



# Smart Contract Audit

FOR

# EmojiFinance

DATED : 21 MAR 23'



# AUDIT SUMMARY

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**Project name** – EmojiFinance

**Date:** 21 March, 2023

**Scope of Audit-** Audit Ace was consulted to conduct the smart contract audit of the solidity source codes.

**Audit Status:** **Passed**

## Issues Found

Status	Critical	High	Medium	Low	Suggestion
Open	1	3	2	0	2
Acknowledged	0	0	0	0	0
Resolved	0	0	0	0	0

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# USED TOOLS

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## Tools:

**1. Manual Review:** The code has undergone a line-by-line review by the Ace team.

**2. Forked KAVA:** we forked EVM co-chain of kava using hardhat, and performed all the tests in a realistic environment

**3. Slither:** The code has undergone static analysis using Slither.

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# Token Information

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Audit ace has performed an security audit of the contracts at this github

**8b66b73618cf507d5ccddc4e2a918144c139bff5:**

<https://github.com/EmojiFinance/EmojiProtocol/commits/main>

## **Commit hash:**

8b66b73618cf507d5ccddc4e2a918144c139bff5

The repository contains 3 contracts:

### **- RewardRelease.sol (sha-1:**

f2a6b5685d683114fc4c991d4ed69e7b12ba9e4b)

this contract is used to lock and release rewards of protocol stakers

### **- EquiliLpVault.sol (sha-1 :**

56cc4e8fb09fbfa2743bfa286b5ba00bfd7dbb72)

this contract is used to deposit (stake) liquidity pool shares of a curve 2 token pool, the contract generates new pool tokens from generated rewards upon each deposit or withdraw (or manually) and then restakes those tokens to maximize gains.

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# Token Information

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**KavaCurveThreePoolVault.sol** (sha-1 :

5c4a182ba9600d3659104d914591e875ecbe4cac)

this contract is same as above one, except that its compatible with curve 3 token pools and it interacts directly with pool contract in order to add liquidity and reinvest the new pool shares.

**Network:** The contracts will be live on Kovan EVM co-chain

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# AUDIT METHODOLOGY

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The auditing process will follow a routine as special considerations by Auditace:

- Review of the specifications, sources, and instructions provided to Auditace to make sure the contract logic meets the intentions of the client without exposing the user's funds to risk.
  - Manual review of the entire codebase by our experts, which is the process of reading source code line-by-line in an attempt to identify potential vulnerabilities.
  - Specification comparison is the process of checking whether the code does what the specifications, sources, and instructions provided to Auditace describe.
  - Test coverage analysis determines whether the test cases are covering the code and how much code is exercised when we run the test cases.
  - Symbolic execution is analysing a program to determine what inputs cause each part of a program to execute.
  - Reviewing the codebase to improve maintainability, security, and control based on the established industry and academic practices.
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# VULNERABILITY CHECKLIST

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- |                                    |                               |
|------------------------------------|-------------------------------|
| ✓ Return values of low-level calls | ✓ Gasless Send                |
| ✓ Private modifier                 | ✓ Using block.timestamp       |
| ✓ Multiple Sends                   | ✓ Re-entrancy                 |
| ✓ Using Suicide                    | ✓ Tautology or contradiction  |
| ✓ Gas Limitand Loops               | ✓ Timestamp Dependence        |
| ✓ Address hardcoded                | ✓ Revert/require functions    |
| ✓ Exception Disorder               | ✓ Use of tx.origin            |
| ✓ Using inline assembly            | ✓ Integer overflow/underflow  |
| ✓ Divide before multiply           | ✓ Dangerous strict equalities |
| ✓ Missing Zero Address Validation  | ✓ Using SHA3                  |
| ✓ Compiler version not fixed       | ✓ Using throw                 |
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# CLASSIFICATION OF RISK

## Severity

## Description

◆ Critical	These vulnerabilities could be exploited easily and can lead to asset loss, data loss, asset, or data manipulation. They should be fixed right away.
◆ High-Risk	A vulnerability that affects the desired outcome when using a contract, or provides the opportunity to use a contract in an unintended way.
◆ Medium-Risk	A vulnerability that could affect the desired outcome of executing the contract in a specific scenario.
◆ Low-Risk	A vulnerability that does not have a significant impact on possible scenarios for the use of the contract and is probably subjective.
◆ Gas Optimization /Suggestion	A vulnerability that has an informational character but is not affecting any of the code.

## Findings

### Severity

### Found

◆ Critical	1
◆ High-Risk	3
◆ Medium-Risk	2
◆ Low-Risk	0
◆ Gas Optimization / Suggestions	2





# INHERITANCE TREE

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Current contracts are not implementing or inheriting other contracts



# CONTRACT ASSESMENT

Contract	Type	Bases			
└─	**Function Name**	**Visibility**	**Mutability**	**Modifiers**	
**EquiLpVault**   Implementation					
└─	<Constructor>	Public !	●	NO !	
└─	setOperator	Public !	●	onlyOperator	
└─	setFeeReceiver	Public !	●	onlyOperator	
└─	setFee	Public !	●	onlyOperator	
└─	setClaimTokens	Public !	●	onlyOperator	
└─	setPaths	Public !	●	onlyOperator	
└─	_setPaths	Internal 🔒	●		
└─	setRewardRate	Public !	●	onlyOperator	
└─	_updateReward	Internal 🔒	●		
└─	deposit	Public !	●	NO !	
└─	withdraw	Public !	●	NO !	
└─	withdrawAll	Public !	●	NO !	
└─	getBalance	Public !		NO !	
└─	pendingReward	Public !		NO !	
└─	claimReward	Public !	●	NO !	
└─	reinvest	Public !	●	NO !	
**IERC20**   Interface					
└─	totalSupply	External !		NO !	
└─	balanceOf	External !		NO !	
└─	transfer	External !	●	NO !	
└─	allowance	External !		NO !	
└─	approve	External !	●	NO !	
└─	transferFrom	External !	●	NO !	
**SafeERC20**   Library					
└─	safeTransfer	Internal 🔒	●		
└─	safeTransferFrom	Internal 🔒	●		
└─	safeApprove	Internal 🔒	●		
└─	safeIncreaseAllowance	Internal 🔒	●		
└─	safeDecreaseAllowance	Internal 🔒	●		
└─	safePermit	Internal 🔒	●		
└─	_callOptionalReturn	Private 🔒	●		
**IERC20Permit**   Interface					
└─	permit	External !	●	NO !	
└─	nonces	External !		NO !	

# CONTRACT ASSESMENT

```

|  | DOMAIN_SEPARATOR | External  !  | | NO  !  |
|||||
| **Address** | Library | |||
|  | isContract | Internal  |  |  |
|  | sendValue | Internal  |  |  |
|  | functionCall | Internal  |  |  |
|  | functionCall | Internal  |  |  |
|  | functionCallWithValue | Internal  |  |  |
|  | functionCallWithValue | Internal  |  |  |
|  | functionStaticCall | Internal  |  |  |
|  | functionStaticCall | Internal  |  |  |
|  | functionDelegateCall | Internal  |  |  |
|  | functionDelegateCall | Internal  |  |  |
|  | verifyCallResult | Internal  |  |  |
|||||
| **IEquillRouter** | Interface | |||
|  | pairFor | External  !  | | NO  !  |
|  | addLiquidity | External  !  |  | NO  !  |
|  | addLiquidityETH | External  !  |  | NO  !  |
|  | swapExactTokensForTokensSimple | External  !  |  | NO  !  |
|  | swapExactTokensForTokens | External  !  |  | NO  !  |
|  | swapExactETHForTokens | External  !  |  | NO  !  |
|  | swapExactTokensForETH | External  !  |  | NO  !  |
|||||
| **IEquiliPair** | Interface | |||
|  | token0 | External  !  | | NO  !  |
|  | token1 | External  !  | | NO  !  |
|  | stable | External  !  | | NO  !  |
|||||
| **IEquiliGauge** | Interface | |||
|  | deposit | External  !  |  | NO  !  |
|  | withdraw | External  !  |  | NO  !  |
|  | balanceOf | External  !  |  | NO  !  |
|  | getReward | External  !  |  | NO  !  |
|||||
| **IRewardRelease** | Interface | |||
|  | release | External  !  |  | NO  !  |
|||||
| **RewardRelease** | Implementation | |||
|  | <Constructor> | Public  !  |  | NO  !  |
|  | setOperator | Public  !  |  | onlyOperator |
|  | setVault | Public  !  |  | onlyOperator |

```



# CONTRACT ASSESMENT

```
|  | release | External  !  | ● |NO  !  |
|  | getTotalReward | Public  !  | ● |NO  !  |
|  | getClaimable | Public  !  | ● |NO  !  |
|  | claim | External  !  | ● |NO  !  |
|||||
| **KavaCurveThreePoolVault** | Implementation | |||
|  | <Constructor> | Public  !  | ● |NO  !  |
|  | setOperator | Public  !  | ● |onlyOperator |
|  | setFeeReceiver | Public  !  | ● |onlyOperator |
|  | setFee | Public  !  | ● |onlyOperator |
|  | setRewardRate | Public  !  | ● |onlyOperator |
|  | _updateReward | Internal  !  | ● |
|  | deposit | Public  !  | ● |NO  !  |
|  | withdraw | Public  !  | ● |NO  !  |
|  | withdrawAll | Public  !  | ● |NO  !  |
|  | getBalance | Public  !  | ● |NO  !  |
|  | pendingReward | Public  !  | ● |NO  !  |
|  | claimReward | Public  !  | ● |NO  !  |
|  | reinvest | Public  !  | ● |NO  !  |
|||||
| **ICurvePool** | Interface | |||
|  | add_liquidity | External  !  | ● |NO  !  |
|||||
| **ICurveGauge** | Interface | |||
|  | balanceOf | External  !  | ● |NO  !  |
|  | claimable_reward | External  !  | ● |NO  !  |
|  | claim_rewards | External  !  | ● |NO  !  |
|  | deposit | External  !  | ● |NO  !  |
|  | withdraw | External  !  | ● |NO  !  |
|  | reward_contract | External  !  | ● |NO  !  |
```

## Legend

| Symbol | Meaning |

| :-----:|-----|

| ● | Function can modify state |






| 💰 | Function is payable |



# FUNCTIONAL TESTING

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below tests have been done, the test files (in hardhat) were given to the EmojiFinance team:

- Deployment 
  - Depositing LP tokens 
  - Calculation of rewards based on reward rate and shares 
  - Correct Lock period (2 days) and release of rewards 
  - Reinvests mechanism of both 3 and 2 token pool contracts 
  - Correct calculation of each depositor reward (**failed**)
  - Withdraw and withdrawAll (**failed**)
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# MANUAL TESTING

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## Logical – Invalid calculation of rewardDebt

**Severity:** Critical

**Function:** Deposit

**Type:** Logical

**Line:** 164-166

**Overview:**

user.rewardDebt is divided by 1e12 instead of 10e12, this would disable claims and withdrawals because pending will be almost 1/10 of rewardDebt. This issue can be seen all over the codebase

```
user.pending += accRewardPerShare * user.amount / 10e12 - user.rewardDebt;  
user.amount += shareAmount;  
user.rewardDebt = user.amount * accRewardPerShare / 1e12;
```

**Recommendation:**

carefully replace all the 1e12 with 10e12

# MANUAL TESTING

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## Logical – rewardDebt is not calculated correctly upon deposit

Severity: **High**

Function: Deposit

Type: Logical

Line: 164-166

### Overview:

The current implementation of the deposit function updates the user's pending rewards (user.pending) after the user's total deposited amount has been updated. This causes an inconsistency in the calculation of rewardDebt, which represents the user's share of rewards that have already been accounted for. As a result, rewardDebt can be greater than the actual pending rewards, leading to incorrect reward payouts.

```
user.pending += accRewardPerShare * user.amount / 10e12 - user.rewardDebt;  
user.amount += shareAmount;  
user.rewardDebt = user.amount * accRewardPerShare / 1e12;
```

### Recommendation:

To address this issue, we recommend updating the user's rewardDebt and user.pending variables only after the user.amount has been updated. This will ensure that the rewardDebt and pending rewards calculations accurately reflect the user's actual deposited amount and share of rewards.

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# MANUAL TESTING

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## Logical – Access control

**Severity:** High

**Function:** withdraw

**Type:** Logical

**Line:** 188

**Overview:**

In the present version of the contract, there exists only one operator who has the authority to alter key components in the contract. This operator plays a crucial role and any incorrect modification by this operator can result in the failure of the entire system. For instance, removing the staking contract from valid vaults in the reward contract would disable claims. Similarly, setting up malicious claim tokens and paths can lead to transaction failure during deposit or withdrawal.

**Recommendation:**

It is recommended to implement a multi-operator scheme to ensure that no single operator has complete control over the contract. This will decrease the risk of the system failure in case of incorrect modifications by the operator. Additionally, the access control system should be reviewed and enhanced to restrict the operator's capabilities to only necessary functions. Regular audits and testing of the contract should also be conducted to identify and rectify any potential vulnerabilities.

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# MANUAL TESTING

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## **Logical** – Lack of escape hatch mechanism (emergency withdraw)

**Severity:** High

**Function:** withdraw

**Type:** Logical

**Line:** 188

### **Overview:**

An escape hatch mechanism refers to a feature in a software system or a smart contract that allows an authorized entity to override or bypass certain functionalities or restrictions in the system. Essentially, it is a safety mechanism that can be used in an emergency or exceptional circumstances to regain control of the system or to prevent a catastrophic failure. The current version of the contract does not include any emergency withdraw functionality that would enable wallets to bypass or skip regular functionalities of the contract in case of an emergency event or issue.

### **Recommendation:**

It is strongly recommended to implement an emergency withdraw mechanism in the contract to mitigate the risk of potential catastrophic failure.

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# MANUAL TESTING

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## Logical – Possible revert on zero token transfer

**Severity:** Medium

**Function:** withdraw

**Type:** Logical

**Line:** 188

**Overview:**

At withdraw function, even if withdrawFeeRatio fee amount (0) is sent to feeReceiver, some pools may not allow this kind of transfer in their \_transfer function as we see in some implementations of openzeppelin ERC20 contracts where 0 token transfers are not allowed

**Recommendation:**

check if fee amount is greater than zero or not

# MANUAL TESTING

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## Logical – pendingReward is not calculating rewards correctly

**Severity:** Medium

**Function:** Deposit

**Type:** Logical

**Line:** 241-247

### Overview:

pendingReward function is used to calculate realtime rewards of a staker, however the 10e12 factor is not considered here, which means that if user.amount is not equal to total shares only user.pending will be returned.

Also this function is not considering rewardDebt, which is the paid rewards.

```
function pendingReward(address _user) public view returns (uint256) {
    if (totalShareAmount == 0) {
        return 0;
    }
    UserInfo memory user = userInfo[_user];
    return
        user.pending +
        (user.amount *
         curRewardRate *
         (block.timestamp - lastRewardUpdateTs)) /
        totalShareAmount;
}
```

### Recommendation:

Consider multiplying the numerator by the 10e12 factor in order to avoid 0 results.

Subtract rewardDebt from the current rewards

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# MANUAL TESTING

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## Informational – User rewards are not paid upon withdraw or deposit

**Severity:** Informational

**Function:** Deposit

**Type:** Logical

**Line:** 143-171

**Overview:**

The current implementation of the deposit function does not distribute pending rewards to the user when a new deposit is made. Instead, the pending rewards are treated as part of the rewardDebt, which is considered already paid to the user. This approach may lead to inconsistencies in reward payouts and a less intuitive user experience.

**Recommendation:**

To resolve this issue, we recommend distributing the user's pending rewards upon deposit or withdrawal. This can be achieved by adding a reward distribution function call within the deposit function, such as `claimReward()` or a similar function, before updating the user's rewardDebt and pending variables. This will ensure that the user's pending rewards are distributed correctly and provide a more intuitive experience.

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# MANUAL TESTING

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## Informational – double use of approve function

**Severity:** Low (redundant gas)

**Function:** Deposit

**Type:** Informative

**Line:** ---

**Overview:**

Within the context of the contract, the approve function is being called twice. The first time is to approve a zero value, and the second time is to approve the desired amount. However, this is unnecessary because the approval of the spender changes to the new amount after the first approval:

```
function approve(address _spender, uint256 _value) public returns (bool)  
{  
    allowance[msg.sender][_spender] = _value;  
    emit Approval(msg.sender, _spender, _value);  
    return true;  
}
```

**Recommendation:**

Use the approve function once, unless the target approve function (such as the approve function of LP tokens) has a different implementation that requires two separate approvals.

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