest`.

Specification:

```
requires recipient != sender;
requires balanceOf(recipient) + amount <= type(uint256).max;
ensures \result ==> balanceOf(\old(recipient)) == \old(balanceOf(recipient) +
amount)
    && balanceOf(\old(sender)) == \old(balanceOf(sender) - amount);
```

#### `erc20-transferfrom-correct-amount-self`

All non-reverting invocations of `transferFrom(from, dest, amount)` that return `true` and where the address in `from` equals the address in `dest` (i.e. self-transfers) do not change the balance entry of the `from` address (which equals `dest`).

Specification:

```
requires recipient == sender;  
ensures \result ==> balanceOf(\old(recipient)) == \old(balanceOf(recipient));
```

#### erc20-transferfrom-fail-exceed-allowance

Any call of the form `transferFrom(from, dest, amount)` with a value for `amount` that exceeds the allowance of address `msg.sender` must fail.

Specification:

```
requires msg.sender != sender;  
requires amount > allowance(sender, msg.sender);  
ensures !\result;
```

#### erc20-transferfrom-fail-exceed-balance

Any call of the form `transferFrom(from, dest, amount)` with a value for `amount` that exceeds the balance of address `from` must fail.

Specification:

```
requires amount > balanceOf(sender);  
ensures !\result;
```

#### erc20-transferfrom-false

If `transferFrom` returns `false` to signal a failure, it must undo all incurred state changes before returning to the caller.

Specification:

```
ensures !\result ==> \assigned (\nothing);
```

#### erc20-transferfrom-never-return-false

The `transferFrom` function must never return `false`.

Specification:

```
ensures \result;
```

#### erc20-transferfrom-revert-from-zero

All calls of the form `transferFrom(from, dest, amount)` where the `from` address is zero, must fail.

Specification:



```
ensures \old(sender) == address(0) ==> !\result;
```

#### erc20-transferfrom-revert-to-zero

All calls of the form `transferFrom(from, dest, amount)` where the `dest` address is zero, must fail.

Specification:

```
ensures \old(recipient) == address(0) ==> !\result;
```

#### erc20-transferfrom-succeed-normal

All invocations of `transferFrom(from, dest, amount)` must succeed and return `true` if

- the value of `amount` does not exceed the balance of address `from`,
- the value of `amount` does not exceed the allowance of `msg.sender` for address `from`,
- transferring a value of `amount` to the address in `dest` does not lead to an overflow of the recipient's balance, and
- the supplied gas suffices to complete the call.

Specification:

```
requires recipient != address(0) && sender != address(0) && recipient != sender;  
requires amount <= balanceOf(sender);  
requires amount <= allowance(sender, msg.sender);  
requires balanceOf(recipient) + amount <= type(uint256).max;  
ensures \result;  
reverts_only_when false;
```

#### erc20-transferfrom-succeed-self

All invocations of `transferFrom(from, dest, amount)` where the `dest` address equals the `from` address (i.e. self-transfers) must succeed and return `true` if:

- The value of `amount` does not exceed the balance of address `from`,
- the value of `amount` does not exceed the allowance of `msg.sender` for address `from`, and
- the supplied gas suffices to complete the call.

Specification:

```
requires recipient != address(0) && recipient == sender;  
requires amount <= balanceOf(sender);  
requires amount <= allowance(sender, msg.sender);  
ensures \result;  
reverts_only_when false;
```

## Properties related to function `approve`

### erc20-approve-correct-amount

All non-reverting calls of the form `approve(spender, amount)` that return `true` must correctly update the allowance mapping according to the address `msg.sender` and the values of `spender` and `amount`.

Specification:

```
requires spender != address(0);
ensures \result ==> allowance(msg.sender, \old(spender)) == \old(amount);
```

### erc20-approve-false

If function `approve` returns `false` to signal a failure, it must undo all state changes that it incurred before returning to the caller.

Specification:

```
ensures !\result ==> \assigned (\nothing);
```

### erc20-approve-never-return-false

The function `approve` must never returns `false`.

Specification:

```
ensures \result;
```

### erc20-approve-revert-zero

All calls of the form `approve(spender, amount)` must fail if the address in `spender` is the zero address.

Specification:

```
ensures \old(spender) == address(0) ==> !\result;
```

### erc20-approve-succeed-normal

All calls of the form `approve(spender, amount)` must succeed, if

- the address in `spender` is not the zero address and
- the execution does not run out of gas.

Specification:

```
requires spender != address(0);
ensures \result;
reverts_only_when false;
```

### Properties related to function `totalSupply`

#### erc20-totalsupply-change-state

The `totalSupply` function in contract TIMEDividend must not change any state variables.

Specification:

```
assignable \nothing;
```

#### erc20-totalsupply-correct-value

The `totalSupply` function must return the value that is held in the corresponding state variable of contract TIMEDividend.

Specification:

```
ensures \result == totalSupply();
```

#### erc20-totalsupply-succeed-always

The function `totalSupply` must always succeeds, assuming that its execution does not run out of gas.

Specification:

```
reverts_only_when false;
```

### Properties related to function `transfer`

#### erc20-transfer-correct-amount

All non-reverting invocations of `transfer(recipient, amount)` that return `true` must subtract the value in `amount` from the balance of `msg.sender` and add the same value to the balance of the `recipient` address.

Specification:

```
requires recipient != msg.sender;
requires balanceOf(recipient) + amount <= type(uint256).max;
ensures \result ==> balanceOf(recipient) == \old(balanceOf(recipient) + amount)
&& balanceOf(msg.sender) == \old(balanceOf(msg.sender) - amount);
```

#### erc20-transfer-correct-amount-self

All non-reverting invocations of `transfer(recipient, amount)` that return `true` and where the `recipient` address equals `msg.sender` (i.e. self-transfers) must not change the balance of address `msg.sender`.

Specification:

```
requires recipient == msg.sender;  
ensures \result ==> balanceOf(msg.sender) == \old(balanceOf(msg.sender));
```

#### erc20-transfer-exceed-balance

Any transfer of an amount of tokens that exceeds the balance of `msg.sender` must fail.

Specification:

```
requires amount > balanceOf(msg.sender);  
ensures !\result;
```

#### erc20-transfer-false

If the `transfer` function in contract `TIMEDividend` fails by returning `false`, it must undo all state changes it incurred before returning to the caller.

Specification:

```
ensures !\result ==> \assigned (\nothing);
```

#### erc20-transfer-never-return-false

The transfer function must never return `false` to signal a failure.

Specification:

```
ensures \result;
```

#### erc20-transfer-revert-zero

Any call of the form `transfer(recipient, amount)` must fail if the recipient address is the zero address.

Specification:

```
ensures \old(recipient) == address(0) ==> !\result;
```

#### erc20-transfer-succeed-normal

All invocations of the form `transfer(recipient, amount)` must succeed and return `true` if

- the `recipient` address is not the zero address,

- `amount` does not exceed the balance of address `msg.sender`,
- transferring `amount` to the `recipient` address does not lead to an overflow of the recipient's balance, and
- the supplied gas suffices to complete the call.

Specification:

```
requires recipient != address(0) && recipient != msg.sender;
requires amount <= balanceOf(msg.sender);
requires balanceOf(recipient) + amount <= type(uint256).max;
ensures \result;
reverts_only_when false;
```

#### erc20-transfer-succeed-self

All self-transfers, i.e. invocations of the form `transfer(recipient, amount)` where the `recipient` address equals the address in `msg.sender` must succeed and return `true` if

- the value in `amount` does not exceed the balance of `msg.sender` and
- the supplied gas suffices to complete the call.

Specification:

```
requires recipient == msg.sender;
requires amount <= balanceOf(msg.sender);
ensures \result;
reverts_only_when false;
```

#### Properties related to function `allowance`

##### erc20-allowance-change-state

Function `allowance` must not change any of the contract's state variables.

Specification:

```
assignable \nothing;
```

##### erc20-allowance-correct-value

Invocations of `allowance(owner, spender)` must return the allowance that address `spender` has over tokens held by address `owner`.

Specification:

```
ensures \result == allowance(\old(owner), \old(spender));
```

**erc20-allowance-succeed-always**

Function `allowance` must always succeed, assuming that its execution does not run out of gas.

Specification:

```
reverts_only_when false;
```

**Properties related to function `balanceOf`****erc20-balanceof-change-state**

Function `balanceOf` must not change any of the contract's state variables.

Specification:

```
assignable \nothing;
```

**erc20-balanceof-correct-value**

Invocations of `balanceOf(owner)` must return the value that is held in the contract's balance mapping for address `owner`.

Specification:

```
ensures \result == balanceOf(\old(account));
```

**erc20-balanceof-succeed-always**

Function `balanceOf` must always succeed if it does not run out of gas.

Specification:

```
reverts_only_when false;
```

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Founded in 2017 by leading academics in the field of Computer Science from both Yale and Columbia University, CertiK is a leading blockchain security company that serves to verify the security and correctness of smart contracts and blockchain-based protocols. Through the utilization of our world-class technical expertise, alongside our proprietary, innovative tech, we're able to support the success of our clients with best-in-class security, all whilst realizing our overarching vision; provable trust for all throughout all facets of blockchain.

