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Smart Contract Audit Report

Security status

Safe

★ ★ ★ ★ ★

Principal tester: **KnownSec blockchain security research team**

版本说明

Revised	Time	Revised by	Version
Written document	20201027	KnownSec blockchain security research team	V1.0

文档信息

Document name	Document version	Document number	Confidentiality level
farmland **Smart Contract Audit Report**	V1.0	FARM-ZNHY-20201027	**Open project Team**

The statement

KnownSec only issues this report on the facts that have occurred or exist before the issuance of this report, and shall assume the corresponding responsibility therefor.KnownSec is not in a position to judge the security status of its smart contract and does not assume responsibility for the facts that occur or exist after issuance.The security audit analysis and other contents of this report are based solely on the documents and information provided by the information provider to KnownSec as of the issuance of this report.KnownSec assumes that the information provided was not missing, altered, truncated or suppressed.If the information provided is missing, altered, deleted, concealed or reflected in a way inconsistent with the actual situation, KnownSec shall not be liable for any loss or adverse effect caused thereby.

Directory

1. Review

The effective test time of this report is from October 23, 2020 to October 27, 2020. During this period, the security and standardization of farmland smart contract code will be audited and used as the statistical basis for the report.

In this test, Knownsec conducted a comprehensive analysis of the common vulnerabilities of smart contracts (see Chapter 3), and the comprehensive evaluation was passed.

The results of this smart contract security audit: Pass.

Since this test is conducted in a non-production environment, all codes are updated, the test process is communicated with the relevant interface personnel, and relevant test operations are carried out under the control of operational risks, so as to avoid production and operation risks and code security risks in the test process.

The target information of this test:

entry	description
Token name	farmland（farm）
Code type	代币代码、DeFi 协议代码、以太坊智能合约代码
Code language	solidity

Contract Documents and Hash:

The contract documents	MD5
Controller.sol	c8e8acacf2ac4cc0b87828bd29699bdb
Migrations.sol	ca8d6ca8a6edf34f149a5095a8b074c9
StrategyDForceDAI.sol	ff36c68f3bd61573495eb4226e439863
VaultDai.sol	3fb87c174f9e0e85771c484683bae7d0
Farmland.sol	17dd5d2a1eeb569a7ce6ad3473324bb1

RewardsRenbtc.sol	6c19a375aa98af5e5903911f0f0c079f
StrategyCRV.sol	439be44d1dc7b053667b0cd07aa0fdf7
VaultRenbtc.sol	775ac820e9bab777c19d649cad7eaa68
StrategyFortubeUsdc.sol	52cea8816fff13555a9974e609ebc1ba
VaultUsdc.sol	2c14fadef90bfe3138c68651e1574d01
StrategyFortube.sol	a0bfc51fce41d6fc1be1cf0050d82509
VaultUsdt.sol	505684a20a4d844657345fadbcf2ad7a

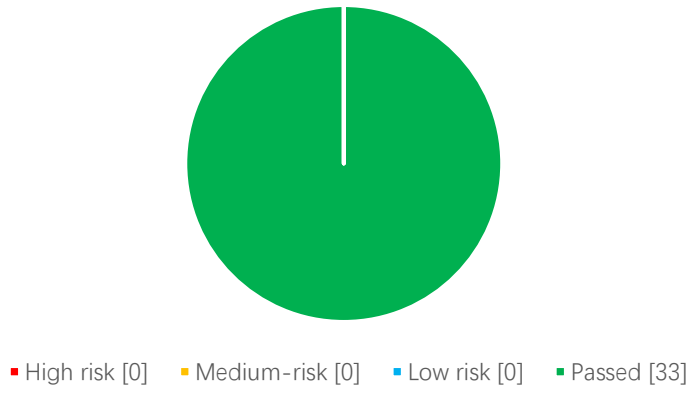
2. Code vulnerability analysis

2.1 Vulnerability level distribution

This vulnerability risk is calculated by level:

Statistics on the number of security risk levels			
High Risk	Medium Risk	Low Risk	Pass
0	0	0	33

Risk level distribution map



2.2 Summary of audit results

Audit results			
Audit item	Audit content	status	description
Business security testing	Controller contract variables and constructor	pass	After testing, there are no safety issues.
	Controller contract yearn function	pass	After testing, there are no safety issues.
	Vault contract deposit function	pass	After testing, there are no safety issues.
	Vault contract withdraw function	pass	After testing, there are no safety issues.
	Strategy contract harvest function	pass	After testing, there are no safety issues.
	Strategy contract withdraw function	pass	After testing, there are no safety issues.
Basic code vulnerability detection	Compiler version security	pass	After testing, there are no safety issues.
	Redundant code	pass	After testing, there are no safety issues.
	Use of safe arithmetic library	pass	After testing, there are no safety issues.
	Not recommended encoding	pass	After testing, there are no safety issues.
	Reasonable use of require/assert	pass	After testing, there are no safety issues.

	fallback function safety	pass	After testing, there are no safety issues.
	tx.orgin authentication	pass	After testing, there are no safety issues.
	Owner permission control	pass	After testing, there are no safety issues.
	Gas consumption detection	pass	After testing, there are no safety issues.
	call injection attack	pass	After testing, there are no safety issues.
	Low-level function safety	pass	After testing, there are no safety issues.
	Vulnerability of additional token issuance	pass	After testing, there are no safety issues.
	Access control defect detection	pass	After testing, there are no safety issues.
	Numerical overflow detection	pass	After testing, there are no safety issues.
	Arithmetic accuracy error	pass	After testing, there are no safety issues.
	Wrong use of random number detection	pass	After testing, there are no safety issues.
	Unsafe interface use	pass	After testing, there are no safety issues.
	Variable coverage	pass	After testing, there are no safety issues.
	Uninitialized storage pointer	pass	After testing, there are no safety issues.

	Return value call verification	pass	After testing, there are no safety issues.
	Transaction order dependency detection	pass	After testing, there are no safety issues.
	Timestamp dependent attack	pass	After testing, there are no safety issues.
	Denial of service attack detection	pass	After testing, there are no safety issues.
	Fake recharge vulnerability detection	pass	After testing, there are no safety issues.
	Reentry attack detection	pass	After testing, there are no safety issues.
	Replay attack detection	pass	After testing, there are no safety issues.
	Rearrangement attack detection	pass	After testing, there are no safety issues.

3. Business Security Testing

3.1. Controller contract variables and constructor[Pass]

Audit analysis: The controller.sol contract variable definition and constructor are designed reasonably.

```
contract Controller {
    using SafeERC20 for IERC20;
    using Address for address;
    using SafeMath for uint256;

    address public governance;//knownsec// 治理地址
    address public onesplit;//knownsec// onesplit 交易所地址
    address public rewards;//knownsec// 奖励提取地址
    address public factory;//knownsec// 工厂合约地址
    mapping(address => address) public vaults;//knownsec// 各代币金库合约地址映射
    mapping(address => address) public strategies;//knownsec// 各代币策略合约地址映射
    mapping(address => mapping(address => address)) public converters;//knownsec// 转换器

    uint public split = 5000;//knownsec// 奖励抽成 split/max 50%
    uint public constant max = 10000;


    event NewVault(address indexed _token, address indexed _vault);


    constructor() public {
        governance = tx.origin;
        onesplit = address(0x50FDA034C0Ce7a8f7EFDAebDA7Aa7cA21CC1267e);
        rewards = 0x0EbcA310383A3f67784e7A573dD9499513e36a94;
    }
}
```

Safety advice: None.

3.2. Controller contract yearn function [Pass]

Audit analysis: The yearn function of the Controller.sol contract of the controller is to collect the specified tokens of the specified strategy, draw the rewards from the income and then invest the rest in the strategy to earn interest.

```
function yearn(address _strategy, address _token, uint parts) public {
    // This contract should never have value in it, but just incase since this is a public call
    uint _before = IERC20(_token).balanceOf(address(this));//knownsec// 提取指定策略代币前的余额
    Strategy(_strategy).withdraw(_token);//knownsec// 将策略合约的所有 token 提取至本合约
    uint _after =  IERC20(_token).balanceOf(address(this));//knownsec// 提取指定策略代币后的余额
    if (_after > _before) {
        uint _amount = _after.sub(_before);//knownsec// 提取先后的差额
        address _want = Strategy(_strategy).want();
        uint[] memory _distribution;
        uint _expected;
        _before = IERC20(_want).balanceOf(address(this));
        IERC20(_token).safeApprove(onesplit, 0);
        IERC20(_token).safeApprove(onesplit, _amount);//knownsec// 授权 onesplit 差值额度
        (_expected, _distribution) = OneSplitAudit(onesplit).getExpectedReturn(_token, _want, _amount, parts, 0);
        OneSplitAudit(onesplit).swap(_token, _want, _amount, _expected, _distribution, 0);
        _after = IERC20(_want).balanceOf(address(this));
        if (_after > _before) {
            _amount = _after.sub(_before);//knownsec// 实际提取额
            uint _reward = _amount.mul(split).div(max);//knownsec// 奖励 = 实际差值 * split / max
            earn(_want, _amount.sub(_reward));
```

```
                IERC20(_want).safeTransfer(rewards, _reward);
            }
        }
    }
```

Safety advice: None.

3.3. Vault contract deposit function [Pass]

Audit analysis: Take VaultDai.sol as an example, the despoit function is used to deposit specified tokens to obtain the corresponding liquidity interest-generating token farm to obtain income interest.

```
function deposit(uint _amount) public {//knownsec// 存入 DAI
        uint _pool = balance();
        uint _before = token.balanceOf(address(this));
        token.safeTransferFrom(msg.sender, address(this), _amount);
        uint _after = token.balanceOf(address(this));
        _amount = _after.sub(_before); // Additional check for deflationary tokens
        uint shares = 0;
        if (totalSupply() == 0) {
            shares = _amount;
        } else {
            shares = (_amount.mul(totalSupply())).div(_pool);//knownsec// 相应 farm 量
        }
        _mint(msg.sender, shares);//knownsec// 存款者获取 shares 量的 farm 代币
        userList.pushAddress(msg.sender);
        if (token.balanceOf(address(this))>earnLowerlimit){//knownsec// 超过设定线自动 earn
            earn();
        }
    }
```

Safety advice: None.

3.4. Vault contract withdraw function [Pass]

Audit analysis: Take VaultDai.sol as an example, the withdraw function is used to withdraw the liquidity income in the strategy contract.

```
function withdraw(uint _shares) public {//knownsec// 提现为DAI
    uint r = (balance().mul(_shares)).div(totalSupply());
    _burn(msg.sender, _shares);

    // Check balance
    uint b = token.balanceOf(address(this));
    if (b < r) {
        uint _withdraw = r.sub(b);//knownsec// 理论差值
        Controller(controller).withdraw(address(token), _withdraw);//knownsec// 从控制器转入理论差值的DAI
        uint _after = token.balanceOf(address(this));
        uint _diff = _after.sub(b);//knownsec// 转入本合约前后的DAI量差值,即控制器实际转入DAI量
        if (_diff < _withdraw) {//knownsec// 若实际差值 < 理论差值
            r = b.add(_diff);//knownsec// 则实际提现量 = 转入前本合约DAI量 + 实际差值
        }
    }

    uint _max = balanceOf(msg.sender);
    if (_shares == _max) {//knownsec// 若提取完则移除用户
        userList.removeAddress(msg.sender);
    }
    token.safeTransfer(msg.sender, r);//knownsec// 转出
}
```

Safety advice: None.

3.5. Strategy contract harvest function [Pass]

Audit analysis: Take StrategyDForceDAI.sol as an example, the harvest function is used to charge interest and distribute dividends and recurring interest for the specified strategy.

```
function harvest() public {
        _checkHarvest();//knownsec//  校验时间
        require(!Address.isContract(msg.sender),"!contract");
        dRewards(pool).getReward();//knownsec//  收取利息

        doswap();
        dosplit();
        // deposit();
}

function doswap() internal {//knownsec//  将收益 DF 换为 DAI
        uint256 _2token = IERC20(output).balanceOf(address(this));
        UniswapRouter(unirouter).swapExactTokensForTokens(_2token,    0,    swap2TokenRouting,
address(this), now.add(1800));
}
function dosplit() internal{
        uint b = IERC20(want).balanceOf(address(this)).mul(10).div(100);
        uint _fee = b.mul(fee).div(max);
        uint _callfee = b.mul(callfee).div(max);
        IERC20(want).safeTransfer(Controller(controller).rewards(), _fee); //6%    team
        IERC20(want).safeTransfer(msg.sender, _callfee); //call fee 1%

        // other => sent to all users
        address _vault = Controller(controller).vaults(address(want));
        uint other = IERC20(want).balanceOf(address(this));
        address[] memory users = Vault(_vault).getUsers();
```

```
    for(uint i=0;i < users.length;i++) {//knownsec//  将剩余 DAI 按比例分红给金库所有用户
        address _user = users[i];
        uint reward = other.mul(
            Vault(_vault).balanceOf(_user)
        ).div(
            Vault(_vault).totalSupply()
        );
        if (reward > 0) {
            IERC20(want).safeTransfer(_user, reward);
        }
    }
}
```

Safety advice: None.

3.6. Strategy contract withdraw function [Pass]

Audit analysis: Taking StrategyDForceDAI.sol as an example, the withdraw function is used to withdraw liquidity tokens to the vault contract.

```
function withdraw(uint _amount) external {
    require(msg.sender == controller, "!controller");
    uint _balance = IERC20(want).balanceOf(address(this));
    if (_balance < _amount) {//knownsec//  若本合约余额不足提现,则从 DAI/dDAI 赎回差额的 DAI
        _amount = _withdrawSome(_amount.sub(_balance));
        _amount = _amount.add(_balance);
    }

    uint _fee = 0;
    if (withdrawalFee>0){//knownsec//  若有提现费,收取 withdrawalFee/withdrawalMax
        _fee = _amount.mul(withdrawalFee).div(withdrawalMax);
        IERC20(want).safeTransfer(Controller(controller).rewards(), _fee);
```

```
    }


    address _vault = Controller(controller).vaults(address(want));
    require(_vault != address(0), "!vault"); // additional protection so we don't burn the funds
    IERC20(want).safeTransfer(_vault, _amount.sub(_fee));
}
function _withdrawSome(uint256 _amount) internal returns (uint) {
    uint _d = _amount.mul(1e18).div(dERC20(d).getExchangeRate());
    uint _before = IERC20(d).balanceOf(address(this));
    dRewards(pool).withdraw(_d);//knownsec//  赎回 dDAI
    uint _after = IERC20(d).balanceOf(address(this));
    uint _withdrew = _after.sub(_before);
    _before = IERC20(want).balanceOf(address(this));
    dERC20(d).redeem(address(this), _withdrew);//knownsec//  赎回 DAI
    _after = IERC20(want).balanceOf(address(this));
    _withdrew = _after.sub(_before);
    return _withdrew;
}
```

Safety advice: None.

4. Basic code vulnerability detection

4.1. Compiler version security [Pass]

Check whether a safe compiler version is used in the contract code implementation.

Test result: After testing, the compiler version 0.6.2 is formulated in the smart contract code, and there is no such security issue.

Safety advice: None.

4.2. Redundant code [Pass]

Check whether the contract code implementation contains redundant code.

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.3. Use of safe arithmetic library [Pass]

Check whether the SafeMath safe arithmetic library is used in the contract code implementation

Test result: After testing, the SafeMath safe arithmetic library has been used in the smart contract code, and there is no such security problem.

Safety advice: None.

4.4. Not recommended encoding [Pass]

Check whether there is an encoding method that is not officially recommended or

abandoned in the contract code implementation

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.5. Reasonable use of require/assert [Pass]

Check the rationality of the use of require and assert statements in the contract code implementation

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.6. fallback function safety [Pass]

Check whether the fallback function is used correctly in the contract code implementation

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.7. tx.orgin authentication [Pass]

tx.origin is a global variable of Solidity that traverses the entire call stack and returns the address of the account that originally sent the call (or transaction). Using

this variable for authentication in a smart contract makes the contract vulnerable to attacks like phishing.

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.8. Owner permission control [Pass]

Check whether the owner in the contract code implementation has excessive authority. For example, arbitrarily modify other account balances, etc.

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.9. Gas consumption detection [Pass]

Check whether the consumption of gas exceeds the maximum block limit

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.10. call injection attack [Pass]

When the call function is called, strict permission control should be done, or the function called by the call should be written dead.

Detection result: After detection, the smart contract does not use the call function, and this vulnerability does not exist.

Safety advice: None.

4.11. Low-level function safety [Pass]

Check whether there are security vulnerabilities in the use of low-level functions (call/delegatecall) in the contract code implementation

The execution context of the call function is in the called contract; the execution context of the delegatecall function is in the contract that currently calls the function

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.12. Vulnerability of additional token issuance [Pass]

Check whether there is a function that may increase the total amount of tokens in the token contract after initializing the total amount of tokens.

Test result: After testing, the smart contract code has the function of issuing additional tokens, but because liquid mining requires additional tokens, it is approved.

Safety advice: None.

4.13. Access control defect detection [Pass]

Different functions in the contract should set reasonable permissions

Check whether each function in the contract correctly uses keywords such as public and private for visibility modification, check whether the contract is correctly defined and use modifier to restrict access to key functions to avoid problems caused by unauthorized access.

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.14. Numerical overflow detection [Pass]

The arithmetic problems in smart contracts refer to integer overflow and integer underflow.

Solidity can handle up to 256-bit numbers (2^256-1). If the maximum number increases by 1, it will overflow to 0. Similarly, when the number is an unsigned type, 0 minus 1 will underflow to get the maximum digital value.

Integer overflow and underflow are not a new type of vulnerability, but they are especially dangerous in smart contracts. Overflow conditions can lead to incorrect results, especially if the possibility is not expected, which may affect the reliability and safety of the program.

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.15. Arithmetic accuracy error [Pass]

As a programming language, Solidity has data structure design similar to ordinary programming languages, such as variables, constants, functions, arrays, functions, structures, etc. There is also a big difference between Solidity and ordinary programming languages-Solidity does not float Point type, and all the numerical calculation results of Solidity will only be integers, there will be no decimals, and it is not allowed to define decimal type data. Numerical calculations in the contract are indispensable, and the design of numerical calculations may cause relative errors. For example, the same level of calculations: 5/2*10=20, and 5*10/2=25, resulting in errors, which are larger in data The error will be larger and more obvious.

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.16. Wrong use of random number detection [Pass]

Smart contracts may need to use random numbers. Although the functions and variables provided by Solidity can access values that are obviously unpredictable, such as block.number and block.timestamp, they are usually more public than they appear or are affected by miners. These random numbers are predictable to a certain extent, so malicious users can usually copy it and rely on its unpredictability to attack the function.

Test result: After testing, the security problem does not exist in the smart contract

code.

Safety advice: None.

4.17. Unsafe interface use [Pass]

Check whether unsafe interfaces are used in the contract code implementation

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.18. Variable coverage [Pass]

Check whether there are security issues caused by variable coverage in the contract code implementation

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.19. Uninitialized storage pointer [Pass]

In solidity, a special data structure is allowed to be a struct structure, and the local variables in the function are stored in storage or memory by default.

The existence of storage (memory) and memory (memory) are two different concepts. Solidity allows pointers to point to an uninitialized reference, while uninitialized local storage will cause variables to point to other storage variables,

leading to variable coverage, or even more serious As a consequence, you should avoid initializing struct variables in functions during development.

Test result: After testing, the smart contract code does not use structure, and there is no such problem.

Safety advice: None.

4.20. Return value call verification [Pass]

This problem mostly occurs in smart contracts related to currency transfer, so it is also called silent failed delivery or unchecked delivery.

There are transfer(), send(), call.value() and other currency transfer methods in Solidity, which can all be used to send Ether to an address. The difference is: When the transfer fails, it will be thrown and the state will be rolled back; Only 2300gas will be passed for calling to prevent reentry attacks; false will be returned when send fails; only 2300gas will be passed for calling to prevent reentry attacks; false will be returned when call.value fails to be sent; all available gas will be passed for calling (can be By passing in the gas_value parameter to limit), it cannot effectively prevent reentry attacks.

If the return value of the above send and call.value transfer functions is not checked in the code, the contract will continue to execute the following code, which may lead to unexpected results due to Ether sending failure.

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.21. Transaction order dependency detection [Pass]

Since miners always get gas fees through codes that represent externally owned addresses (EOA), users can specify higher fees for faster transactions. Since the Ethereum blockchain is public, everyone can see the content of other people's pending transactions. This means that if a user submits a valuable solution, a malicious user can steal the solution and copy its transaction at a higher fee to preempt the original solution.

Test result: After testing, the security issue does not exist in the smart contract code.

```
function deposit() public {//knownsec//  流动性挖矿
        uint _want = IERC20(want).balanceOf(address(this));
        address _controller = For(fortube).controller();
        if (_want > 0) {
            //knownsec//  由于HBTC 合约不能设置授权额为0
            // IERC20(want).safeApprove(_controller, 0);
            IERC20(want).safeApprove(_controller, _want);
            For(fortube).deposit(want, _want);
        }
    }
```

Safety advice: None.

4.22. Timestamp dependent attack [Pass]

The timestamp of the data block usually uses the local time of the miner, and this time can fluctuate in the range of about 900 seconds. When other nodes accept a new block, it is only necessary to verify whether the timestamp is later than the previous block and The error with local time is within 900 seconds. A miner can profit from it

by setting the timestamp of the block to satisfy the conditions that are beneficial to him as much as possible.

Check whether there are key functions that depend on the timestamp in the contract code implementation

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.23. Denial of service attack detection [Pass]

In the world of Ethereum, denial of service is fatal, and a smart contract that has suffered this type of attack may never be able to return to its normal working state. There may be many reasons for the denial of service of the smart contract, including malicious behavior as the transaction recipient, artificially increasing the gas required for computing functions to cause gas exhaustion, abusing access control to access the private component of the smart contract, using confusion and negligence, etc. Wait.

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.24. Fake recharge vulnerability detection [Pass]

The transfer function of the token contract uses the if judgment method to check the balance of the transfer initiator (msg.sender). When balances[msg.sender] <value,

it enters the else logic part and returns false, and finally no exception is thrown. We believe that only if/else this kind of gentle judgment method is an imprecise coding method in the scene of sensitive functions such as transfer.

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.25. Reentry attack detection [Pass]

Re-entry vulnerability is the most famous Ethereum smart contract vulnerability, which once led to the fork of Ethereum (The DAO hack).

The call.value() function in Solidity consumes all the gas it receives when it is used to send Ether. When the call.value() function is called to send Ether before it actually reduces the balance of the sender's account, There is a risk of reentry attacks.

Test result: After testing, the security problem does not exist in the smart contract code.

Safety advice: None.

4.26. Replay attack detection [Pass]

If the contract involves the need for entrusted management, attention should be paid to the non-reusability of verification to avoid replay attacks

In the asset management system, there are often cases of entrusted management. The principal assigns assets to the trustee for management, and the principal pays a

certain fee to the trustee. This business scenario is also common in smart contracts. .

Detection result: After detection, the smart contract does not use the call function, and this vulnerability does not exist.

Safety advice: None.

4.27. Rearrangement attack detection [Pass]

A rearrangement attack refers to a miner or other party trying to "compete" with smart contract participants by inserting their own information into a list or mapping, so that the attacker has the opportunity to store their own information in the contract. in.

Test result: After testing, there are no related vulnerabilities in the smart contract code.

Safety advice: None.

5. Appendix A: Contract code

Source code for this test:

Controller.sol

```
pragma solidity ^0.5.16;

interface IERC20 {
    function totalSupply() external view returns (uint256);
    function balanceOf(address account) external view returns (uint256);
    function transfer(address recipient, uint256 amount) external returns (bool);
    function allowance(address owner, address spender) external view returns (uint256);
    function approve(address spender, uint256 amount) external returns (bool);
    function transferFrom(address sender, address recipient, uint256 amount) external returns (bool);
    event Transfer(address indexed from, address indexed to, uint256 value);
    event Approval(address indexed owner, address indexed spender, uint256 value);
}

library SafeMath {
    function add(uint256 a, uint256 b) internal pure returns (uint256) {
        uint256 c = a + b;
        require(c >= a, "SafeMath: addition overflow");

        return c;
    }
    function sub(uint256 a, uint256 b) internal pure returns (uint256) {
        return sub(a, b, "SafeMath: subtraction overflow");
    }
    function sub(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b <= a, errorMessage);
        uint256 c = a - b;

        return c;
    }
    function mul(uint256 a, uint256 b) internal pure returns (uint256) {
        if (a == 0) {
            return 0;
        }

        uint256 c = a * b;
        require(c / a == b, "SafeMath: multiplication overflow");

        return c;
    }
    function div(uint256 a, uint256 b) internal pure returns (uint256) {
        return div(a, b, "SafeMath: division by zero");
    }
    function div(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        // Solidity only automatically asserts when dividing by 0
        require(b > 0, errorMessage);
        uint256 c = a / b;

        return c;
    }
    function mod(uint256 a, uint256 b) internal pure returns (uint256) {
        return mod(a, b, "SafeMath: modulo by zero");
    }
    function mod(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b != 0, errorMessage);
        return a % b;
    }
}

library Address {
    function isContract(address account) internal view returns (bool) {
        bytes32 codehash;
        bytes32 accountHash = 0xc5d2460186f7233c927e7db2dcc703c0e500b653ca82273b7bfad8045d85a470;
        // solhint-disable-next-line no-inline-assembly
        assembly { codehash := extcodehash(account) }
        return (codehash != 0x0 && codehash != accountHash);
    }
    function toPayable(address account) internal pure returns (address payable) {
        return address(uint160(account));
    }
    function sendValue(address payable recipient, uint256 amount) internal {
        require(address(this).balance >= amount, "Address: insufficient balance");

        // solhint-disable-next-line avoid-call-value
        (bool success, ) = recipient.call.value(amount)("");
        require(success, "Address: unable to send value, recipient may have reverted");
    }
}
```

```
library SafeERC20 {
    using SafeMath for uint256;
    using Address for address;

    function safeTransfer(IERC20 token, address to, uint256 value) internal {
        callOptionalReturn(token, abi.encodeWithSelector(token.transfer.selector, to, value));
    }

    function safeTransferFrom(IERC20 token, address from, address to, uint256 value) internal {
        callOptionalReturn(token, abi.encodeWithSelector(token.transferFrom.selector, from, to, value));
    }

    function safeApprove(IERC20 token, address spender, uint256 value) internal {
        require((value == 0) || (token.allowance(address(this), spender) == 0),
            "SafeERC20: approve from non-zero to non-zero allowance"
        );
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, value));
    }
    function callOptionalReturn(IERC20 token, bytes memory data) private {
        require(address(token).isContract(), "SafeERC20: call to non-contract");

        // solhint-disable-next-line avoid-low-level-calls
        (bool success, bytes memory returndata) = address(token).call(data);
        require(success, "SafeERC20: low-level call failed");

        if (returndata.length > 0) { // Return data is optional
            // solhint-disable-next-line max-line-length
            require(abi.decode(returndata, (bool)), "SafeERC20: ERC20 operation did not succeed");
        }
    }
}

interface Strategy {
    function want() external view returns (address);
    function deposit() external;
    function withdraw(address) external;
    function withdraw(uint) external;
    function withdrawAll() external returns (uint);
    function balanceOf() external view returns (uint);
}

interface Converter {
    function convert(address) external returns (uint);
}

interface OneSplitAudit {
    function swap(
        address fromToken,
        address destToken,
        uint256 amount,
        uint256 minReturn,
        uint256[] calldata distribution,
        uint256 flags
    )
        external
        payable
        returns(uint256 returnAmount);

    function getExpectedReturn(
        address fromToken,
        address destToken,
        uint256 amount,
        uint256 parts,
        uint256 flags // See constants in IOneSplit.sol
    )
        external
        view
        returns(
            uint256 returnAmount,
            uint256[] memory distribution
        );
}

contract Controller {
    using SafeERC20 for IERC20;
    using Address for address;
    using SafeMath for uint256;

    address public governance;//knownsec//  治理地址
    address public onesplit;//knownsec// onesplit 交易所地址
    address public rewards;//knownsec//  奖励提取地址
    address public factory;//knownsec//  工厂合约地址
    mapping(address => address) public vaults;//knownsec//  各代币金库合约地址映射
    mapping(address => address) public strategies;//knownsec//  各代币策略合约地址映射
    mapping(address => mapping(address => address)) public converters;//knownsec//  转换器
```

```
    uint public split = 5000;//knownsec//  奖励抽成  split/max 50%
    uint public constant max = 10000;


    event NewVault(address indexed _token, address indexed _vault);


    constructor() public {
        governance = tx.origin;
        onesplit = address(0x50FDA034C0Ce7a8f7EFDAebDA7Aa7cA21CC1267e);
        rewards = 0x0EbcA310383A3f67784e7A573dD9499513e36a94;
    }

    function setFactory(address _factory) public {
        require(msg.sender == governance, "!governance");
        factory = _factory;
    }

    function setSplit(uint _split) public {
        require(msg.sender == governance, "!governance");
        split = _split;
    }

    function setOneSplit(address _onesplit) public {
        require(msg.sender == governance, "!governance");
        onesplit = _onesplit;
    }

    function setGovernance(address _governance) public {
        require(msg.sender == governance, "!governance");
        governance = _governance;
    }

    function setVault(address _token, address _vault) public {
        //TODO:加个 Event 添加新的策略了.
        require(msg.sender == governance, "!governance");
        vaults[_token] = _vault;
        emit NewVault(_token, _vault);
    }

    function setConverter(address _input, address _output, address _converter) public {
        require(msg.sender == governance, "!governance");
        converters[_input][_output] = _converter;
    }

    function setStrategy(address _token, address _strategy) public {
        //某个币对应一个策略
        require(msg.sender == governance, "!governance");
        address _current = strategies[_token];
        if (_current != address(0)) {//之前的策略存在的话,那么就先提取所有资金
            Strategy(_current).withdrawAll();
        }
        strategies[_token] = _strategy;
    }

    //
    function earn(address _token, uint _amount) public {
        address _strategy = strategies[_token]; //获取策略的合约地址
        address _want = Strategy(_strategy).want();//策略需要的 token 地址
        if (_want != _token) {//如果策略需要的和输入的不一样,需要先转换
            address converter = converters[_token][_want];//转换器合约地址
            IERC20(_token).safeTransfer(converter, _amount);//给转换器打钱
            _amount = Converter(converter).convert(_strategy);//执行转换...
            IERC20(_want).safeTransfer(_strategy, _amount);
        } else {
            IERC20(_token).safeTransfer(_strategy, _amount);
        }
        Strategy(_strategy).deposit();//存钱
    }

    function balanceOf(address _token) external view returns (uint) {
        return Strategy(strategies[_token]).balanceOf();
    }

    function withdrawAll(address _token) public {
        require(msg.sender == governance, "!governance");
        Strategy(strategies[_token]).withdrawAll();
    }

    function inCaseTokensGetStuck(address _token, uint _amount) public {//转任意 erc20
        require(msg.sender == governance, "!governance");
        IERC20(_token).safeTransfer(governance, _amount);
    }

    function getExpectedReturn(address _strategy, address _token, uint parts) public view returns (uint expected)
{
        uint _balance = IERC20(_token).balanceOf(_strategy);//获取策略器 某个代币的余额
```

```
        address _want = Strategy(_strategy).want();//策略器需要的代币.
        (expected,) = OneSplitAudit(onesplit).getExpectedReturn(_token, _want, _balance, parts, 0);
    }

    // Only allows to withdraw non-core strategy tokens ~ this is over and above normal yield
    function yearn(address _strategy, address _token, uint parts) public {
        // This contract should never have value in it, but just incase since this is a public call
        uint _before = IERC20(_token).balanceOf(address(this));//knownsec// 提取指定策略代币前的余额
        Strategy(_strategy).withdraw(_token);//knownsec// 将策略合约的所有 token 提取至本合约
        uint _after =  IERC20(_token).balanceOf(address(this));//knownsec// 提取指定策略代币后的余额
        if (_after > _before) {
            uint _amount = _after.sub(_before);//knownsec// 提取先后的差额
            address _want = Strategy(_strategy).want();
            uint[] memory _distribution;
            uint _expected;
            _before = IERC20(_want).balanceOf(address(this));
            IERC20(_token).safeApprove(onesplit, 0);
            IERC20(_token).safeApprove(onesplit, _amount);//knownsec// 授权 onesplit 差值额度
            (_expected, _distribution) = OneSplitAudit(onesplit).getExpectedReturn(_token, _want, _amount,
parts, 0);
            OneSplitAudit(onesplit).swap(_token, _want, _amount, _expected, _distribution, 0);
            _after = IERC20(_want).balanceOf(address(this));
            if (_after > _before) {
                _amount = _after.sub(_before);//knownsec// 实际提取额
                uint _reward = _amount.mul(split).div(max);//knownsec// 奖励 = 实际差值 * split / max
                earn(_want, _amount.sub(_reward));
                IERC20(_want).safeTransfer(rewards, _reward);
            }
        }
    }

    function withdraw(address _token, uint _amount) public {
        require(msg.sender == vaults[_token], "!vault");
        Strategy(strategies[_token]).withdraw(_amount);
    }
}
```

Migrations.sol

```
// SPDX-License-Identifier: MIT
pragma solidity >=0.4.22 <0.8.0;

contract Migrations {
  address public owner = msg.sender;
  uint public last_completed_migration;

  modifier restricted() {
    require(
      msg.sender == owner,
      "This function is restricted to the contract's owner"
    );
    _;
  }

  function setCompleted(uint completed) public restricted {
    last_completed_migration = completed;
  }
}
```

StrategyDForceDAI.sol

```
pragma solidity ^0.5.16;

interface IERC20 {
    function totalSupply() external view returns (uint256);
    function balanceOf(address account) external view returns (uint256);
    function transfer(address recipient, uint256 amount) external returns (bool);
    function allowance(address owner, address spender) external view returns (uint256);
    function decimals() external view returns (uint);
    function name() external view returns (string memory);
    function approve(address spender, uint256 amount) external returns (bool);
    function transferFrom(address sender, address recipient, uint256 amount) external returns (bool);
    event Transfer(address indexed from, address indexed to, uint256 value);
    event Approval(address indexed owner, address indexed spender, uint256 value);
}

library SafeMath {
    function add(uint256 a, uint256 b) internal pure returns (uint256) {
        uint256 c = a + b;
        require(c >= a, "SafeMath: addition overflow");

        return c;
    }
    function sub(uint256 a, uint256 b) internal pure returns (uint256) {
        return sub(a, b, "SafeMath: subtraction overflow");
    }
```

```
    function sub(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b <= a, errorMessage);
        uint256 c = a - b;

        return c;
    }
    function mul(uint256 a, uint256 b) internal pure returns (uint256) {
        if (a == 0) {
            return 0;
        }

        uint256 c = a * b;
        require(c / a == b, "SafeMath: multiplication overflow");

        return c;
    }
    function div(uint256 a, uint256 b) internal pure returns (uint256) {
        return div(a, b, "SafeMath: division by zero");
    }
    function div(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        // Solidity only automatically asserts when dividing by 0
        require(b > 0, errorMessage);
        uint256 c = a / b;

        return c;
    }
    function mod(uint256 a, uint256 b) internal pure returns (uint256) {
        return mod(a, b, "SafeMath: modulo by zero");
    }
    function mod(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b != 0, errorMessage);
        return a % b;
    }
}

library Address {
    function isContract(address account) internal view returns (bool) {
        bytes32 codehash;
        bytes32 accountHash = 0xc5d2460186f7233c927e7db2dcc703c0e500b653ca82273b7bfad8045d85a470;
        // solhint-disable-next-line no-inline-assembly
        assembly { codehash := extcodehash(account) }
        return (codehash != 0x0 && codehash != accountHash);
    }
    function toPayable(address account) internal pure returns (address payable) {
        return address(uint160(account));
    }
    function sendValue(address payable recipient, uint256 amount) internal {
        require(address(this).balance >= amount, "Address: insufficient balance");

        // solhint-disable-next-line avoid-call-value
        (bool success, ) = recipient.call.value(amount)("");
        require(success, "Address: unable to send value, recipient may have reverted");
    }
}

library SafeERC20 {
    using SafeMath for uint256;
    using Address for address;

    function safeTransfer(IERC20 token, address to, uint256 value) internal {
        callOptionalReturn(token, abi.encodeWithSelector(token.transfer.selector, to, value));
    }

    function safeTransferFrom(IERC20 token, address from, address to, uint256 value) internal {
        callOptionalReturn(token, abi.encodeWithSelector(token.transferFrom.selector, from, to, value));
    }

    function safeApprove(IERC20 token, address spender, uint256 value) internal {
        require((value == 0) || (token.allowance(address(this), spender) == 0),
            "SafeERC20: approve from non-zero to non-zero allowance"
        );
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, value));
    }
    function callOptionalReturn(IERC20 token, bytes memory data) private {
        require(address(token).isContract(), "SafeERC20: call to non-contract");

        // solhint-disable-next-line avoid-low-level-calls
        (bool success, bytes memory returndata) = address(token).call(data);
        require(success, "SafeERC20: low-level call failed");

        if (returndata.length > 0) { // Return data is optional
            // solhint-disable-next-line max-line-length
            require(abi.decode(returndata, (bool)), "SafeERC20: ERC20 operation did not succeed");
        }
    }
}
```

```
interface Controller {
    function vaults(address) external view returns (address);
    function rewards() external view returns (address);
}

interface Vault {
    function getUsers() external view returns (address[] memory);
    function balanceOf(address account) external view returns (uint256);
    function totalSupply() external view returns (uint256);
}

interface dRewards {
    function withdraw(uint) external;
    function getReward() external;
    function stake(uint) external;
    function balanceOf(address) external view returns (uint);
    function exit() external;
}

interface dERC20 {
   function mint(address, uint256) external;
   function redeem(address, uint) external;
   function getTokenBalance(address) external view returns (uint);
   function getExchangeRate() external view returns (uint);
}

interface UniswapRouter {
    function swapExactTokensForTokens(uint, uint, address[] calldata, address, uint) external;
}

contract StrategyDForceDAI {
    using SafeERC20 for IERC20;
    using Address for address;
    using SafeMath for uint256;

    address constant public want = address(0x6B175474E89094C44Da98b954EedeAC495271d0F);//knownsec// DAI
    address constant public d = address(0x02285AcaafEB533e03A7306C55EC031297df9224);//knownsec// dDAI
    address constant public pool = address(0xD2fA07cD6Cd4A5A96aa86BacfA6E50bB3aaDBA8B);//knownsec// dDAI->DF unipool
    address constant public df = address(0x431ad2ff6a9C365805eBaD47Ee021148d6f7DBe0);//knownsec// DF
    address constant public output = address(0x431ad2ff6a9C365805eBaD47Ee021148d6f7DBe0);//knownsec// DF
    address constant public unirouter = address(0x7a250d5630B4cF539739dF2C5dAcb4c659F2488D);//knownsec// UniswapV2Router
    address constant public weth = address(0xC02aaA39b223FE8D0A0e5C4F27eAD9083C756Cc2); // used for df <> weth <> usdc route

    address constant public farmland = address(0xa1d0E215a23d7030842FC67cE582a6aFa3CCaB83);


    uint public strategyfee = 0;
    uint public fee = 600;
    uint public callfee = 100;
    uint constant public max = 1000;

    uint public withdrawalFee = 0;
    uint constant public withdrawalMax = 10000;

    address public governance;
    address public controller;

    string public getName;

    address[] public swap2TokenRouting;

    uint256 public minHarvestTimeIntervalSec;
    uint256 public lastHarvestTimestampSec;
    uint256 public harvestWindowLengthSec;
    uint256 public epoch;

    constructor() public {
        governance = msg.sender;
        controller = 0x67b199B87a1bA9948CC73e946dca7c2bac2d6C3F;
        getName = string(
            abi.encodePacked("farmland:Strategy:",
                abi.encodePacked(IERC20(want).name(),"DF Token"
                )
            ));
        swap2TokenRouting = [output,weth,want];//knownsec// DF <> weth <> DAI
        doApprove();
        lastHarvestTimestampSec = 1603281600; // 2020-10-21 20:00:00 utc+8
        minHarvestTimeIntervalSec = 24 hours;
        harvestWindowLengthSec = 30 * 60;
    }

    function doApprove () public{
```

```
        IERC20(output).safeApprove(unirouter, 0);
        IERC20(output).safeApprove(unirouter, uint(-1));
    }


    function deposit() public {
        uint _want = IERC20(want).balanceOf(address(this));
        if (_want > 0) {
            IERC20(want).safeApprove(d, 0);
            IERC20(want).safeApprove(d, _want);
            dERC20(d).mint(address(this), _want);//knownsec// DAI 转为 dDAI
        }

        uint _d = IERC20(d).balanceOf(address(this));
        if (_d > 0) {
            IERC20(d).safeApprove(pool, 0);
            IERC20(d).safeApprove(pool, _d);
            dRewards(pool).stake(_d);//knownsec// 质押 dDAI
        }
    }

    // Controller only function for creating additional rewards from dust
    function withdraw(IERC20 _asset) external returns (uint balance) {
        require(msg.sender == controller, "!controller");
        require(want != address(_asset), "want");
        require(d != address(_asset), "d");
        balance = _asset.balanceOf(address(this));
        _asset.safeTransfer(controller, balance);
    }

    // Withdraw partial funds, normally used with a vault withdrawal
    function withdraw(uint _amount) external {
        require(msg.sender == controller, "!controller");
        uint _balance = IERC20(want).balanceOf(address(this));
        if (_balance < _amount) {//knownsec// 若本合约余额不足提现,则从 DAI/dDAI 赎回差额的 DAI
            _amount = _withdrawSome(_amount.sub(_balance));
            _amount = _amount.add(_balance);
        }

        uint _fee = 0;
        if (withdrawalFee>0){//knownsec// 若有提现费,收取 withdrawalFee/withdrawalMax
            _fee = _amount.mul(withdrawalFee).div(withdrawalMax);
            IERC20(want).safeTransfer(Controller(controller).rewards(), _fee);
        }


        address _vault = Controller(controller).vaults(address(want));
        require(_vault != address(0), "!vault"); // additional protection so we don't burn the funds
        IERC20(want).safeTransfer(_vault, _amount.sub(_fee));
    }

    // Withdraw all funds, normally used when migrating strategies
    function withdrawAll() external returns (uint balance) {
        require(msg.sender == controller, "!controller");
        _withdrawAll();


        balance = IERC20(want).balanceOf(address(this));

        address _vault = Controller(controller).vaults(address(want));
        require(_vault != address(0), "!vault"); // additional protection so we don't burn the funds
        IERC20(want).safeTransfer(_vault, balance);
    }

    function _withdrawAll() internal {
        dRewards(pool).exit();
        uint _d = IERC20(d).balanceOf(address(this));
        if (_d > 0) {
            dERC20(d).redeem(address(this), _d);
        }
    }

    function harvest() public {
        _checkHarvest();//knownsec// 校验时间
        require(!Address.isContract(msg.sender),"!contract");
        dRewards(pool).getReward();//knownsec// 收取利息

        doswap();
        dosplit();
        // deposit();
    }

    function doswap() internal {//knownsec// 将收益 DF 换为 DAI
        uint256 _2token = IERC20(output).balanceOf(address(this));
        UniswapRouter(unirouter).swapExactTokensForTokens(_2token, 0, swap2TokenRouting, address(this),
now.add(1800));
    }
```

```
function dosplit() internal{
        uint b = IERC20(want).balanceOf(address(this)).mul(10).div(100);
        uint _fee = b.mul(fee).div(max);
        uint _callfee = b.mul(callfee).div(max);
        IERC20(want).safeTransfer(Controller(controller).rewards(), _fee); //6%   team
        IERC20(want).safeTransfer(msg.sender, _callfee); //call fee 1%

        // other => sent to all users
        address _vault = Controller(controller).vaults(address(want));
        uint other = IERC20(want).balanceOf(address(this));
        address[] memory users = Vault(_vault).getUsers();
        for(uint i=0;i < users.length;i++) {//knownsec//  将剩余 DAI 按比例分红给金库所有用户
            address _user = users[i];
            uint reward = other.mul(
                Vault(_vault).balanceOf(_user)
            ).div(
                Vault(_vault).totalSupply()
            );
            if (reward > 0) {
                IERC20(want).safeTransfer(_user, reward);
            }
        }
}

function _withdrawSome(uint256 _amount) internal returns (uint) {
        uint _d = _amount.mul(1e18).div(dERC20(d).getExchangeRate());
        uint _before = IERC20(d).balanceOf(address(this));
        dRewards(pool).withdraw(_d);//knownsec//  赎回 dDAI
        uint _after = IERC20(d).balanceOf(address(this));
        uint _withdrew = _after.sub(_before);
        _before = IERC20(want).balanceOf(address(this));
        dERC20(d).redeem(address(this), _withdrew);//knownsec//  赎回 DAI
        _after = IERC20(want).balanceOf(address(this));
        _withdrew = _after.sub(_before);
        return _withdrew;
}

function balanceOfWant() public view returns (uint) {
        return IERC20(want).balanceOf(address(this));
}

function balanceOfPool() public view returns (uint) {
        return (dRewards(pool).balanceOf(address(this))).mul(dERC20(d).getExchangeRate()).div(1e18);
}

function getExchangeRate() public view returns (uint) {
        return dERC20(d).getExchangeRate();
}

function balanceOfD() public view returns (uint) {
        return dERC20(d).getTokenBalance(address(this));
}

function balanceOf() public view returns (uint) {
        return balanceOfWant()
                .add(balanceOfD())
                .add(balanceOfPool());
}

function setGovernance(address _governance) external {
        require(msg.sender == governance, "!governance");
        governance = _governance;
}

function setController(address _controller) external {
        require(msg.sender == governance, "!governance");
        controller = _controller;
}
function setFee(uint256 _fee) external{
        require(msg.sender == governance, "!governance");
        fee = _fee;
}
function setCallFee(uint256 _fee) external{
        require(msg.sender == governance, "!governance");
        callfee = _fee;
}

function setWithdrawalFee(uint _withdrawalFee) external {
        require(msg.sender == governance, "!governance");
        require(_withdrawalFee <=100,"fee >= 1%"); //max:1%
        withdrawalFee = _withdrawalFee;
}

function _checkHarvest() internal {
        // ensure harvest at correct time
        require(now.sub(lastHarvestTimestampSec) >= minHarvestTimeIntervalSec, "too early");
        require(now.sub(lastHarvestTimestampSec)                                                    <
```

```
(minHarvestTimeIntervalSec.add(harvestWindowLengthSec)), "too late");

            lastHarvestTimestampSec = lastHarvestTimestampSec.add(minHarvestTimeIntervalSec);

            epoch = epoch.add(1);
        }
    }
```

VaultDai.sol

```
pragma solidity ^0.5.16;

interface IERC20 {
    function totalSupply() external view returns (uint256);
    function balanceOf(address account) external view returns (uint256);
    function transfer(address recipient, uint256 amount) external returns (bool);
    function allowance(address owner, address spender) external view returns (uint256);
    function approve(address spender, uint256 amount) external returns (bool);
    function transferFrom(address sender, address recipient, uint256 amount) external returns (bool);
    event Transfer(address indexed from, address indexed to, uint256 value);
    event Approval(address indexed owner, address indexed spender, uint256 value);
}

contract Context {
    constructor () internal { }
    // solhint-disable-previous-line no-empty-blocks

    function _msgSender() internal view returns (address payable) {
        return msg.sender;
    }

    function _msgData() internal view returns (bytes memory) {
        this; // silence state mutability warning without generating bytecode - see https://github.com/ethereum/solidity/issues/2691
        return msg.data;
    }
}

contract Ownable is Context {
    address private _owner;

    event OwnershipTransferred(address indexed previousOwner, address indexed newOwner);
    constructor () internal {
        _owner = _msgSender();
        emit OwnershipTransferred(address(0), _owner);
    }
    function owner() public view returns (address) {
        return _owner;
    }
    modifier onlyOwner() {
        require(isOwner(), "Ownable: caller is not the owner");
        _;
    }
    function isOwner() public view returns (bool) {
        return _msgSender() == _owner;
    }
    function renounceOwnership() public onlyOwner {
        emit OwnershipTransferred(_owner, address(0));
        _owner = address(0);
    }
    function transferOwnership(address newOwner) public onlyOwner {
        _transferOwnership(newOwner);
    }
    function _transferOwnership(address newOwner) internal {
        require(newOwner != address(0), "Ownable: new owner is the zero address");
        emit OwnershipTransferred(_owner, newOwner);
        _owner = newOwner;
    }
}

contract ERC20 is Context, IERC20 {
    using SafeMath for uint256;

    mapping (address => uint256) private _balances;

    mapping (address => mapping (address => uint256)) private _allowances;

    uint256 private _totalSupply;
    function totalSupply() public view returns (uint256) {
        return _totalSupply;
    }
    function balanceOf(address account) public view returns (uint256) {
        return _balances[account];
    }
    function transfer(address recipient, uint256 amount) public returns (bool) {
        _transfer(_msgSender(), recipient, amount);
        return true;
```

```
    }
    function allowance(address owner, address spender) public view returns (uint256) {
        return _allowances[owner][spender];
    }
    function approve(address spender, uint256 amount) public returns (bool) {
        _approve(_msgSender(), spender, amount);
        return true;
    }
    function transferFrom(address sender, address recipient, uint256 amount) public returns (bool) {
        _transfer(sender, recipient, amount);
        _approve(sender, _msgSender(), _allowances[sender][_msgSender()].sub(amount, "ERC20: transfer amount exceeds allowance"));
        return true;
    }
    function increaseAllowance(address spender, uint256 addedValue) public returns (bool) {
        _approve(_msgSender(), spender, _allowances[_msgSender()][spender].add(addedValue));
        return true;
    }
    function decreaseAllowance(address spender, uint256 subtractedValue) public returns (bool) {
        _approve(_msgSender(), spender, _allowances[_msgSender()][spender].sub(subtractedValue, "ERC20: decreased allowance below zero"));
        return true;
    }
    function _transfer(address sender, address recipient, uint256 amount) internal {
        require(sender != address(0), "ERC20: transfer from the zero address");
        require(recipient != address(0), "ERC20: transfer to the zero address");

        _balances[sender] = _balances[sender].sub(amount, "ERC20: transfer amount exceeds balance");
        _balances[recipient] = _balances[recipient].add(amount);
        emit Transfer(sender, recipient, amount);
    }
    function _mint(address account, uint256 amount) internal {
        require(account != address(0), "ERC20: mint to the zero address");

        _totalSupply = _totalSupply.add(amount);
        _balances[account] = _balances[account].add(amount);
        emit Transfer(address(0), account, amount);
    }
    function _burn(address account, uint256 amount) internal {
        require(account != address(0), "ERC20: burn from the zero address");

        _balances[account] = _balances[account].sub(amount, "ERC20: burn amount exceeds balance");
        _totalSupply = _totalSupply.sub(amount);
        emit Transfer(account, address(0), amount);
    }
    function _approve(address owner, address spender, uint256 amount) internal {
        require(owner != address(0), "ERC20: approve from the zero address");
        require(spender != address(0), "ERC20: approve to the zero address");

        _allowances[owner][spender] = amount;
        emit Approval(owner, spender, amount);
    }
    function _burnFrom(address account, uint256 amount) internal {
        _burn(account, amount);
        _approve(account, _msgSender(), _allowances[account][_msgSender()].sub(amount, "ERC20: burn amount exceeds allowance"));
    }
}

contract ERC20Detailed is IERC20 {
    string private _name;
    string private _symbol;
    uint8 private _decimals;

    constructor (string memory name, string memory symbol, uint8 decimals) public {
        _name = name;
        _symbol = symbol;
        _decimals = decimals;
    }
    function name() public view returns (string memory) {
        return _name;
    }
    function symbol() public view returns (string memory) {
        return _symbol;
    }
    function decimals() public view returns (uint8) {
        return _decimals;
    }
}

library SafeMath {
    function add(uint256 a, uint256 b) internal pure returns (uint256) {
        uint256 c = a + b;
        require(c >= a, "SafeMath: addition overflow");

        return c;
    }
```

```
    function sub(uint256 a, uint256 b) internal pure returns (uint256) {
        return sub(a, b, "SafeMath: subtraction overflow");
    }
    function sub(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b <= a, errorMessage);
        uint256 c = a - b;

        return c;
    }
    function mul(uint256 a, uint256 b) internal pure returns (uint256) {
        if (a == 0) {
            return 0;
        }

        uint256 c = a * b;
        require(c / a == b, "SafeMath: multiplication overflow");

        return c;
    }
    function div(uint256 a, uint256 b) internal pure returns (uint256) {
        return div(a, b, "SafeMath: division by zero");
    }
    function div(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        // Solidity only automatically asserts when dividing by 0
        require(b > 0, errorMessage);
        uint256 c = a / b;

        return c;
    }
    function mod(uint256 a, uint256 b) internal pure returns (uint256) {
        return mod(a, b, "SafeMath: modulo by zero");
    }
    function mod(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b != 0, errorMessage);
        return a % b;
    }
}

library Address {
    function isContract(address account) internal view returns (bool) {
        bytes32 codehash;
        bytes32 accountHash = 0xc5d2460186f7233c927e7db2dcc703c0e500b653ca82273b7bfad8045d85a470;
        // solhint-disable-next-line no-inline-assembly
        assembly { codehash := extcodehash(account) }
        return (codehash != 0x0 && codehash != accountHash);
    }
    function toPayable(address account) internal pure returns (address payable) {
        return address(uint160(account));
    }
    function sendValue(address payable recipient, uint256 amount) internal {
        require(address(this).balance >= amount, "Address: insufficient balance");

        // solhint-disable-next-line avoid-call-value
        (bool success, ) = recipient.call.value(amount)("");
        require(success, "Address: unable to send value, recipient may have reverted");
    }
}

library AddrArrayLib {
    using AddrArrayLib for Addresses;

    struct Addresses {
       address[]  _items;
    }

    /**
     * @notice push an address to the array
     * @dev if the address already exists, it will not be added again
     * @param self Storage array containing address type variables
     * @param element the element to add in the array
     */
    function pushAddress(Addresses storage self, address element) internal {
       if (!exists(self, element)) {
           self._items.push(element);
       }
    }

    /**
     * @notice remove an address from the array
     * @dev finds the element, swaps it with the last element, and then deletes it;
     *          returns a boolean whether the element was found and deleted
     * @param self Storage array containing address type variables
     * @param element the element to remove from the array
     */
    function removeAddress(Addresses storage self, address element) internal returns (bool) {
        for (uint i = 0; i < self.size(); i++) {
            if (self._items[i] == element) {
```

```
                    self._items[i] = self._items[self.size() - 1];
                    self._items.pop();
                    return true;
                }
            }
            return false;
        }

        /**
         * @notice get the address at a specific index from array
         * @dev revert if the index is out of bounds
         * @param self Storage array containing address type variables
         * @param index the index in the array
         */
        function getAddressAtIndex(Addresses storage self, uint256 index) internal view returns (address) {
            require(index < size(self), "the index is out of bounds");
            return self._items[index];
        }

        /**
         * @notice get the size of the array
         * @param self Storage array containing address type variables
         */
        function size(Addresses storage self) internal view returns (uint256) {
            return self._items.length;
        }

        /**
         * @notice check if an element exist in the array
         * @param self Storage array containing address type variables
         * @param element the element to check if it exists in the array
         */
        function exists(Addresses storage self, address element) internal view returns (bool) {
            for (uint i = 0; i < self.size(); i++) {
                if (self._items[i] == element) {
                    return true;
                }
            }
            return false;
        }

        /**
         * @notice get the array
         * @param self Storage array containing address type variables
         */
        function getAllAddresses(Addresses storage self) internal view returns(address[] memory) {
            return self._items;
        }

}

library SafeERC20 {
    using SafeMath for uint256;
    using Address for address;

    function safeTransfer(IERC20 token, address to, uint256 value) internal {
        callOptionalReturn(token, abi.encodeWithSelector(token.transfer.selector, to, value));
    }

    function safeTransferFrom(IERC20 token, address from, address to, uint256 value) internal {
        callOptionalReturn(token, abi.encodeWithSelector(token.transferFrom.selector, from, to, value));
    }

    function safeApprove(IERC20 token, address spender, uint256 value) internal {
        require((value == 0) || (token.allowance(address(this), spender) == 0),
            "SafeERC20: approve from non-zero to non-zero allowance"
        );
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, value));
    }

    function safeIncreaseAllowance(IERC20 token, address spender, uint256 value) internal {
        uint256 newAllowance = token.allowance(address(this), spender).add(value);
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, newAllowance));
    }

    function safeDecreaseAllowance(IERC20 token, address spender, uint256 value) internal {
        uint256 newAllowance = token.allowance(address(this), spender).sub(value, "SafeERC20: decreased
allowance below zero");
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, newAllowance));
    }
    function callOptionalReturn(IERC20 token, bytes memory data) private {
        require(address(token).isContract(), "SafeERC20: call to non-contract");

        // solhint-disable-next-line avoid-low-level-calls
        (bool success, bytes memory returndata) = address(token).call(data);
        require(success, "SafeERC20: low-level call failed");
```

```
            if (returndata.length > 0) { // Return data is optional
                // solhint-disable-next-line max-line-length
                require(abi.decode(returndata, (bool)), "SafeERC20: ERC20 operation did not succeed");
            }
        }
}

interface Controller {
        function withdraw(address, uint) external;
        function balanceOf(address) external view returns (uint);
        function earn(address, uint) external;
}

contract VaultDai is ERC20, ERC20Detailed {
        using SafeERC20 for IERC20;
        using Address for address;
        using SafeMath for uint256;
        using AddrArrayLib for AddrArrayLib.Addresses;

        IERC20 public token;

        uint public min = 9500;
        uint public constant max = 10000;
        uint public earnLowerlimit; //池内空余资金到这个值就自动 earn

        address public governance;
        address public controller;
        AddrArrayLib.Addresses userList;

        constructor (address _token,uint _earnLowerlimit) public ERC20Detailed(
                string(abi.encodePacked("Farmland ", ERC20Detailed(_token).name())),
                string(abi.encodePacked("farm", ERC20Detailed(_token).symbol())),
                ERC20Detailed(_token).decimals()
        ) {
                token = IERC20(_token);
                governance = tx.origin;
                controller = 0x67b199B87a1bA9948CC73e946dea7c2bac2d6C3F;
                earnLowerlimit = _earnLowerlimit;
        }

        function balance() public view returns (uint) {
                return token.balanceOf(address(this))
                                .add(Controller(controller).balanceOf(address(token)));
        }

        function setMin(uint _min) external {
                require(msg.sender == governance, "!governance");
                min = _min;
        }

        function setGovernance(address _governance) public {
                require(msg.sender == governance, "!governance");
                governance = _governance;
        }

        function setController(address _controller) public {
                require(msg.sender == governance, "!governance");
                controller = _controller;
        }
        function setEarnLowerlimit(uint256 _earnLowerlimit) public{
            require(msg.sender == governance, "!governance");
           earnLowerlimit = _earnLowerlimit;
    }

        // Custom logic in here for how much the vault allows to be borrowed
        // Sets minimum required on-hand to keep small withdrawals cheap
        function available() public view returns (uint) {
                return token.balanceOf(address(this)).mul(min).div(max);
        }

        function earn() public {
                uint _bal = available();
                token.safeTransfer(controller, _bal);
                Controller(controller).earn(address(token), _bal);
        }

        function depositAll() external {
                deposit(token.balanceOf(msg.sender));
        }

        function getUsers() public view returns (address[] memory) {
                return userList.getAllAddresses();
        }

        function deposit(uint _amount) public {//knownsec//  存入 DAI
                uint _pool = balance();
                uint _before = token.balanceOf(address(this));
```

```
            token.safeTransferFrom(msg.sender, address(this), _amount);
            uint _after = token.balanceOf(address(this));
            _amount = _after.sub(_before); // Additional check for deflationary tokens
            uint shares = 0;
            if (totalSupply() == 0) {
                shares = _amount;
            } else {
                shares = (_amount.mul(totalSupply())).div(_pool);//knownsec// 相应 farm 量
            }
            _mint(msg.sender, shares);//knownsec// 存款者获取 shares 量的 farm 代币
            userList.pushAddress(msg.sender);
            if (token.balanceOf(address(this))>earnLowerlimit){//knownsec// 超过设定线自动 earn
              earn();
            }
        }

        function withdrawAll() external {
            withdraw(balanceOf(msg.sender));
        }

        // No rebalance implementation for lower fees and faster swaps
        function withdraw(uint _shares) public {//knownsec// 提现为 DAI
            uint r = (balance().mul(_shares)).div(totalSupply());
            _burn(msg.sender, _shares);

            // Check balance
            uint b = token.balanceOf(address(this));
            if (b < r) {
                uint _withdraw = r.sub(b);//knownsec// 理论差值
                Controller(controller).withdraw(address(token), _withdraw);//knownsec// 从控制器转入理论差值
的 DAI
                uint _after = token.balanceOf(address(this));
                uint _diff = _after.sub(b);//knownsec// 转入本合约前后的 DAI 量差值,即控制器实际转入 DAI 量
                if (_diff < _withdraw) {//knownsec// 若实际差值 < 理论差值
                    r = b.add(_diff);//knownsec// 则实际提现量 = 转入前本合约 DAI 量 + 实际差值
                }
            }

            uint _max = balanceOf(msg.sender);
            if (_shares == _max) {//knownsec// 若提取完则移除用户
                userList.removeAddress(msg.sender);
            }
            token.safeTransfer(msg.sender, r);//knownsec// 转出
        }

        function getPricePerFullShare() public view returns (uint) {
            return balance().mul(1e18).div(totalSupply());
        }
    }
```

Farmland.sol

```
    pragma solidity ^0.5.16;

    interface IERC20 {
        function totalSupply() external view returns (uint);
        function balanceOf(address account) external view returns (uint);
        function transfer(address recipient, uint amount) external returns (bool);
        function allowance(address owner, address spender) external view returns (uint);
        function approve(address spender, uint amount) external returns (bool);
        function transferFrom(address sender, address recipient, uint amount) external returns (bool);
        event Transfer(address indexed from, address indexed to, uint value);
        event Approval(address indexed owner, address indexed spender, uint value);
    }

    contract Context {
        constructor () internal { }
        // solhint-disable-previous-line no-empty-blocks

        function _msgSender() internal view returns (address payable) {
            return msg.sender;
        }
    }

    contract ERC20 is Context, IERC20 {
        using SafeMath for uint;

        mapping (address => uint) private _balances;

        mapping (address => mapping (address => uint)) private _allowances;

        uint private _totalSupply;
        function totalSupply() public view returns (uint) {
            return _totalSupply;
        }
        function balanceOf(address account) public view returns (uint) {
            return _balances[account];
```

```
    }
    function transfer(address recipient, uint amount) public returns (bool) {
        _transfer(_msgSender(), recipient, amount);
        return true;
    }
    function allowance(address owner, address spender) public view returns (uint) {
        return _allowances[owner][spender];
    }
    function approve(address spender, uint amount) public returns (bool) {
        _approve(_msgSender(), spender, amount);
        return true;
    }
    function transferFrom(address sender, address recipient, uint amount) public returns (bool) {
        _transfer(sender, recipient, amount);
        _approve(sender, _msgSender(), _allowances[sender][_msgSender()].sub(amount, "ERC20: transfer
amount exceeds allowance"));
        return true;
    }
    function increaseAllowance(address spender, uint addedValue) public returns (bool) {
        _approve(_msgSender(), spender, _allowances[_msgSender()][spender].add(addedValue));
        return true;
    }
    function decreaseAllowance(address spender, uint subtractedValue) public returns (bool) {
        _approve(_msgSender(), spender, _allowances[_msgSender()][spender].sub(subtractedValue, "ERC20:
decreased allowance below zero"));
        return true;
    }
    function _transfer(address sender, address recipient, uint amount) internal {
        require(sender != address(0), "ERC20: transfer from the zero address");
        require(recipient != address(0), "ERC20: transfer to the zero address");

        _balances[sender] = _balances[sender].sub(amount, "ERC20: transfer amount exceeds balance");
        _balances[recipient] = _balances[recipient].add(amount);
        emit Transfer(sender, recipient, amount);
    }
    function _mint(address account, uint amount) internal {
        require(account != address(0), "ERC20: mint to the zero address");

        _totalSupply = _totalSupply.add(amount);
        _balances[account] = _balances[account].add(amount);
        emit Transfer(address(0), account, amount);
    }
    function _burn(address account, uint amount) internal {
        require(account != address(0), "ERC20: burn from the zero address");

        _balances[account] = _balances[account].sub(amount, "ERC20: burn amount exceeds balance");
        _totalSupply = _totalSupply.sub(amount);
        emit Transfer(account, address(0), amount);
    }
    function _approve(address owner, address spender, uint amount) internal {
        require(owner != address(0), "ERC20: approve from the zero address");
        require(spender != address(0), "ERC20: approve to the zero address");

        _allowances[owner][spender] = amount;
        emit Approval(owner, spender, amount);
    }
}
contract ERC20Detailed is IERC20 {
    string private _name;
    string private _symbol;
    uint8 private _decimals;

    constructor (string memory name, string memory symbol, uint8 decimals) public {
        _name = name;
        _symbol = symbol;
        _decimals = decimals;
    }
    function name() public view returns (string memory) {
        return _name;
    }
    function symbol() public view returns (string memory) {
        return _symbol;
    }
    function decimals() public view returns (uint8) {
        return _decimals;
    }
}

library SafeMath {
    function add(uint a, uint b) internal pure returns (uint) {
        uint c = a + b;
        require(c >= a, "SafeMath: addition overflow");

        return c;
    }
    function sub(uint a, uint b) internal pure returns (uint) {
```

```
        return sub(a, b, "SafeMath: subtraction overflow");
    }
    function sub(uint a, uint b, string memory errorMessage) internal pure returns (uint) {
        require(b <= a, errorMessage);
        uint c = a - b;

        return c;
    }
    function mul(uint a, uint b) internal pure returns (uint) {
        if (a == 0) {
            return 0;
        }

        uint c = a * b;
        require(c / a == b, "SafeMath: multiplication overflow");

        return c;
    }
    function div(uint a, uint b) internal pure returns (uint) {
        return div(a, b, "SafeMath: division by zero");
    }
    function div(uint a, uint b, string memory errorMessage) internal pure returns (uint) {
        // Solidity only automatically asserts when dividing by 0
        require(b > 0, errorMessage);
        uint c = a / b;

        return c;
    }
}

library Address {
    function isContract(address account) internal view returns (bool) {
        bytes32 codehash;
        bytes32 accountHash = 0xc5d2460186f7233c927e7db2dcc703c0e500b653ca82273b7bfad8045d85a470;
        // solhint-disable-next-line no-inline-assembly
        assembly { codehash := extcodehash(account) }
        return (codehash != 0x0 && codehash != accountHash);
    }
}

library SafeERC20 {
    using SafeMath for uint;
    using Address for address;

    function safeTransfer(IERC20 token, address to, uint value) internal {
        callOptionalReturn(token, abi.encodeWithSelector(token.transfer.selector, to, value));
    }

    function safeTransferFrom(IERC20 token, address from, address to, uint value) internal {
        callOptionalReturn(token, abi.encodeWithSelector(token.transferFrom.selector, from, to, value));
    }

    function safeApprove(IERC20 token, address spender, uint value) internal {
        require((value == 0) || (token.allowance(address(this), spender) == 0),
            "SafeERC20: approve from non-zero to non-zero allowance"
        );
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, value));
    }
    function callOptionalReturn(IERC20 token, bytes memory data) private {
        require(address(token).isContract(), "SafeERC20: call to non-contract");

        // solhint-disable-next-line avoid-low-level-calls
        (bool success, bytes memory returndata) = address(token).call(data);
        require(success, "SafeERC20: low-level call failed");

        if (returndata.length > 0) { // Return data is optional
            // solhint-disable-next-line max-line-length
            require(abi.decode(returndata, (bool)), "SafeERC20: ERC20 operation did not succeed");
        }
    }
}

contract Farmland is ERC20, ERC20Detailed {
  using SafeERC20 for IERC20;
  using Address for address;
  using SafeMath for uint;


  address public governance;
  mapping (address => bool) public minters;

  constructor () public ERC20Detailed("farm.land", "FARM", 18) {
      governance = msg.sender;
  }

  function mint(address account, uint amount) public {
      require(minters[msg.sender], "!minter");
```

```
        _mint(account, amount);
    }

    function setGovernance(address _governance) public {
        require(msg.sender == governance, "!governance");
        governance = _governance;
    }

    function addMinter(address _minter) public {
        require(msg.sender == governance, "!governance");
        minters[_minter] = true;
    }

    function removeMinter(address _minter) public {
        require(msg.sender == governance, "!governance");
        minters[_minter] = false;
    }
}
```

RewardsRenbtc.sol

```
/*
   ____            __   __        __   _
  / __/__ __ ___  / /_ / /  ___  / /_ (_)__ __
 _\ \ / // // _ \/ __// _ \/ -_)/ __// / \ \ /
/___/ \_, //_//_/\__//_//_/\__/ \__//_/_\_\
     /___/

*
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*
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*/

// File: @openzeppelin/contracts/math/Math.sol

pragma solidity ^0.5.0;

/**
 * @dev Standard math utilities missing in the Solidity language.
 */
library Math {
    /**
     * @dev Returns the largest of two numbers.
     */
    function max(uint256 a, uint256 b) internal pure returns (uint256) {
        return a >= b ? a : b;
    }

    /**
     * @dev Returns the smallest of two numbers.
     */
    function min(uint256 a, uint256 b) internal pure returns (uint256) {
        return a < b ? a : b;
    }

    /**
     * @dev Returns the average of two numbers. The result is rounded towards
     * zero.
     */
    function average(uint256 a, uint256 b) internal pure returns (uint256) {
        // (a + b) / 2 can overflow, so we distribute
        return (a / 2) + (b / 2) + ((a % 2 + b % 2) / 2);
    }
}
```

```
// File: @openzeppelin/contracts/math/SafeMath.sol

pragma solidity ^0.5.0;

/**
 * @dev Wrappers over Solidity's arithmetic operations with added overflow
 * checks.
 *
 * Arithmetic operations in Solidity wrap on overflow. This can easily result
 * in bugs, because programmers usually assume that an overflow raises an
 * error, which is the standard behavior in high level programming languages.
 * `SafeMath` restores this intuition by reverting the transaction when an
 * operation overflows.
 *
 * Using this library instead of the unchecked operations eliminates an entire
 * class of bugs, so it's recommended to use it always.
 */
library SafeMath {
    /**
     * @dev Returns the addition of two unsigned integers, reverting on
     * overflow.
     *
     * Counterpart to Solidity's `+` operator.
     *
     * Requirements:
     * - Addition cannot overflow.
     */
    function add(uint256 a, uint256 b) internal pure returns (uint256) {
        uint256 c = a + b;
        require(c >= a, "SafeMath: addition overflow");

        return c;
    }

    /**
     * @dev Returns the subtraction of two unsigned integers, reverting on
     * overflow (when the result is negative).
     *
     * Counterpart to Solidity's `-` operator.
     *
     * Requirements:
     * - Subtraction cannot overflow.
     */
    function sub(uint256 a, uint256 b) internal pure returns (uint256) {
        return sub(a, b, "SafeMath: subtraction overflow");
    }

    /**
     * @dev Returns the subtraction of two unsigned integers, reverting with custom message on
     * overflow (when the result is negative).
     *
     * Counterpart to Solidity's `-` operator.
     *
     * Requirements:
     * - Subtraction cannot overflow.
     *
     * _Available since v2.4.0._
     */
    function sub(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b <= a, errorMessage);
        uint256 c = a - b;

        return c;
    }

    /**
     * @dev Returns the multiplication of two unsigned integers, reverting on
     * overflow.
     *
     * Counterpart to Solidity's `*` operator.
     *
     * Requirements:
     * - Multiplication cannot overflow.
     */
    function mul(uint256 a, uint256 b) internal pure returns (uint256) {
        // Gas optimization: this is cheaper than requiring 'a' not being zero, but the
        // benefit is lost if 'b' is also tested.
        // See: https://github.com/OpenZeppelin/openzeppelin-contracts/pull/522
        if (a == 0) {
            return 0;
        }

        uint256 c = a * b;
        require(c / a == b, "SafeMath: multiplication overflow");

        return c;
```

```
    }

    /**
     * @dev Returns the integer division of two unsigned integers. Reverts on
     * division by zero. The result is rounded towards zero.
     *
     * Counterpart to Solidity's `/` operator. Note: this function uses a
     * `revert` opcode (which leaves remaining gas untouched) while Solidity
     * uses an invalid opcode to revert (consuming all remaining gas).
     *
     * Requirements:
     * - The divisor cannot be zero.
     */
    function div(uint256 a, uint256 b) internal pure returns (uint256) {
        return div(a, b, "SafeMath: division by zero");
    }

    /**
     * @dev Returns the integer division of two unsigned integers. Reverts with custom message on
     * division by zero. The result is rounded towards zero.
     *
     * Counterpart to Solidity's `/` operator. Note: this function uses a
     * `revert` opcode (which leaves remaining gas untouched) while Solidity
     * uses an invalid opcode to revert (consuming all remaining gas).
     *
     * Requirements:
     * - The divisor cannot be zero.
     *
     * _Available since v2.4.0._
     */
    function div(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        // Solidity only automatically asserts when dividing by 0
        require(b > 0, errorMessage);
        uint256 c = a / b;
        // assert(a == b * c + a % b); // There is no case in which this doesn't hold

        return c;
    }

    /**
     * @dev Returns the remainder of dividing two unsigned integers. (unsigned integer modulo),
     * Reverts when dividing by zero.
     *
     * Counterpart to Solidity's `%` operator. This function uses a `revert`
     * opcode (which leaves remaining gas untouched) while Solidity uses an
     * invalid opcode to revert (consuming all remaining gas).
     *
     * Requirements:
     * - The divisor cannot be zero.
     */
    function mod(uint256 a, uint256 b) internal pure returns (uint256) {
        return mod(a, b, "SafeMath: modulo by zero");
    }

    /**
     * @dev Returns the remainder of dividing two unsigned integers. (unsigned integer modulo),
     * Reverts with custom message when dividing by zero.
     *
     * Counterpart to Solidity's `%` operator. This function uses a `revert`
     * opcode (which leaves remaining gas untouched) while Solidity uses an
     * invalid opcode to revert (consuming all remaining gas).
     *
     * Requirements:
     * - The divisor cannot be zero.
     *
     * _Available since v2.4.0._
     */
    function mod(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b != 0, errorMessage);
        return a % b;
    }
}

// File: @openzeppelin/contracts/GSN/Context.sol

pragma solidity ^0.5.0;

/*
 * @dev Provides information about the current execution context, including the
 * sender of the transaction and its data. While these are generally available
 * via msg.sender and msg.data, they should not be accessed in such a direct
 * manner, since when dealing with GSN meta-transactions the account sending and
 * paying for execution may not be the actual sender (as far as an application
 * is concerned).
 *
 * This contract is only required for intermediate, library-like contracts.
 */
```

```
contract Context {
    // Empty internal constructor, to prevent people from mistakenly deploying
    // an instance of this contract, which should be used via inheritance.
    constructor () internal { }
    // solhint-disable-previous-line no-empty-blocks

    function _msgSender() internal view returns (address payable) {
        return msg.sender;
    }

    function _msgData() internal view returns (bytes memory) {
        this; // silence state mutability warning without generating bytecode - see https://github.com/ethereum/solidity/issues/2691
        return msg.data;
    }
}

// File: @openzeppelin/contracts/ownership/Ownable.sol

pragma solidity ^0.5.0;

/**
 * @dev Contract module which provides a basic access control mechanism, where
 * there is an account (an owner) that can be granted exclusive access to
 * specific functions.
 *
 * This module is used through inheritance. It will make available the modifier
 * `onlyOwner`, which can be applied to your functions to restrict their use to
 * the owner.
 */
contract Ownable is Context {
    address private _owner;

    event OwnershipTransferred(address indexed previousOwner, address indexed newOwner);

    /**
     * @dev Initializes the contract setting the deployer as the initial owner.
     */
    constructor () internal {
        _owner = _msgSender();
        emit OwnershipTransferred(address(0), _owner);
    }

    /**
     * @dev Returns the address of the current owner.
     */
    function owner() public view returns (address) {
        return _owner;
    }

    /**
     * @dev Throws if called by any account other than the owner.
     */
    modifier onlyOwner() {
        require(isOwner(), "Ownable: caller is not the owner");
        _;
    }

    /**
     * @dev Returns true if the caller is the current owner.
     */
    function isOwner() public view returns (bool) {
        return _msgSender() == _owner;
    }

    /**
     * @dev Leaves the contract without owner. It will not be possible to call
     * `onlyOwner` functions anymore. Can only be called by the current owner.
     *
     * NOTE: Renouncing ownership will leave the contract without an owner,
     * thereby removing any functionality that is only available to the owner.
     */
    function renounceOwnership() public onlyOwner {
        emit OwnershipTransferred(_owner, address(0));
        _owner = address(0);
    }

    /**
     * @dev Transfers ownership of the contract to a new account (`newOwner`).
     * Can only be called by the current owner.
     */
    function transferOwnership(address newOwner) public onlyOwner {
        _transferOwnership(newOwner);
    }

    /**
     * @dev Transfers ownership of the contract to a new account (`newOwner`).
```

```
     */
    function _transferOwnership(address newOwner) internal {
        require(newOwner != address(0), "Ownable: new owner is the zero address");
        emit OwnershipTransferred(_owner, newOwner);
        _owner = newOwner;
    }
}

// File: @openzeppelin/contracts/token/ERC20/IERC20.sol

pragma solidity ^0.5.0;

/**
 * @dev Interface of the ERC20 standard as defined in the EIP. Does not include
 * the optional functions; to access them see {ERC20Detailed}.
 */
interface IERC20 {
    function mint(address account, uint amount) external;
    /**
     * @dev Returns the amount of tokens in existence.
     */
    function totalSupply() external view returns (uint256);

    /**
     * @dev Returns the amount of tokens owned by `account`.
     */
    function balanceOf(address account) external view returns (uint256);

    /**
     * @dev Moves `amount` tokens from the caller's account to `recipient`.
     *
     * Returns a boolean value indicating whether the operation succeeded.
     *
     * Emits a {Transfer} event.
     */
    function transfer(address recipient, uint256 amount) external returns (bool);

    /**
     * @dev Returns the remaining number of tokens that `spender` will be
     * allowed to spend on behalf of `owner` through {transferFrom}. This is
     * zero by default.
     *
     * This value changes when {approve} or {transferFrom} are called.
     */
    function allowance(address owner, address spender) external view returns (uint256);

    /**
     * @dev Sets `amount` as the allowance of `spender` over the caller's tokens.
     *
     * Returns a boolean value indicating whether the operation succeeded.
     *
     * IMPORTANT: Beware that changing an allowance with this method brings the risk
     * that someone may use both the old and the new allowance by unfortunate
     * transaction ordering. One possible solution to mitigate this race
     * condition is to first reduce the spender's allowance to 0 and set the
     * desired value afterwards:
     * https://github.com/ethereum/EIPs/issues/20#issuecomment-263524729
     *
     * Emits an {Approval} event.
     */
    function approve(address spender, uint256 amount) external returns (bool);

    /**
     * @dev Moves `amount` tokens from `sender` to `recipient` using the
     * allowance mechanism. `amount` is then deducted from the caller's
     * allowance.
     *
     * Returns a boolean value indicating whether the operation succeeded.
     *
     * Emits a {Transfer} event.
     */
    function transferFrom(address sender, address recipient, uint256 amount) external returns (bool);

    /**
     * @dev Emitted when `value` tokens are moved from one account (`from`) to
     * another (`to`).
     *
     * Note that `value` may be zero.
     */
    event Transfer(address indexed from, address indexed to, uint256 value);

    /**
     * @dev Emitted when the allowance of a `spender` for an `owner` is set by
     * a call to {approve}. `value` is the new allowance.
     */
    event Approval(address indexed owner, address indexed spender, uint256 value);
}
```

```
// File: @openzeppelin/contracts/utils/Address.sol

pragma solidity ^0.5.5;

/**
 * @dev Collection of functions related to the address type
 */
library Address {
    /**
     * @dev Returns true if `account` is a contract.
     *
     * This test is non-exhaustive, and there may be false-negatives: during the
     * execution of a contract's constructor, its address will be reported as
     * not containing a contract.
     *
     * IMPORTANT: It is unsafe to assume that an address for which this
     * function returns false is an externally-owned account (EOA) and not a
     * contract.
     */
    function isContract(address account) internal view returns (bool) {
        // This method relies in extcodesize, which returns 0 for contracts in
        // construction, since the code is only stored at the end of the
        // constructor execution.

        // According to EIP-1052, 0x0 is the value returned for not-yet created accounts
        // and 0xc5d2460186f7233c927e7db2dcc703c0e500b653ca82273b7bfad8045d85a470 is returned
        // for accounts without code, i.e. `keccak256('')`
        bytes32 codehash;
        bytes32 accountHash = 0xc5d2460186f7233c927e7db2dcc703c0e500b653ca82273b7bfad8045d85a470;
        // solhint-disable-next-line no-inline-assembly
        assembly { codehash := extcodehash(account) }
        return (codehash != 0x0 && codehash != accountHash);
    }

    /**
     * @dev Converts an `address` into `address payable`. Note that this is
     * simply a type cast: the actual underlying value is not changed.
     *
     * _Available since v2.4.0._
     */
    function toPayable(address account) internal pure returns (address payable) {
        return address(uint160(account));
    }

    /**
     * @dev Replacement for Solidity's `transfer`: sends `amount` wei to
     * `recipient`, forwarding all available gas and reverting on errors.
     *
     * https://eips.ethereum.org/EIPS/eip-1884[EIP1884] increases the gas cost
     * of certain opcodes, possibly making contracts go over the 2300 gas limit
     * imposed by `transfer`, making them unable to receive funds via
     * `transfer`. {sendValue} removes this limitation.
     *
     * https://diligence.consensys.net/posts/2019/09/stop-using-soliditys-transfer-now/[Learn more].
     *
     * IMPORTANT: because control is transferred to `recipient`, care must be
     * taken to not create reentrancy vulnerabilities. Consider using
     * {ReentrancyGuard} or the
     * https://solidity.readthedocs.io/en/v0.5.11/security-considerations.html#use-the-checks-effects-interactions-pattern[checks-effects-interactions pattern].
     *
     * _Available since v2.4.0._
     */
    function sendValue(address payable recipient, uint256 amount) internal {
        require(address(this).balance >= amount, "Address: insufficient balance");

        // solhint-disable-next-line avoid-call-value
        (bool success, ) = recipient.call.value(amount)("");
        require(success, "Address: unable to send value, recipient may have reverted");
    }
}

// File: @openzeppelin/contracts/token/ERC20/SafeERC20.sol

pragma solidity ^0.5.0;



/**
 * @title SafeERC20
 * @dev Wrappers around ERC20 operations that throw on failure (when the token
 * contract returns false). Tokens that return no value (and instead revert or
 * throw on failure) are also supported, non-reverting calls are assumed to be
 * successful.
 * To use this library you can add a `using SafeERC20 for ERC20;` statement to your contract,
```

```
 * which allows you to call the safe operations as `token.safeTransfer(...)`, etc.
 */
library SafeERC20 {
    using SafeMath for uint256;
    using Address for address;

    function safeTransfer(IERC20 token, address to, uint256 value) internal {
        callOptionalReturn(token, abi.encodeWithSelector(token.transfer.selector, to, value));
    }

    function safeTransferFrom(IERC20 token, address from, address to, uint256 value) internal {
        callOptionalReturn(token, abi.encodeWithSelector(token.transferFrom.selector, from, to, value));
    }

    function safeApprove(IERC20 token, address spender, uint256 value) internal {
        // safeApprove should only be called when setting an initial allowance,
        // or when resetting it to zero. To increase and decrease it, use
        // 'safeIncreaseAllowance' and 'safeDecreaseAllowance'
        // solhint-disable-next-line max-line-length
        require((value == 0) || (token.allowance(address(this), spender) == 0),
            "SafeERC20: approve from non-zero to non-zero allowance"
        );
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, value));
    }

    function safeIncreaseAllowance(IERC20 token, address spender, uint256 value) internal {
        uint256 newAllowance = token.allowance(address(this), spender).add(value);
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, newAllowance));
    }

    function safeDecreaseAllowance(IERC20 token, address spender, uint256 value) internal {
        uint256 newAllowance = token.allowance(address(this), spender).sub(value, "SafeERC20: decreased
allowance below zero");
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, newAllowance));
    }

    /**
     * @dev Imitates a Solidity high-level call (i.e. a regular function call to a contract), relaxing the requirement
     * on the return value: the return value is optional (but if data is returned, it must not be false).
     * @param token The token targeted by the call.
     * @param data The call data (encoded using abi.encode or one of its variants).
     */
    function callOptionalReturn(IERC20 token, bytes memory data) private {
        // We need to perform a low level call here, to bypass Solidity's return data size checking mechanism, since
        // we're implementing it ourselves.

        // A Solidity high level call has three parts:
        //   1. The target address is checked to verify it contains contract code
        //   2. The call itself is made, and success asserted
        //   3. The return value is decoded, which in turn checks the size of the returned data.
        // solhint-disable-next-line max-line-length
        require(address(token).isContract(), "SafeERC20: call to non-contract");

        // solhint-disable-next-line avoid-low-level-calls
        (bool success, bytes memory returndata) = address(token).call(data);
        require(success, "SafeERC20: low-level call failed");

        if (returndata.length > 0) { // Return data is optional
            // solhint-disable-next-line max-line-length
            require(abi.decode(returndata, (bool)), "SafeERC20: ERC20 operation did not succeed");
        }
    }
}

// File: contracts/IRewardDistributionRecipient.sol

pragma solidity ^0.5.0;


contract IRewardDistributionRecipient is Ownable {
    function notifyRewardAmount(uint256 reward) external;
}

// File: contracts/CurveRewards.sol

pragma solidity ^0.5.0;

contract LPTokenWrapper {
    using SafeMath for uint256;
    using SafeERC20 for IERC20;

    IERC20 public renbtc = IERC20(0x0A9ADD98C076448CBcFAcf5E457DA12ddbEF4A8f);

    uint256 private _totalSupply;
    mapping(address => uint256) private _balances;
```

```
    function totalSupply() public view returns (uint256) {
        return _totalSupply;
    }

    function balanceOf(address account) public view returns (uint256) {
        return _balances[account];
    }

    function deposit(uint256 amount) public {
        _totalSupply = _totalSupply.add(amount);
        _balances[msg.sender] = _balances[msg.sender].add(amount);
        renbtc.safeTransferFrom(msg.sender, address(this), amount);
    }

    function withdraw(uint256 amount) public {
        _totalSupply = _totalSupply.sub(amount);
        _balances[msg.sender] = _balances[msg.sender].sub(amount);
        renbtc.safeTransfer(msg.sender, amount);
    }
}

contract RewardsRenbtc is LPTokenWrapper, IRewardDistributionRecipient {
    IERC20 public farm = IERC20(0xe1AB5C9b806F8898f8194CD369adDc66997a9907);

    uint256 public constant DURATION = 7 days;
    uint256 public starttime = 1602864000; //utc+8 2020-10-17 00:00:00
    uint256 public periodFinish = 0;
    uint256 public rewardRate = 0;
    uint256 public lastUpdateTime;
    uint256 public rewardPerTokenStored;
    mapping(address => uint256) public userRewardPerTokenPaid;
    mapping(address => uint256) public rewards;

    event RewardAdded(uint256 reward);
    event Staked(address indexed user, uint256 amount);
    event Withdrawn(address indexed user, uint256 amount);
    event RewardPaid(address indexed user, uint256 reward);

    modifier updateReward(address account) {
        rewardPerTokenStored = rewardPerToken();
        lastUpdateTime = lastTimeRewardApplicable();
        if (account != address(0)) {
            rewards[account] = claimable_tokens(account);
            userRewardPerTokenPaid[account] = rewardPerTokenStored;
        }
        _;
    }

    function lastTimeRewardApplicable() public view returns (uint256) {
        return Math.min(block.timestamp, periodFinish);
    }

    function rewardPerToken() public view returns (uint256) {
        if (totalSupply() == 0) {
            return rewardPerTokenStored;
        }
        return
            rewardPerTokenStored.add(
                lastTimeRewardApplicable()
                    .sub(lastUpdateTime)
                    .mul(rewardRate)
                    .mul(1e18)
                    .div(totalSupply())
            );
    }

    function claimable_tokens(address account) public view returns (uint256) {
        return
            balanceOf(account)
                .mul(rewardPerToken().sub(userRewardPerTokenPaid[account]))
                .div(1e18)
                .add(rewards[account]);
    }

    // stake visibility is public as overriding LPTokenWrapper's stake() function
    function deposit(uint256 amount) public updateReward(msg.sender) checkStart {
        require(amount > 0, "Cannot stake 0");
        super.deposit(amount);
        emit Staked(msg.sender, amount);
    }

    function withdraw(uint256 amount) public updateReward(msg.sender) checkStart {
        require(amount > 0, "Cannot withdraw 0");
        super.withdraw(amount);
        emit Withdrawn(msg.sender, amount);
    }
```

```
    function exit() external {
        withdraw(balanceOf(msg.sender));
        getReward();
    }

    function getReward() public updateReward(msg.sender) checkStart {
        uint256 reward = claimable_tokens(msg.sender);
        if (reward > 0) {
            rewards[msg.sender] = 0;
            farm.safeTransfer(msg.sender, reward);
            emit RewardPaid(msg.sender, reward);
        }
    }

    modifier checkStart() {
        require(block.timestamp > starttime, "not start");
        _;
    }

    function notifyRewardAmount(uint256 reward)
        external
        onlyOwner
        updateReward(address(0))
    {
        if (block.timestamp >= periodFinish) {
            rewardRate = reward.div(DURATION);
        } else {
            uint256 remaining = periodFinish.sub(block.timestamp);
            uint256 leftover = remaining.mul(rewardRate);
            rewardRate = reward.add(leftover).div(DURATION);
        }
        lastUpdateTime = block.timestamp;
        periodFinish = block.timestamp.add(DURATION);
        farm.mint(address(this), reward);
        emit RewardAdded(reward);
    }
}
```

StrategyCRV.sol

```
pragma solidity ^0.5.15;

interface IERC20 {
    function totalSupply() external view returns (uint256);
    function balanceOf(address account) external view returns (uint256);
    function transfer(address recipient, uint256 amount) external returns (bool);
    function allowance(address owner, address spender) external view returns (uint256);
    function decimals() external view returns (uint);
    function name() external view returns (string memory);
    function approve(address spender, uint256 amount) external returns (bool);
    function transferFrom(address sender, address recipient, uint256 amount) external returns (bool);
    event Transfer(address indexed from, address indexed to, uint256 value);
    event Approval(address indexed owner, address indexed spender, uint256 value);
}

library SafeMath {
    function add(uint256 a, uint256 b) internal pure returns (uint256) {
        uint256 c = a + b;
        require(c >= a, "SafeMath: addition overflow");

        return c;
    }
    function sub(uint256 a, uint256 b) internal pure returns (uint256) {
        return sub(a, b, "SafeMath: subtraction overflow");
    }
    function sub(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b <= a, errorMessage);
        uint256 c = a - b;

        return c;
    }
    function mul(uint256 a, uint256 b) internal pure returns (uint256) {
        if (a == 0) {
            return 0;
        }

        uint256 c = a * b;
        require(c / a == b, "SafeMath: multiplication overflow");

        return c;
    }
    function div(uint256 a, uint256 b) internal pure returns (uint256) {
        return div(a, b, "SafeMath: division by zero");
    }
    function div(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        // Solidity only automatically asserts when dividing by 0
```

```
            require(b > 0, errorMessage);
            uint256 c = a / b;

            return c;
        }
        function mod(uint256 a, uint256 b) internal pure returns (uint256) {
            return mod(a, b, "SafeMath: modulo by zero");
        }
        function mod(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
            require(b != 0, errorMessage);
            return a % b;
        }
}

library Address {
        function isContract(address account) internal view returns (bool) {
            bytes32 codehash;
            bytes32 accountHash = 0xc5d2460186f7233c927e7db2dcc703c0e500b653ca82273b7bfad8045d85a470;
            // solhint-disable-next-line no-inline-assembly
            assembly { codehash := extcodehash(account) }
            return (codehash != 0x0 && codehash != accountHash);
        }
        function toPayable(address account) internal pure returns (address payable) {
            return address(uint160(account));
        }
        function sendValue(address payable recipient, uint256 amount) internal {
            require(address(this).balance >= amount, "Address: insufficient balance");

            // solhint-disable-next-line avoid-call-value
            (bool success, ) = recipient.call.value(amount)("");
            require(success, "Address: unable to send value, recipient may have reverted");
        }
}

library SafeERC20 {
        using SafeMath for uint256;
        using Address for address;

        function safeTransfer(IERC20 token, address to, uint256 value) internal {
            callOptionalReturn(token, abi.encodeWithSelector(token.transfer.selector, to, value));
        }

        function safeTransferFrom(IERC20 token, address from, address to, uint256 value) internal {
            callOptionalReturn(token, abi.encodeWithSelector(token.transferFrom.selector, from, to, value));
        }

        function safeApprove(IERC20 token, address spender, uint256 value) internal {
            require((value == 0) || (token.allowance(address(this), spender) == 0),
                "SafeERC20: approve from non-zero to non-zero allowance"
            );
            callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, value));
        }
        function callOptionalReturn(IERC20 token, bytes memory data) private {
            require(address(token).isContract(), "SafeERC20: call to non-contract");

            // solhint-disable-next-line avoid-low-level-calls
            (bool success, bytes memory returndata) = address(token).call(data);
            require(success, "SafeERC20: low-level call failed");

            if (returndata.length > 0) { // Return data is optional
                // solhint-disable-next-line max-line-length
                require(abi.decode(returndata, (bool)), "SafeERC20: ERC20 operation did not succeed");
            }
        }
}

interface Controller {
        function vaults(address) external view returns (address);
        function rewards() external view returns (address);
}

interface CurveDeposit{
        function deposit(uint256) external;
        function withdraw(uint256) external;
        function balanceOf(address) external view returns (uint256);
        function claimable_tokens(address) external view returns (uint256);
}

interface CurveMinter{
        function mint(address) external;
}

interface ICurveFi {
    function get_virtual_price() external view returns (uint);
    function add_liquidity(
        uint256[2] calldata amounts,
        uint256 min_mint_amount
```

```
    ) external;
    function remove_liquidity_imbalance(
        uint256[2] calldata amounts,
        uint256 max_burn_amount
    ) external;
    function remove_liquidity(
        uint256 _amount,
        uint256[2] calldata amounts
    ) external;
    function remove_liquidity_one_coin(
        uint256 _amount,
        int128 i,
        uint256 min
    ) external;
    function exchange(
        int128 from, int128 to, uint256 _from_amount, uint256 _min_to_amount
    ) external;
}

interface UniswapRouter {
    function swapExactTokensForTokens(
            uint amountIn,
            uint amountOutMin,
            address[] calldata path,
            address to,
            uint deadline
        ) external returns (uint[] memory amounts);
        function getAmountsOut(uint amountIn, address[] calldata path) external view returns (uint[] memory amounts);

}

contract StrategyCRV  {
        using SafeERC20 for IERC20;
        using Address for address;
        using SafeMath for uint256;

        address public constant want = address(0xEB4C2781e4ebA804CE9a9803C67d0893436bB27D); // renbtc
        address public constant curveminter = address(0xd061D61a4d941c39E5453435B6345Dc261C2fcE0); // Token minter
        address constant public unirouter = address(0x7a250d5630B4cF539739dF2C5dAcb4c659F2488D);
        address constant public weth = address(0xC02aaA39b223FE8D0A0e5C4F27eAD9083C756Cc2);

        address constant public curve = address(0x93054188d876f558f4a66B2EF1d97d16eDf0895B); // Curve.fi:REN Swap
        address public constant curvedeposit = address(0xB1F2cdeC61db658F091671F5f199635aEF202CAC); // Curve.fi: renCrv Gauge
        address public constant rencrv = address(0x49849C98ae39Fff122806C06791Fa73784FB3675); // Curve.fi: renCrv Token
        address constant public output = address(0xD533a949740bb3306d119CC777fa900bA034cd52); // crv

        uint constant public DENOMINATION = 10 ** 10;

        uint public fee = 600;
        uint public callfee = 100;
        uint constant public max = 1000;

        uint public withdrawalFee = 0;
        uint constant public withdrawalMax = 10000;

        address public governance;
        address public controller;

        string public getName;

        address[] public swap2TokenRouting;

        constructor() public {
                governance = tx.origin;
                controller = 0x67D320cf7148D69058477B2b86991D2C1dE60E86;
                getName = string(
                        abi.encodePacked("farmland:Strategy:",
                                abi.encodePacked(IERC20(want).name(),
                                        abi.encodePacked(":",IERC20(output).name())
                                )
                        ));
                doApprove();
                swap2TokenRouting = [output,weth,want]; //knownsec// crv <> weth <> renbtc
        }

        function deposit() public {
                // renbtc -> ren
                uint _renbtc = IERC20(want).balanceOf(address(this));
                if (_renbtc > 0) {
                        IERC20(want).safeApprove(curve, 0);
                        IERC20(want).safeApprove(curve, _renbtc);
                        ICurveFi(curve).add_liquidity([_renbtc, 0], 0);
```

```
        }
        uint _rencrv = IERC20(rencrv).balanceOf(address(this));
        if (_rencrv > 0) {
            IERC20(rencrv).safeApprove(curvedeposit, 0);
            IERC20(rencrv).safeApprove(curvedeposit, _rencrv);
            CurveDeposit(curvedeposit).deposit(_rencrv);
        }
    }

    // Controller only function for creating additional rewards from dust
    function withdraw(IERC20 _asset) external returns (uint balance) {
        require(msg.sender == controller, "!controller");
        require(want != address(_asset), "want");
        require(rencrv != address(_asset), "rencrv");
        balance = _asset.balanceOf(address(this));
        _asset.safeTransfer(controller, balance);
    }

    // Withdraw partial funds, normally used with a vault withdrawal
    function withdraw(uint _amount) external {
        require(msg.sender == controller, "!controller");
        uint _balance = IERC20(want).balanceOf(address(this));
        if (_balance < _amount) {
            uint _diff = _amount.sub(_balance);
            // calculate amount of rencrv lp to withdraw for amount of _want_
            uint _rencrv = _diff.mul(1e18).div(ICurveFi(curve).get_virtual_price());
            _amount = _withdrawSome(_rencrv.mul(DENOMINATION));
            _amount = _amount.add(_balance);
        }
        uint _fee = 0;
        if (withdrawalFee > 0) {
            _fee = _amount.mul(withdrawalFee).div(withdrawalMax);
            IERC20(want).safeTransfer(Controller(controller).rewards(), _fee);
        }

        address _vault = Controller(controller).vaults(address(want));
        require(_vault != address(0), "!vault"); // additional protection so we don't burn the funds
        IERC20(want).safeTransfer(_vault, _amount.sub(_fee));
    }

    // Withdraw all funds, normally used when migrating strategies
    function withdrawAll() external returns (uint balance) {
        require(msg.sender == controller, "!controller");
        _withdrawAll();
        balance = IERC20(want).balanceOf(address(this));

        address _vault = Controller(controller).vaults(address(want));
        require(_vault != address(0), "!vault"); // additional protection so we don't burn the funds
        IERC20(want).safeTransfer(_vault, balance);
    }

    function _withdrawAll() internal {
        uint256 b = CurveDeposit(curvedeposit).balanceOf(address(this));
        if (b > 0) {
            _withdrawSome(b);
        }
    }

    function _withdrawSome(uint256 _rencrv) internal returns(uint256) {
        uint _before = IERC20(rencrv).balanceOf(address(this));
        CurveDeposit(curvedeposit).withdraw(_rencrv); // get rencrv
        uint _after = IERC20(rencrv).balanceOf(address(this));

        return withdrawUnderlying(_after.sub(_before));
    }

    function withdrawUnderlying(uint256 _amount) internal returns (uint) {
        IERC20(rencrv).safeApprove(curve, 0);
        IERC20(rencrv).safeApprove(curve, _amount);

        uint _before = IERC20(want).balanceOf(address(this));
        ICurveFi(curve).remove_liquidity_one_coin(_amount, 0, 0);
        uint _after = IERC20(want).balanceOf(address(this));

        return _after.sub(_before);
    }

    function doApprove () public {
        IERC20(output).safeApprove(unirouter, 0);
        IERC20(output).safeApprove(unirouter, uint(-1));
    }

    function harvest() public {
        require(!Address.isContract(msg.sender),"!contract");
        CurveMinter(curveminter).mint(curvedeposit);//get crv

        address _vault = Controller(controller).vaults(address(want));
```

```
        require(_vault != address(0), "!vault"); // additional protection so we don't burn the funds

        doswap();

        deposit(); //循环生息

        // fee of want
        uint b = IERC20(want).balanceOf(address(this));
        uint _fee = b.mul(fee).div(max);
        uint _callfee = b.mul(callfee).div(max);
        IERC20(want).safeTransfer(Controller(controller).rewards(), _fee); //6% team
        IERC20(want).safeTransfer(msg.sender, _callfee); //call fee 1%

    }
    function doswap() internal {
            uint256 _2token = IERC20(output).balanceOf(address(this)); //100%
            UniswapRouter(unirouter).swapExactTokensForTokens(_2token, 0, swap2TokenRouting,
address(this), now.add(1800));

            // want -> ren
            uint _renbtc = IERC20(want).balanceOf(address(this)).mul(90).div(100);
            if (_renbtc > 0) {
                IERC20(want).safeApprove(curve, 0);
                IERC20(want).safeApprove(curve, _renbtc);
                ICurveFi(curve).add_liquidity([_renbtc, 0], 0);
            }
    }

    function balanceOf() public view returns (uint) {
        uint _rencrv = CurveDeposit(curvedeposit).balanceOf(address(this)); // amount of rencrv
        uint _amount = _rencrv.mul(ICurveFi(curve).get_virtual_price()).div(1e18);
        return _amount.div(DENOMINATION);
    }

    function balanceOfPendingReward() public view returns(uint){ //还没有领取的收益有多少...
        return CurveDeposit(curvedeposit).claimable_tokens(address(this));
    }

    function setGovernance(address _governance) external {
        require(msg.sender == governance, "!governance");
        governance = _governance;
    }

    function setController(address _controller) external {
        require(msg.sender == governance, "!governance");
        controller = _controller;
    }

    function setFee(uint256 _fee) external{
        require(msg.sender == governance, "!governance");
        fee = _fee;
    }
    function setCallFee(uint256 _fee) external{
        require(msg.sender == governance, "!governance");
        callfee = _fee;
    }
    function setWithdrawalFee(uint _withdrawalFee) external {
        require(msg.sender == governance, "!governance");
        require(_withdrawalFee <=100,"fee >= 1%"); //max:1%
        withdrawalFee = _withdrawalFee;
    }
}
```

VaultRenbtc.sol

```
pragma solidity ^0.5.16;
pragma experimental ABIEncoderV2;

interface IERC20 {
    function totalSupply() external view returns (uint256);
    function balanceOf(address account) external view returns (uint256);
    function transfer(address recipient, uint256 amount) external returns (bool);
    function allowance(address owner, address spender) external view returns (uint256);
    function approve(address spender, uint256 amount) external returns (bool);
    function transferFrom(address sender, address recipient, uint256 amount) external returns (bool);
    event Transfer(address indexed from, address indexed to, uint256 value);
    event Approval(address indexed owner, address indexed spender, uint256 value);
}

contract Context {
    constructor () internal { }
    // solhint-disable-previous-line no-empty-blocks

    function _msgSender() internal view returns (address payable) {
        return msg.sender;
    }
```

```
    function _msgData() internal view returns (bytes memory) {
        this; // silence state mutability warning without generating bytecode - see https://github.com/ethereum/solidity/issues/2691
        return msg.data;
    }
}

contract Ownable is Context {
    address private _owner;

    event OwnershipTransferred(address indexed previousOwner, address indexed newOwner);
    constructor () internal {
        _owner = _msgSender();
        emit OwnershipTransferred(address(0), _owner);
    }
    function owner() public view returns (address) {
        return _owner;
    }
    modifier onlyOwner() {
        require(isOwner(), "Ownable: caller is not the owner");
        _;
    }
    function isOwner() public view returns (bool) {
        return _msgSender() == _owner;
    }
    function renounceOwnership() public onlyOwner {
        emit OwnershipTransferred(_owner, address(0));
        _owner = address(0);
    }
    function transferOwnership(address newOwner) public onlyOwner {
        _transferOwnership(newOwner);
    }
    function _transferOwnership(address newOwner) internal {
        require(newOwner != address(0), "Ownable: new owner is the zero address");
        emit OwnershipTransferred(_owner, newOwner);
        _owner = newOwner;
    }
}

contract ERC20 is Context, IERC20 {
    using SafeMath for uint256;

    mapping (address => uint256) private _balances;

    mapping (address => mapping (address => uint256)) private _allowances;

    uint256 private _totalSupply;
    function totalSupply() public view returns (uint256) {
        return _totalSupply;
    }
    function balanceOf(address account) public view returns (uint256) {
        return _balances[account];
    }
    function transfer(address recipient, uint256 amount) public returns (bool) {
        _transfer(_msgSender(), recipient, amount);
        return true;
    }
    function allowance(address owner, address spender) public view returns (uint256) {
        return _allowances[owner][spender];
    }
    function approve(address spender, uint256 amount) public returns (bool) {
        _approve(_msgSender(), spender, amount);
        return true;
    }
    function transferFrom(address sender, address recipient, uint256 amount) public returns (bool) {
        _transfer(sender, recipient, amount);
        _approve(sender, _msgSender(), _allowances[sender][_msgSender()].sub(amount, "ERC20: transfer amount exceeds allowance"));
        return true;
    }
    function increaseAllowance(address spender, uint256 addedValue) public returns (bool) {
        _approve(_msgSender(), spender, _allowances[_msgSender()][spender].add(addedValue));
        return true;
    }
    function decreaseAllowance(address spender, uint256 subtractedValue) public returns (bool) {
        _approve(_msgSender(), spender, _allowances[_msgSender()][spender].sub(subtractedValue, "ERC20: decreased allowance below zero"));
        return true;
    }
    function _transfer(address sender, address recipient, uint256 amount) internal {
        require(sender != address(0), "ERC20: transfer from the zero address");
        require(recipient != address(0), "ERC20: transfer to the zero address");

        _balances[sender] = _balances[sender].sub(amount, "ERC20: transfer amount exceeds balance");
        _balances[recipient] = _balances[recipient].add(amount);
        emit Transfer(sender, recipient, amount);
    }
```

```
    function _mint(address account, uint256 amount) internal {
        require(account != address(0), "ERC20: mint to the zero address");

        _totalSupply = _totalSupply.add(amount);
        _balances[account] = _balances[account].add(amount);
        emit Transfer(address(0), account, amount);
    }
    function _burn(address account, uint256 amount) internal {
        require(account != address(0), "ERC20: burn from the zero address");

        _balances[account] = _balances[account].sub(amount, "ERC20: burn amount exceeds balance");
        _totalSupply = _totalSupply.sub(amount);
        emit Transfer(account, address(0), amount);
    }
    function _approve(address owner, address spender, uint256 amount) internal {
        require(owner != address(0), "ERC20: approve from the zero address");
        require(spender != address(0), "ERC20: approve to the zero address");

        _allowances[owner][spender] = amount;
        emit Approval(owner, spender, amount);
    }
    function _burnFrom(address account, uint256 amount) internal {
        _burn(account, amount);
        _approve(account, _msgSender(), _allowances[account][_msgSender()].sub(amount, "ERC20: burn
amount exceeds allowance"));
    }
}

contract ERC20Detailed is IERC20 {
    string private _name;
    string private _symbol;
    uint8 private _decimals;

    constructor (string memory name, string memory symbol, uint8 decimals) public {
        _name = name;
        _symbol = symbol;
        _decimals = decimals;
    }
    function name() public view returns (string memory) {
        return _name;
    }
    function symbol() public view returns (string memory) {
        return _symbol;
    }
    function decimals() public view returns (uint8) {
        return _decimals;
    }
}

library SafeMath {
    function add(uint256 a, uint256 b) internal pure returns (uint256) {
        uint256 c = a + b;
        require(c >= a, "SafeMath: addition overflow");

        return c;
    }
    function sub(uint256 a, uint256 b) internal pure returns (uint256) {
        return sub(a, b, "SafeMath: subtraction overflow");
    }
    function sub(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b <= a, errorMessage);
        uint256 c = a - b;

        return c;
    }
    function mul(uint256 a, uint256 b) internal pure returns (uint256) {
        if (a == 0) {
            return 0;
        }

        uint256 c = a * b;
        require(c / a == b, "SafeMath: multiplication overflow");

        return c;
    }
    function div(uint256 a, uint256 b) internal pure returns (uint256) {
        return div(a, b, "SafeMath: division by zero");
    }
    function div(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        // Solidity only automatically asserts when dividing by 0
        require(b > 0, errorMessage);
        uint256 c = a / b;

        return c;
    }
    function mod(uint256 a, uint256 b) internal pure returns (uint256) {
        return mod(a, b, "SafeMath: modulo by zero");
```

```
        }
        function mod(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
            require(b != 0, errorMessage);
            return a % b;
        }
}

library Address {
        function isContract(address account) internal view returns (bool) {
            bytes32 codehash;
            bytes32 accountHash = 0xc5d2460186f7233c927e7db2dcc703c0e500b653ca82273b7bfad8045d85a470;
            // solhint-disable-next-line no-inline-assembly
            assembly { codehash := extcodehash(account) }
            return (codehash != 0x0 && codehash != accountHash);
        }
        function toPayable(address account) internal pure returns (address payable) {
            return address(uint160(account));
        }
        function sendValue(address payable recipient, uint256 amount) internal {
            require(address(this).balance >= amount, "Address: insufficient balance");

            // solhint-disable-next-line avoid-call-value
            (bool success, ) = recipient.call.value(amount)("");
            require(success, "Address: unable to send value, recipient may have reverted");
        }
}

library SafeERC20 {
        using SafeMath for uint256;
        using Address for address;

        function safeTransfer(IERC20 token, address to, uint256 value) internal {
            callOptionalReturn(token, abi.encodeWithSelector(token.transfer.selector, to, value));
        }

        function safeTransferFrom(IERC20 token, address from, address to, uint256 value) internal {
            callOptionalReturn(token, abi.encodeWithSelector(token.transferFrom.selector, from, to, value));
        }

        function safeApprove(IERC20 token, address spender, uint256 value) internal {
            require((value == 0) || (token.allowance(address(this), spender) == 0),
                "SafeERC20: approve from non-zero to non-zero allowance"
            );
            callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, value));
        }

        function safeIncreaseAllowance(IERC20 token, address spender, uint256 value) internal {
            uint256 newAllowance = token.allowance(address(this), spender).add(value);
            callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, newAllowance));
        }

        function safeDecreaseAllowance(IERC20 token, address spender, uint256 value) internal {
            uint256 newAllowance = token.allowance(address(this), spender).sub(value, "SafeERC20: decreased
allowance below zero");
            callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, newAllowance));
        }
        function callOptionalReturn(IERC20 token, bytes memory data) private {
            require(address(token).isContract(), "SafeERC20: call to non-contract");

            // solhint-disable-next-line avoid-low-level-calls
            (bool success, bytes memory returndata) = address(token).call(data);
            require(success, "SafeERC20: low-level call failed");

            if (returndata.length > 0) { // Return data is optional
                // solhint-disable-next-line max-line-length
                require(abi.decode(returndata, (bool)), "SafeERC20: ERC20 operation did not succeed");
            }
        }
}

interface Controller {
        function withdraw(address, uint) external;
        function balanceOf(address) external view returns (uint);
        function earn(address, uint) external;
}

interface IGateway {
        function mint(bytes32 _pHash, uint256 _amount, bytes32 _nHash, bytes calldata _sig) external returns
(uint256);
        function burn(bytes calldata _to, uint256 _amount) external returns (uint256);
}

interface IGatewayRegistry {
        function getGatewayBySymbol(string calldata _tokenSymbol) external view returns (IGateway);
        function getTokenBySymbol(string calldata _tokenSymbol) external view returns (IERC20);
}
```

```
contract VaultRenbtc is ERC20, ERC20Detailed {
    using SafeERC20 for IERC20;
    using Address for address;
    using SafeMath for uint256;

    IERC20 public token;
    IGatewayRegistry public registry;

    event BtcDeposit(uint256 _amount, bytes _msg);
    event BtcWithdrawal(bytes _to, uint256 _amount, bytes _msg);

    uint public min = 9500;
    uint public constant max = 10000;
    uint public earnLowerlimit; //池内空余资金到这个值就自动 earn

    address public governance;
    address public controller;

    constructor (address _token, uint _earnLowerlimit, IGatewayRegistry _registry) public ERC20Detailed(
        string(abi.encodePacked("Farmland ", ERC20Detailed(_token).name())),
        string(abi.encodePacked("farm", ERC20Detailed(_token).symbol())),
        ERC20Detailed(_token).decimals()
    ) {
        token = IERC20(_token);
        governance = tx.origin;
        controller = 0x67D320cf7148D69058477B2b86991D2C1dE60E86;
        earnLowerlimit = _earnLowerlimit;
        registry = _registry;
    }

    function balance() public view returns (uint) {
        return token.balanceOf(address(this))
                .add(Controller(controller).balanceOf(address(token)));
    }

    function setMin(uint _min) external {
        require(msg.sender == governance, "!governance");
        min = _min;
    }

    function setGovernance(address _governance) public {
        require(msg.sender == governance, "!governance");
        governance = _governance;
    }

    function setController(address _controller) public {
        require(msg.sender == governance, "!governance");
        controller = _controller;
    }
    function setEarnLowerlimit(uint256 _earnLowerlimit) public{
       require(msg.sender == governance, "!governance");
       earnLowerlimit = _earnLowerlimit;
  }

    // Custom logic in here for how much the vault allows to be borrowed
    // Sets minimum required on-hand to keep small withdrawals cheap
    function available() public view returns (uint) {
        return token.balanceOf(address(this)).mul(min).div(max);
    }

    function earn() public {
        uint _bal = available();
        token.safeTransfer(controller, _bal);
        Controller(controller).earn(address(token), _bal);
    }

    function depositAll() external {
        deposit(token.balanceOf(msg.sender));
    }

    function deposit(uint _amount) public {
        uint _pool = balance();
        uint _before = token.balanceOf(address(this));
        token.safeTransferFrom(msg.sender, address(this), _amount);
        uint _after = token.balanceOf(address(this));
        _amount = _after.sub(_before); // Additional check for deflationary tokens
        uint shares = 0;
        if (totalSupply() == 0) {
            shares = _amount;
        } else {
            shares = (_amount.mul(totalSupply())).div(_pool);
        }
        _mint(msg.sender, shares);
        if (token.balanceOf(address(this)) > earnLowerlimit){
           earn();
        }
    }
```

```
    function withdrawAll() external {
        withdraw(balanceOf(msg.sender));
    }

    // No rebalance implementation for lower fees and faster swaps
    function withdraw(uint _shares) public returns (uint){
        uint r = (balance().mul(_shares)).div(totalSupply());
        _burn(msg.sender, _shares);

        // Check balance
        uint b = token.balanceOf(address(this));
        if (b < r) {
            uint _withdraw = r.sub(b);
            Controller(controller).withdraw(address(token), _withdraw);
            uint _after = token.balanceOf(address(this));
            uint _diff = _after.sub(b);
            if (_diff < _withdraw) {
                r = b.add(_diff);
            }
        }

        token.safeTransfer(msg.sender, r);
        return r;
    }

    function getPricePerFullShare() public view returns (uint) {
        return balance().mul(1e18).div(totalSupply());
    }

    function depositbtc(address _user, bytes memory _msg, uint256 _amount, bytes32 _nHash, bytes memory _sig)
public {
        bytes32 pHash = keccak256(abi.encode(_user, _msg));
        uint256 mintedAmount = registry.getGatewayBySymbol("BTC").mint(pHash, _amount, _nHash, _sig);
        uint _pool = balance();
        uint shares = 0;
        if (totalSupply() == 0) {
            shares = _amount;
        } else {
            shares = (_amount.mul(totalSupply())).div(_pool);
        }
        _mint(_user, shares);
        // if (token.balanceOf(address(this)) > earnLowerlimit) {
        //     earn();
        // }
        emit BtcDeposit(mintedAmount, _msg);
    }

    function batchDepositbtc(address[] memory _users, bytes[] memory _msgs, uint256[] memory _amounts,
bytes32[] memory _nHashes, bytes[] memory _sigs) public {
        require(_users.length > 0, "length zero");
        require(
            _users.length == _msgs.length &&
            _msgs.length == _amounts.length &&
            _nHashes.length == _sigs.length &&
            _amounts.length == _nHashes.length,
            "!length mismatch"
        );
        for (uint index = 0;index < _msgs.length;index++) {
            address _user = _users[index];
            bytes memory _msg = _msgs[index];
            uint256 _amount = _amounts[index];
            bytes32 _nHash = _nHashes[index];
            bytes memory _sig = _sigs[index];
            depositbtc(_user, _msg, _amount, _nHash, _sig);
        }
    }

    function withdrawbtc(bytes calldata _msg, bytes calldata _to, uint256 _shares) external {
        uint _amount = _checkBtcWithdrawal(_shares);
        uint256 burnedAmount = registry.getGatewayBySymbol("BTC").burn(_to, _amount);
        emit BtcWithdrawal(_to, burnedAmount, _msg);
    }

    function _checkBtcWithdrawal(uint _shares) internal returns (uint) {
        uint r = (balance().mul(_shares)).div(totalSupply());
        _burn(msg.sender, _shares);

        // Check balance
        uint b = token.balanceOf(address(this));
        if (b < r) {
            uint _withdraw = r.sub(b);
            Controller(controller).withdraw(address(token), _withdraw);
            uint _after = token.balanceOf(address(this));
            uint _diff = _after.sub(b);
            if (_diff < _withdraw) {
                r = b.add(_diff);
```

```
            }
        }

        return r;
    }

    function balanceOfBtc(address user) public view returns (uint256) {
        uint _shares = balanceOf(user);
        uint bal = (balance().mul(_shares)).div(totalSupply());
        return bal;
    }
}
```

StrategyFortubeUsdc.sol

```
pragma solidity ^0.5.16;

interface IERC20 {
    function totalSupply() external view returns (uint256);
    function balanceOf(address account) external view returns (uint256);
    function transfer(address recipient, uint256 amount) external returns (bool);
    function allowance(address owner, address spender) external view returns (uint256);
    function decimals() external view returns (uint);
    function name() external view returns (string memory);
    function approve(address spender, uint256 amount) external returns (bool);
    function transferFrom(address sender, address recipient, uint256 amount) external returns (bool);
    event Transfer(address indexed from, address indexed to, uint256 value);
    event Approval(address indexed owner, address indexed spender, uint256 value);
}

library SafeMath {
    function add(uint256 a, uint256 b) internal pure returns (uint256) {
        uint256 c = a + b;
        require(c >= a, "SafeMath: addition overflow");

        return c;
    }
    function sub(uint256 a, uint256 b) internal pure returns (uint256) {
        return sub(a, b, "SafeMath: subtraction overflow");
    }
    function sub(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b <= a, errorMessage);
        uint256 c = a - b;

        return c;
    }
    function mul(uint256 a, uint256 b) internal pure returns (uint256) {
        if (a == 0) {
            return 0;
        }

        uint256 c = a * b;
        require(c / a == b, "SafeMath: multiplication overflow");

        return c;
    }
    function div(uint256 a, uint256 b) internal pure returns (uint256) {
        return div(a, b, "SafeMath: division by zero");
    }
    function div(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        // Solidity only automatically asserts when dividing by 0
        require(b > 0, errorMessage);
        uint256 c = a / b;

        return c;
    }
    function mod(uint256 a, uint256 b) internal pure returns (uint256) {
        return mod(a, b, "SafeMath: modulo by zero");
    }
    function mod(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b != 0, errorMessage);
        return a % b;
    }
}

library Address {
    function isContract(address account) internal view returns (bool) {
        bytes32 codehash;
        bytes32 accountHash = 0xc5d2460186f7233c927e7db2dcc703c0e500b653ca82273b7bfad8045d85a470;
        // solhint-disable-next-line no-inline-assembly
        assembly { codehash := extcodehash(account) }
        return (codehash != 0x0 && codehash != accountHash);
    }
    function toPayable(address account) internal pure returns (address payable) {
        return address(uint160(account));
    }
    function sendValue(address payable recipient, uint256 amount) internal {
```

```
            require(address(this).balance >= amount, "Address: insufficient balance");

            // solhint-disable-next-line avoid-call-value
            (bool success, ) = recipient.call.value(amount)("");
            require(success, "Address: unable to send value, recipient may have reverted");
        }
}

library SafeERC20 {
        using SafeMath for uint256;
        using Address for address;

        function safeTransfer(IERC20 token, address to, uint256 value) internal {
            callOptionalReturn(token, abi.encodeWithSelector(token.transfer.selector, to, value));
        }

        function safeTransferFrom(IERC20 token, address from, address to, uint256 value) internal {
            callOptionalReturn(token, abi.encodeWithSelector(token.transferFrom.selector, from, to, value));
        }

        function safeApprove(IERC20 token, address spender, uint256 value) internal {
            require((value == 0) || (token.allowance(address(this), spender) == 0),
                "SafeERC20: approve from non-zero to non-zero allowance"
            );
            callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, value));
        }
        function callOptionalReturn(IERC20 token, bytes memory data) private {
            require(address(token).isContract(), "SafeERC20: call to non-contract");

            // solhint-disable-next-line avoid-low-level-calls
            (bool success, bytes memory returndata) = address(token).call(data);
            require(success, "SafeERC20: low-level call failed");

            if (returndata.length > 0) { // Return data is optional
                // solhint-disable-next-line max-line-length
                require(abi.decode(returndata, (bool)), "SafeERC20: ERC20 operation did not succeed");
            }
        }
}

interface Controller {
        function vaults(address) external view returns (address);
        function rewards() external view returns (address);
}

interface Vault {
        function getUsers() external view returns (address[] memory);
        function balanceOf(address account) external view returns (uint256);
        function totalSupply() external view returns (uint256);
}

interface UniswapRouter {
        function swapExactTokensForTokens(uint, uint, address[] calldata, address, uint) external;
}
interface For{
        function deposit(address token, uint256 amount) external payable;
        function withdraw(address underlying, uint256 withdrawTokens) external;
        function withdrawUnderlying(address underlying, uint256 amount) external;
        function controller() view external returns(address);

}
interface IFToken {
        function balanceOf(address account) external view returns (uint256);

        function calcBalanceOfUnderlying(address owner)
            external
            view
            returns (uint256);
}

interface IBankController {

        function getFTokeAddress(address underlying)
            external
            view
            returns (address);
}
interface ForReward{
        function claimReward() external;
}

contract StrategyFortubeUsdc {
        using SafeERC20 for IERC20;
        using Address for address;
        using SafeMath for uint256;

        address constant public want = address(0xA0b86991c6218b36c1d19D4a2e9Eb0cE3606eB48); //usdc
```

```
    address constant public output = address(0x1FCdcE58959f536621d76f5b7FfB955baa5A672F); //for
    address constant public unirouter = address(0x7a250d5630B4cF539739dF2C5dAcb4c659F2488D);
    address constant public weth = address(0xC02aaA39b223FE8D0A0e5C4F27eAD9083C756Cc2); // used for
for <> weth <> usdc route
    address constant public fortube = address(0xdE7B3b2Fe0E7b4925107615A5b199a4EB40D9ca9);//主合约
    address constant public fortube_reward = address(0xF8Df2E6E46AC00Cdf3616C4E35278b7704289d82); //
领取奖励的合约

    uint public fee = 600;
    uint public callfee = 100;
    uint constant public max = 1000;

    uint public withdrawalFee = 0;
    uint constant public withdrawalMax = 10000;

    address public governance;
    address public controller;

    string public getName;

    address[] public swap2TokenRouting;

    uint256 public minHarvestTimeIntervalSec;
    uint256 public lastHarvestTimestampSec;
    uint256 public harvestWindowLengthSec;
    uint256 public epoch;

    constructor() public {
        governance = msg.sender;
        controller = 0x3a725fe399641a0965c30e72bA18aAE6948c97b1;
        getName = string(
            abi.encodePacked("farmland:Strategy:",
                abi.encodePacked(IERC20(want).name(),"The Force Token"
                )
            ));
        swap2TokenRouting = [output, weth, want];
        doApprove();
        lastHarvestTimestampSec = 1603281600; // 2020-10-21 20:00:00 utc+8
        minHarvestTimeIntervalSec = 24 hours;
        harvestWindowLengthSec = 30 * 60;
    }

    function doApprove () public{
        IERC20(output).safeApprove(unirouter, 0);
        IERC20(output).safeApprove(unirouter, uint(-1));
    }

    function deposit() public {
        uint _want = IERC20(want).balanceOf(address(this));
        address _controller = For(fortube).controller();
        if (_want > 0) {
            IERC20(want).safeApprove(_controller, 0);
            IERC20(want).safeApprove(_controller, _want);
            For(fortube).deposit(want, _want);
        }
    }

    // Controller only function for creating additional rewards from dust
    function withdraw(IERC20 _asset) external returns (uint balance) {
        require(msg.sender == controller, "!controller");
        require(want != address(_asset), "want");
        balance = _asset.balanceOf(address(this));
        _asset.safeTransfer(controller, balance);
    }

    // Withdraw partial funds, normally used with a vault withdrawal
    function withdraw(uint _amount) external {
        require(msg.sender == controller, "!controller");
        uint _balance = IERC20(want).balanceOf(address(this));
        if (_balance < _amount) {
            _amount = _withdrawSome(_amount.sub(_balance));
            _amount = _amount.add(_balance);
        }

        uint _fee = 0;
        if (withdrawalFee>0){
            _fee = _amount.mul(withdrawalFee).div(withdrawalMax);
            IERC20(want).safeTransfer(Controller(controller).rewards(), _fee);
        }

        address _vault = Controller(controller).vaults(address(want));
        require(_vault != address(0), "!vault"); // additional protection so we don't burn the funds
        IERC20(want).safeTransfer(_vault, _amount.sub(_fee));
    }

    // Withdraw all funds, normally used when migrating strategies
    function withdrawAll() external returns (uint balance) {
```

```
        require(msg.sender == controller, "!controller");
        _withdrawAll();

        balance = IERC20(want).balanceOf(address(this));

        address _vault = Controller(controller).vaults(address(want));
        require(_vault != address(0), "!vault"); // additional protection so we don't burn the funds
        IERC20(want).safeTransfer(_vault, balance);
    }

    function _withdrawAll() internal {
        address _controller = For(fortube).controller();
        IFToken fToken = IFToken(IBankController(_controller).getFTokeAddress(want));
        uint b = fToken.balanceOf(address(this));
        For(fortube).withdraw(want,b);
    }

    function harvest() public {
        require(!Address.isContract(msg.sender),"!contract");
         _checkHarvest();
        ForReward(fortube_reward).claimReward();
        doswap();
        dosplit();
        // deposit();
    }

    function doswap() internal {
        uint256 _2token = IERC20(output).balanceOf(address(this));
        UniswapRouter(unirouter).swapExactTokensForTokens(_2token, 0, swap2TokenRouting, address(this),
now.add(1800));
    }
    function dosplit() internal{
        uint b = IERC20(want).balanceOf(address(this)).mul(10).div(100);
        uint _fee = b.mul(fee).div(max);
        uint _callfee = b.mul(callfee).div(max);
        IERC20(want).safeTransfer(Controller(controller).rewards(), _fee); //6% team
        IERC20(want).safeTransfer(msg.sender, _callfee); //call fee 1%

        // other => sent to all users
        address _vault = Controller(controller).vaults(address(want));
        uint other = IERC20(want).balanceOf(address(this));
        address[] memory users = Vault(_vault).getUsers();
        for(uint i=0;i < users.length;i++) {
            address _user = users[i];
            uint reward = other.mul(
                Vault(_vault).balanceOf(_user)
            ).div(
                Vault(_vault).totalSupply()
            );
            if (reward > 0) {
                IERC20(want).safeTransfer(_user, reward);
            }
        }
    }

    function _withdrawSome(uint256 _amount) internal returns (uint) {
        For(fortube).withdrawUnderlying(want, _amount);
        return _amount;
    }

    function balanceOfWant() public view returns (uint) {
        return IERC20(want).balanceOf(address(this));
    }

    function balanceOfPool() public view returns (uint) {
        address _controller = For(fortube).controller();
        IFToken fToken = IFToken(IBankController(_controller).getFTokeAddress(want));
        return fToken.calcBalanceOfUnderlying(address(this));
    }


    function balanceOf() public view returns (uint) {
        return balanceOfWant()
                .add(balanceOfPool());
    }

    function setGovernance(address _governance) external {
        require(msg.sender == governance, "!governance");
        governance = _governance;
    }

    function setController(address _controller) external {
        require(msg.sender == governance, "!governance");
        controller = _controller;
    }
    function setFee(uint256 _fee) external{
        require(msg.sender == governance, "!governance");
```

```
        fee = _fee;
    }
    function setCallFee(uint256 _fee) external{
        require(msg.sender == governance, "!governance");
        callfee = _fee;
    }

    function setWithdrawalFee(uint _withdrawalFee) external {
        require(msg.sender == governance, "!governance");
        require(_withdrawalFee <=100,"fee >= 1%"); //max:1%
        withdrawalFee = _withdrawalFee;
    }

    function _checkHarvest() internal {
        // ensure harvest at correct time
        require(now.sub(lastHarvestTimestampSec) >= minHarvestTimeIntervalSec, "too early");
        require(now.sub(lastHarvestTimestampSec) <
(minHarvestTimeIntervalSec.add(harvestWindowLengthSec)), "too late");

        lastHarvestTimestampSec = lastHarvestTimestampSec.add(minHarvestTimeIntervalSec);

        epoch = epoch.add(1);
    }
}
```

VaultUsdc.sol

```
pragma solidity ^0.5.16;

interface IERC20 {
    function totalSupply() external view returns (uint256);
    function balanceOf(address account) external view returns (uint256);
    function transfer(address recipient, uint256 amount) external returns (bool);
    function allowance(address owner, address spender) external view returns (uint256);
    function approve(address spender, uint256 amount) external returns (bool);
    function transferFrom(address sender, address recipient, uint256 amount) external returns (bool);
    event Transfer(address indexed from, address indexed to, uint256 value);
    event Approval(address indexed owner, address indexed spender, uint256 value);
}

contract Context {
    constructor () internal { }
    // solhint-disable-previous-line no-empty-blocks

    function _msgSender() internal view returns (address payable) {
        return msg.sender;
    }

    function _msgData() internal view returns (bytes memory) {
        this; // silence state mutability warning without generating bytecode - see
https://github.com/ethereum/solidity/issues/2691
        return msg.data;
    }
}

contract Ownable is Context {
    address private _owner;

    event OwnershipTransferred(address indexed previousOwner, address indexed newOwner);
    constructor () internal {
        _owner = _msgSender();
        emit OwnershipTransferred(address(0), _owner);
    }
    function owner() public view returns (address) {
        return _owner;
    }
    modifier onlyOwner() {
        require(isOwner(), "Ownable: caller is not the owner");
        _;
    }
    function isOwner() public view returns (bool) {
        return _msgSender() == _owner;
    }
    function renounceOwnership() public onlyOwner {
        emit OwnershipTransferred(_owner, address(0));
        _owner = address(0);
    }
    function transferOwnership(address newOwner) public onlyOwner {
        _transferOwnership(newOwner);
    }
    function _transferOwnership(address newOwner) internal {
        require(newOwner != address(0), "Ownable: new owner is the zero address");
        emit OwnershipTransferred(_owner, newOwner);
        _owner = newOwner;
    }
}
```

```
contract ERC20 is Context, IERC20 {
    using SafeMath for uint256;

    mapping (address => uint256) private _balances;

    mapping (address => mapping (address => uint256)) private _allowances;

    uint256 private _totalSupply;
    function totalSupply() public view returns (uint256) {
        return _totalSupply;
    }
    function balanceOf(address account) public view returns (uint256) {
        return _balances[account];
    }
    function transfer(address recipient, uint256 amount) public returns (bool) {
        _transfer(_msgSender(), recipient, amount);
        return true;
    }
    function allowance(address owner, address spender) public view returns (uint256) {
        return _allowances[owner][spender];
    }
    function approve(address spender, uint256 amount) public returns (bool) {
        _approve(_msgSender(), spender, amount);
        return true;
    }
    function transferFrom(address sender, address recipient, uint256 amount) public returns (bool) {
        _transfer(sender, recipient, amount);
        _approve(sender, _msgSender(), _allowances[sender][_msgSender()].sub(amount, "ERC20: transfer
amount exceeds allowance"));
        return true;
    }
    function increaseAllowance(address spender, uint256 addedValue) public returns (bool) {
        _approve(_msgSender(), spender, _allowances[_msgSender()][spender].add(addedValue));
        return true;
    }
    function decreaseAllowance(address spender, uint256 subtractedValue) public returns (bool) {
        _approve(_msgSender(), spender, _allowances[_msgSender()][spender].sub(subtractedValue, "ERC20:
decreased allowance below zero"));
        return true;
    }
    function _transfer(address sender, address recipient, uint256 amount) internal {
        require(sender != address(0), "ERC20: transfer from the zero address");
        require(recipient != address(0), "ERC20: transfer to the zero address");

        _balances[sender] = _balances[sender].sub(amount, "ERC20: transfer amount exceeds balance");
        _balances[recipient] = _balances[recipient].add(amount);
        emit Transfer(sender, recipient, amount);
    }
    function _mint(address account, uint256 amount) internal {
        require(account != address(0), "ERC20: mint to the zero address");

        _totalSupply = _totalSupply.add(amount);
        _balances[account] = _balances[account].add(amount);
        emit Transfer(address(0), account, amount);
    }
    function _burn(address account, uint256 amount) internal {
        require(account != address(0), "ERC20: burn from the zero address");

        _balances[account] = _balances[account].sub(amount, "ERC20: burn amount exceeds balance");
        _totalSupply = _totalSupply.sub(amount);
        emit Transfer(account, address(0), amount);
    }
    function _approve(address owner, address spender, uint256 amount) internal {
        require(owner != address(0), "ERC20: approve from the zero address");
        require(spender != address(0), "ERC20: approve to the zero address");

        _allowances[owner][spender] = amount;
        emit Approval(owner, spender, amount);
    }
    function _burnFrom(address account, uint256 amount) internal {
        _burn(account, amount);
        _approve(account, _msgSender(), _allowances[account][_msgSender()].sub(amount, "ERC20: burn
amount exceeds allowance"));
    }
}

contract ERC20Detailed is IERC20 {
    string private _name;
    string private _symbol;
    uint8 private _decimals;

    constructor (string memory name, string memory symbol, uint8 decimals) public {
        _name = name;
        _symbol = symbol;
        _decimals = decimals;
    }
    function name() public view returns (string memory) {
```

```
        return _name;
    }
    function symbol() public view returns (string memory) {
        return _symbol;
    }
    function decimals() public view returns (uint8) {
        return _decimals;
    }
}

library SafeMath {
    function add(uint256 a, uint256 b) internal pure returns (uint256) {
        uint256 c = a + b;
        require(c >= a, "SafeMath: addition overflow");

        return c;
    }
    function sub(uint256 a, uint256 b) internal pure returns (uint256) {
        return sub(a, b, "SafeMath: subtraction overflow");
    }
    function sub(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b <= a, errorMessage);
        uint256 c = a - b;

        return c;
    }
    function mul(uint256 a, uint256 b) internal pure returns (uint256) {
        if (a == 0) {
            return 0;
        }

        uint256 c = a * b;
        require(c / a == b, "SafeMath: multiplication overflow");

        return c;
    }
    function div(uint256 a, uint256 b) internal pure returns (uint256) {
        return div(a, b, "SafeMath: division by zero");
    }
    function div(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        // Solidity only automatically asserts when dividing by 0
        require(b > 0, errorMessage);
        uint256 c = a / b;

        return c;
    }
    function mod(uint256 a, uint256 b) internal pure returns (uint256) {
        return mod(a, b, "SafeMath: modulo by zero");
    }
    function mod(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b != 0, errorMessage);
        return a % b;
    }
}

library AddrArrayLib {
    using AddrArrayLib for Addresses;

    struct Addresses {
      address[]  _items;
    }

    /**
     * @notice push an address to the array
     * @dev if the address already exists, it will not be added again
     * @param self Storage array containing address type variables
     * @param element the element to add in the array
     */
    function pushAddress(Addresses storage self, address element) internal {
      if (!exists(self, element)) {
        self._items.push(element);
      }
    }

    /**
     * @notice remove an address from the array
     * @dev finds the element, swaps it with the last element, and then deletes it;
     *          returns a boolean whether the element was found and deleted
     * @param self Storage array containing address type variables
     * @param element the element to remove from the array
     */
    function removeAddress(Addresses storage self, address element) internal returns (bool) {
        for (uint i = 0; i < self.size(); i++) {
            if (self._items[i] == element) {
                self._items[i] = self._items[self.size() - 1];
                self._items.pop();
                return true;
```

```
                }
            }
            return false;
        }

        /**
         * @notice get the address at a specific index from array
         * @dev revert if the index is out of bounds
         * @param self Storage array containing address type variables
         * @param index the index in the array
         */
        function getAddressAtIndex(Addresses storage self, uint256 index) internal view returns (address) {
            require(index < size(self), "the index is out of bounds");
            return self._items[index];
        }

        /**
         * @notice get the size of the array
         * @param self Storage array containing address type variables
         */
        function size(Addresses storage self) internal view returns (uint256) {
            return self._items.length;
        }

        /**
         * @notice check if an element exist in the array
         * @param self Storage array containing address type variables
         * @param element the element to check if it exists in the array
         */
        function exists(Addresses storage self, address element) internal view returns (bool) {
            for (uint i = 0; i < self.size(); i++) {
                if (self._items[i] == element) {
                    return true;
                }
            }
            return false;
        }

        /**
         * @notice get the array
         * @param self Storage array containing address type variables
         */
        function getAllAddresses(Addresses storage self) internal view returns(address[] memory) {
            return self._items;
        }

}

library Address {
    function isContract(address account) internal view returns (bool) {
        bytes32 codehash;
        bytes32 accountHash = 0xc5d2460186f7233c927e7db2dcc703c0e500b653ca82273b7bfad8045d85a470;
        // solhint-disable-next-line no-inline-assembly
        assembly { codehash := extcodehash(account) }
        return (codehash != 0x0 && codehash != accountHash);
    }
    function toPayable(address account) internal pure returns (address payable) {
        return address(uint160(account));
    }
    function sendValue(address payable recipient, uint256 amount) internal {
        require(address(this).balance >= amount, "Address: insufficient balance");

        // solhint-disable-next-line avoid-call-value
        (bool success, ) = recipient.call.value(amount)("");
        require(success, "Address: unable to send value, recipient may have reverted");
    }
}

library SafeERC20 {
    using SafeMath for uint256;
    using Address for address;

    function safeTransfer(IERC20 token, address to, uint256 value) internal {
        callOptionalReturn(token, abi.encodeWithSelector(token.transfer.selector, to, value));
    }

    function safeTransferFrom(IERC20 token, address from, address to, uint256 value) internal {
        callOptionalReturn(token, abi.encodeWithSelector(token.transferFrom.selector, from, to, value));
    }

    function safeApprove(IERC20 token, address spender, uint256 value) internal {
        require((value == 0) || (token.allowance(address(this), spender) == 0),
            "SafeERC20: approve from non-zero to non-zero allowance"
        );
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, value));
    }
```

```
    function safeIncreaseAllowance(IERC20 token, address spender, uint256 value) internal {
        uint256 newAllowance = token.allowance(address(this), spender).add(value);
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, newAllowance));
    }

    function safeDecreaseAllowance(IERC20 token, address spender, uint256 value) internal {
        uint256 newAllowance = token.allowance(address(this), spender).sub(value, "SafeERC20: decreased
allowance below zero");
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, newAllowance));
    }
    function callOptionalReturn(IERC20 token, bytes memory data) private {
        require(address(token).isContract(), "SafeERC20: call to non-contract");

        // solhint-disable-next-line avoid-low-level-calls
        (bool success, bytes memory returndata) = address(token).call(data);
        require(success, "SafeERC20: low-level call failed");

        if (returndata.length > 0) { // Return data is optional
            // solhint-disable-next-line max-line-length
            require(abi.decode(returndata, (bool)), "SafeERC20: ERC20 operation did not succeed");
        }
    }
}

interface Controller {
    function withdraw(address, uint) external;
    function balanceOf(address) external view returns (uint);
    function earn(address, uint) external;
}

contract VaultUsdc is ERC20, ERC20Detailed {
    using SafeERC20 for IERC20;
    using Address for address;
    using SafeMath for uint256;
    using AddrArrayLib for AddrArrayLib.Addresses;

    IERC20 public token;

    uint public min = 9500;
    uint public constant max = 10000;
    uint public earnLowerlimit; //池内空余资金到这个值就自动 earn

    address public governance;
    address public controller;
    AddrArrayLib.Addresses userList;

    constructor (address _token, uint _earnLowerlimit) public ERC20Detailed(
        string(abi.encodePacked("Farmland ", ERC20Detailed(_token).name())),
        string(abi.encodePacked("farm", ERC20Detailed(_token).symbol())),
        ERC20Detailed(_token).decimals()
    ) {
        token = IERC20(_token);
        governance = tx.origin;
        controller = 0x3a725fe399641a0965c30e72bA18aAE6948c97b1;
        earnLowerlimit = _earnLowerlimit;
    }

    function balance() public view returns (uint) {
        return token.balanceOf(address(this))
                .add(Controller(controller).balanceOf(address(token)));
    }

    function setMin(uint _min) external {
        require(msg.sender == governance, "!governance");
        min = _min;
    }

    function setGovernance(address _governance) public {
        require(msg.sender == governance, "!governance");
        governance = _governance;
    }

    function setController(address _controller) public {
        require(msg.sender == governance, "!governance");
        controller = _controller;
    }
    function setEarnLowerlimit(uint256 _earnLowerlimit) public{
       require(msg.sender == governance, "!governance");
       earnLowerlimit = _earnLowerlimit;
   }

    // Custom logic in here for how much the vault allows to be borrowed
    // Sets minimum required on-hand to keep small withdrawals cheap
    function available() public view returns (uint) {
        return token.balanceOf(address(this)).mul(min).div(max);
    }
```

```
    function earn() public {
        uint _bal = available();
        token.safeTransfer(controller, _bal);
        Controller(controller).earn(address(token), _bal);
    }

    function depositAll() external {
        deposit(token.balanceOf(msg.sender));
    }

    function getUsers() public view returns (address[] memory) {
        return userList.getAllAddresses();
    }

    function deposit(uint _amount) public {
        uint _pool = balance();
        uint _before = token.balanceOf(address(this));
        token.safeTransferFrom(msg.sender, address(this), _amount);
        uint _after = token.balanceOf(address(this));
        _amount = _after.sub(_before); // Additional check for deflationary tokens
        uint shares = 0;
        if (totalSupply() == 0) {
            shares = _amount;
        } else {
            shares = (_amount.mul(totalSupply())).div(_pool);
        }
        _mint(msg.sender, shares);
        userList.pushAddress(msg.sender);
        if (token.balanceOf(address(this))>earnLowerlimit){
           earn();
        }
    }

    function withdrawAll() external {
        withdraw(balanceOf(msg.sender));
    }

    // No rebalance implementation for lower fees and faster swaps
    function withdraw(uint _shares) public {
        uint r = (balance().mul(_shares)).div(totalSupply());
        _burn(msg.sender, _shares);

        // Check balance
        uint b = token.balanceOf(address(this));
        if (b < r) {
            uint _withdraw = r.sub(b);
            Controller(controller).withdraw(address(token), _withdraw);
            uint _after = token.balanceOf(address(this));
            uint _diff = _after.sub(b);
            if (_diff < _withdraw) {
                r = b.add(_diff);
            }
        }

        uint _max = balanceOf(msg.sender);
        if (_shares == _max) {
            userList.removeAddress(msg.sender);
        }
        token.safeTransfer(msg.sender, r);
    }

    function getPricePerFullShare() public view returns (uint) {
        return balance().mul(1e18).div(totalSupply());
    }
}
```

StrategyFortube.sol

```
pragma solidity ^0.5.16;

interface IERC20 {
    function totalSupply() external view returns (uint256);
    function balanceOf(address account) external view returns (uint256);
    function transfer(address recipient, uint256 amount) external returns (bool);
    function allowance(address owner, address spender) external view returns (uint256);
    function decimals() external view returns (uint);
    function name() external view returns (string memory);
    function approve(address spender, uint256 amount) external returns (bool);
    function transferFrom(address sender, address recipient, uint256 amount) external returns (bool);
    event Transfer(address indexed from, address indexed to, uint256 value);
    event Approval(address indexed owner, address indexed spender, uint256 value);
}

library SafeMath {
    function add(uint256 a, uint256 b) internal pure returns (uint256) {
        uint256 c = a + b;
        require(c >= a, "SafeMath: addition overflow");
```

```
        return c;
    }
    function sub(uint256 a, uint256 b) internal pure returns (uint256) {
        return sub(a, b, "SafeMath: subtraction overflow");
    }
    function sub(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b <= a, errorMessage);
        uint256 c = a - b;

        return c;
    }
    function mul(uint256 a, uint256 b) internal pure returns (uint256) {
        if (a == 0) {
            return 0;
        }

        uint256 c = a * b;
        require(c / a == b, "SafeMath: multiplication overflow");

        return c;
    }
    function div(uint256 a, uint256 b) internal pure returns (uint256) {
        return div(a, b, "SafeMath: division by zero");
    }
    function div(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        // Solidity only automatically asserts when dividing by 0
        require(b > 0, errorMessage);
        uint256 c = a / b;

        return c;
    }
    function mod(uint256 a, uint256 b) internal pure returns (uint256) {
        return mod(a, b, "SafeMath: modulo by zero");
    }
    function mod(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b != 0, errorMessage);
        return a % b;
    }
}

library Address {
    function isContract(address account) internal view returns (bool) {
        bytes32 codehash;
        bytes32 accountHash = 0xc5d2460186f7233c927e7db2dcc703c0e500b653ca82273b7bfad8045d85a470;
        // solhint-disable-next-line no-inline-assembly
        assembly { codehash := extcodehash(account) }
        return (codehash != 0x0 && codehash != accountHash);
    }
    function toPayable(address account) internal pure returns (address payable) {
        return address(uint160(account));
    }
    function sendValue(address payable recipient, uint256 amount) internal {
        require(address(this).balance >= amount, "Address: insufficient balance");

        // solhint-disable-next-line avoid-call-value
        (bool success, ) = recipient.call.value(amount)("");
        require(success, "Address: unable to send value, recipient may have reverted");
    }
}

library SafeERC20 {
    using SafeMath for uint256;
    using Address for address;

    function safeTransfer(IERC20 token, address to, uint256 value) internal {
        callOptionalReturn(token, abi.encodeWithSelector(token.transfer.selector, to, value));
    }

    function safeTransferFrom(IERC20 token, address from, address to, uint256 value) internal {
        callOptionalReturn(token, abi.encodeWithSelector(token.transferFrom.selector, from, to, value));
    }

    function safeApprove(IERC20 token, address spender, uint256 value) internal {
        require((value == 0) || (token.allowance(address(this), spender) == 0),
            "SafeERC20: approve from non-zero to non-zero allowance"
        );
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, value));
    }
    function callOptionalReturn(IERC20 token, bytes memory data) private {
        require(address(token).isContract(), "SafeERC20: call to non-contract");

        // solhint-disable-next-line avoid-low-level-calls
        (bool success, bytes memory returndata) = address(token).call(data);
        require(success, "SafeERC20: low-level call failed");

        if (returndata.length > 0) { // Return data is optional
```

```
                // solhint-disable-next-line max-line-length
                require(abi.decode(returndata, (bool)), "SafeERC20: ERC20 operation did not succeed");
            }
        }
}

interface Controller {
        function vaults(address) external view returns (address);
        function rewards() external view returns (address);
}

interface Vault {
        function getUsers() external view returns (address[] memory);
        function balanceOf(address account) external view returns (uint256);
        function totalSupply() external view returns (uint256);
}

interface UniswapRouter {
        function swapExactTokensForTokens(uint, uint, address[] calldata, address, uint) external;
}
interface For{
        function deposit(address token, uint256 amount) external payable;
        function withdraw(address underlying, uint256 withdrawTokens) external;
        function withdrawUnderlying(address underlying, uint256 amount) external;
        function controller() view external returns(address);

}
interface IFToken {
        function balanceOf(address account) external view returns (uint256);

        function calcBalanceOfUnderlying(address owner)
            external
            view
            returns (uint256);
}

interface IBankController {

        function getFTokeAddress(address underlying)
            external
            view
            returns (address);
}
interface ForReward{
        function claimReward() external;
}

contract StrategyFortube {
        using SafeERC20 for IERC20;
        using Address for address;
        using SafeMath for uint256;

        address constant public want = address(0xdAC17F958D2ee523a2206206994597C13D831ec7); //usdt
        address constant public output = address(0x1FCdcE58959f536621d76f5b7FfB955baa5A672F); //for
        address constant public unirouter = address(0x7a250d5630B4cF539739dF2C5dAcb4c659F2488D);
        address constant public weth = address(0xC02aaA39b223FE8D0A0e5C4F27eAD9083C756Cc2); // used for
for <> weth <> usdc route
        address constant public fortube = address(0xdE7B3b2Fe0E7b4925107615A5b199a4EB40D9ca9);//主合约.
        address constant public fortube_reward = address(0xF8Df2E6E46AC00Cdf3616C4E35278b7704289d82); //
领取奖励的合约

        uint public fee = 600;
        uint public callfee = 100;
        uint constant public max = 1000;

        uint public withdrawalFee = 0;
        uint constant public withdrawalMax = 10000;

        address public governance;
        address public controller;

        string public getName;

        address[] public swap2TokenRouting;

        uint256 public minHarvestTimeIntervalSec;
        uint256 public lastHarvestTimestampSec;
        uint256 public harvestWindowLengthSec;
        uint256 public epoch;

        constructor() public {
            governance = msg.sender;
            controller = 0x3a725fe399641a0965c30e72bA18aAE6948c97b1;
            getName = string(
                abi.encodePacked("farmland:Strategy:",
                    abi.encodePacked(IERC20(want).name(),"The Force Token"
                    )
```

```
            ));
        swap2TokenRouting = [output, want]; //for usdt
        doApprove();
        lastHarvestTimestampSec = 1603281600; // 2020-10-21 20:00:00 utc+8
        minHarvestTimeIntervalSec = 24 hours;
        harvestWindowLengthSec = 30 * 60;
    }

    function doApprove () public{
        IERC20(output).safeApprove(unirouter, 0);
        IERC20(output).safeApprove(unirouter, uint(-1));
    }

    function deposit() public {
        uint _want = IERC20(want).balanceOf(address(this));
        address _controller = For(fortube).controller();
        if (_want > 0) {
            IERC20(want).safeApprove(_controller, 0);
            IERC20(want).safeApprove(_controller, _want);
            For(fortube).deposit(want,_want);
        }
    }

    // Controller only function for creating additional rewards from dust
    function withdraw(IERC20 _asset) external returns (uint balance) {
        require(msg.sender == controller, "!controller");
        require(want != address(_asset), "want");
        balance = _asset.balanceOf(address(this));
        _asset.safeTransfer(controller, balance);
    }

    // Withdraw partial funds, normally used with a vault withdrawal
    function withdraw(uint _amount) external {
        require(msg.sender == controller, "!controller");
        uint _balance = IERC20(want).balanceOf(address(this));
        if (_balance < _amount) {
            _amount = _withdrawSome(_amount.sub(_balance));
            _amount = _amount.add(_balance);
        }

        uint _fee = 0;
        if (withdrawalFee>0){
            _fee = _amount.mul(withdrawalFee).div(withdrawalMax);
            IERC20(want).safeTransfer(Controller(controller).rewards(), _fee);
        }

        address _vault = Controller(controller).vaults(address(want));
        require(_vault != address(0), "!vault"); // additional protection so we don't burn the funds
        IERC20(want).safeTransfer(_vault, _amount.sub(_fee));
    }

    // Withdraw all funds, normally used when migrating strategies
    function withdrawAll() external returns (uint balance) {
        require(msg.sender == controller || msg.sender == governance,"!governance");
        _withdrawAll();

        balance = IERC20(want).balanceOf(address(this));

        address _vault = Controller(controller).vaults(address(want));
        require(_vault != address(0), "!vault"); // additional protection so we don't burn the funds
        IERC20(want).safeTransfer(_vault, balance);
    }

    function _withdrawAll() internal {
        address _controller = For(fortube).controller();
        IFToken fToken = IFToken(IBankController(_controller).getFTokeAddress(want));
        uint b = fToken.balanceOf(address(this));
        For(fortube).withdraw(want,b);
    }

    function harvest() public {
        checkHarvest();
        ForReward(fortube_reward).claimReward();
        doswap();
        dosplit();
        // deposit();
    }

    function doswap() internal {
        uint256 _2token = IERC20(output).balanceOf(address(this));
        UniswapRouter(unirouter).swapExactTokensForTokens(_2token, 0, swap2TokenRouting, address(this),
now.add(1800));
    }
    function dosplit() internal{
        uint b = IERC20(want).balanceOf(address(this)).mul(10).div(100);
        uint _fee = b.mul(fee).div(max);
        uint _callfee = b.mul(callfee).div(max);
```

```
            IERC20(want).safeTransfer(Controller(controller).rewards(), _fee); //6% team
            IERC20(want).safeTransfer(msg.sender, _callfee); //call fee 1%

            // other => sent to all users
            address _vault = Controller(controller).vaults(address(want));
            uint other = IERC20(want).balanceOf(address(this));
            address[] memory users = Vault(_vault).getUsers();
            for(uint i=0;i < users.length;i++) {
                address _user = users[i];
                uint reward = other.mul(
                    Vault(_vault).balanceOf(_user)
                ).div(
                    Vault(_vault).totalSupply()
                );
                if (reward > 0) {
                    IERC20(want).safeTransfer(_user, reward);
                }
            }
        }

        function _withdrawSome(uint256 _amount) internal returns (uint) {
            For(fortube).withdrawUnderlying(want,_amount);
            return _amount;
        }

        function balanceOfWant() public view returns (uint) {
            return IERC20(want).balanceOf(address(this));
        }

        function balanceOfPool() public view returns (uint) {
            address _controller = For(fortube).controller();
            IFToken fToken = IFToken(IBankController(_controller).getFTokeAddress(want));
            return fToken.calcBalanceOfUnderlying(address(this));
        }


        function balanceOf() public view returns (uint) {
            return balanceOfWant()
                    .add(balanceOfPool());
        }

        function setGovernance(address _governance) external {
            require(msg.sender == governance, "!governance");
            governance = _governance;
        }

        function setController(address _controller) external {
            require(msg.sender == governance, "!governance");
            controller = _controller;
        }
        function setFee(uint256 _fee) external{
            require(msg.sender == governance, "!governance");
            fee = _fee;
        }
        function setCallFee(uint256 _fee) external{
            require(msg.sender == governance, "!governance");
            callfee = _fee;
        }

        function setWithdrawalFee(uint _withdrawalFee) external {
            require(msg.sender == governance, "!governance");
            require(_withdrawalFee <=100,"fee >= 1%"); //max:1%
            withdrawalFee = _withdrawalFee;
        }

        function setSwap2Token(address[] memory _path) public{
            require(msg.sender == governance, "!governance");
            swap2TokenRouting = _path;
        }

        function _checkHarvest() internal {
            // ensure harvest at correct time
            require(now.sub(lastHarvestTimestampSec) >= minHarvestTimeIntervalSec, "too early");
            require(now.sub(lastHarvestTimestampSec)                                                    <
(minHarvestTimeIntervalSec.add(harvestWindowLengthSec)), "too late");

            lastHarvestTimestampSec = lastHarvestTimestampSec.add(minHarvestTimeIntervalSec);

            epoch = epoch.add(1);
        }
}
```

VaultUsdt.sol

```
pragma solidity ^0.5.16;

interface IERC20 {
```

```
    function totalSupply() external view returns (uint256);
    function balanceOf(address account) external view returns (uint256);
    function transfer(address recipient, uint256 amount) external returns (bool);
    function allowance(address owner, address spender) external view returns (uint256);
    function approve(address spender, uint256 amount) external returns (bool);
    function transferFrom(address sender, address recipient, uint256 amount) external returns (bool);
    event Transfer(address indexed from, address indexed to, uint256 value);
    event Approval(address indexed owner, address indexed spender, uint256 value);
}

contract Context {
    constructor () internal { }
    // solhint-disable-previous-line no-empty-blocks

    function _msgSender() internal view returns (address payable) {
        return msg.sender;
    }

    function _msgData() internal view returns (bytes memory) {
        this; // silence state mutability warning without generating bytecode - see https://github.com/ethereum/solidity/issues/2691
        return msg.data;
    }
}

contract Ownable is Context {
    address private _owner;

    event OwnershipTransferred(address indexed previousOwner, address indexed newOwner);
    constructor () internal {
        _owner = _msgSender();
        emit OwnershipTransferred(address(0), _owner);
    }
    function owner() public view returns (address) {
        return _owner;
    }
    modifier onlyOwner() {
        require(isOwner(), "Ownable: caller is not the owner");
        _;
    }
    function isOwner() public view returns (bool) {
        return _msgSender() == _owner;
    }
    function renounceOwnership() public onlyOwner {
        emit OwnershipTransferred(_owner, address(0));
        _owner = address(0);
    }
    function transferOwnership(address newOwner) public onlyOwner {
        _transferOwnership(newOwner);
    }
    function _transferOwnership(address newOwner) internal {
        require(newOwner != address(0), "Ownable: new owner is the zero address");
        emit OwnershipTransferred(_owner, newOwner);
        _owner = newOwner;
    }
}

contract ERC20 is Context, IERC20 {
    using SafeMath for uint256;

    mapping (address => uint256) private _balances;

    mapping (address => mapping (address => uint256)) private _allowances;

    uint256 private _totalSupply;
    function totalSupply() public view returns (uint256) {
        return _totalSupply;
    }
    function balanceOf(address account) public view returns (uint256) {
        return _balances[account];
    }
    function transfer(address recipient, uint256 amount) public returns (bool) {
        _transfer(_msgSender(), recipient, amount);
        return true;
    }
    function allowance(address owner, address spender) public view returns (uint256) {
        return _allowances[owner][spender];
    }
    function approve(address spender, uint256 amount) public returns (bool) {
        _approve(_msgSender(), spender, amount);
        return true;
    }
    function transferFrom(address sender, address recipient, uint256 amount) public returns (bool) {
        _transfer(sender, recipient, amount);
        _approve(sender, _msgSender(), _allowances[sender][_msgSender()].sub(amount, "ERC20: transfer amount exceeds allowance"));
        return true;
```

```
    }
    function increaseAllowance(address spender, uint256 addedValue) public returns (bool) {
        _approve(_msgSender(), spender, _allowances[_msgSender()][spender].add(addedValue));
        return true;
    }
    function decreaseAllowance(address spender, uint256 subtractedValue) public returns (bool) {
        _approve(_msgSender(), spender, _allowances[_msgSender()][spender].sub(subtractedValue, "ERC20:
decreased allowance below zero"));
        return true;
    }
    function _transfer(address sender, address recipient, uint256 amount) internal {
        require(sender != address(0), "ERC20: transfer from the zero address");
        require(recipient != address(0), "ERC20: transfer to the zero address");

        _balances[sender] = _balances[sender].sub(amount, "ERC20: transfer amount exceeds balance");
        _balances[recipient] = _balances[recipient].add(amount);
        emit Transfer(sender, recipient, amount);
    }
    function _mint(address account, uint256 amount) internal {
        require(account != address(0), "ERC20: mint to the zero address");

        _totalSupply = _totalSupply.add(amount);
        _balances[account] = _balances[account].add(amount);
        emit Transfer(address(0), account, amount);
    }
    function _burn(address account, uint256 amount) internal {
        require(account != address(0), "ERC20: burn from the zero address");

        _balances[account] = _balances[account].sub(amount, "ERC20: burn amount exceeds balance");
        _totalSupply = _totalSupply.sub(amount);
        emit Transfer(account, address(0), amount);
    }
    function _approve(address owner, address spender, uint256 amount) internal {
        require(owner != address(0), "ERC20: approve from the zero address");
        require(spender != address(0), "ERC20: approve to the zero address");

        _allowances[owner][spender] = amount;
        emit Approval(owner, spender, amount);
    }
    function _burnFrom(address account, uint256 amount) internal {
        _burn(account, amount);
        _approve(account, _msgSender(), _allowances[account][_msgSender()].sub(amount, "ERC20: burn
amount exceeds allowance"));
    }
}

contract ERC20Detailed is IERC20 {
    string private _name;
    string private _symbol;
    uint8 private _decimals;

    constructor (string memory name, string memory symbol, uint8 decimals) public {
        _name = name;
        _symbol = symbol;
        _decimals = decimals;
    }
    function name() public view returns (string memory) {
        return _name;
    }
    function symbol() public view returns (string memory) {
        return _symbol;
    }
    function decimals() public view returns (uint8) {
        return _decimals;
    }
}

library SafeMath {
    function add(uint256 a, uint256 b) internal pure returns (uint256) {
        uint256 c = a + b;
        require(c >= a, "SafeMath: addition overflow");

        return c;
    }
    function sub(uint256 a, uint256 b) internal pure returns (uint256) {
        return sub(a, b, "SafeMath: subtraction overflow");
    }
    function sub(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b <= a, errorMessage);
        uint256 c = a - b;

        return c;
    }
    function mul(uint256 a, uint256 b) internal pure returns (uint256) {
        if (a == 0) {
            return 0;
        }
```

```
        uint256 c = a * b;
        require(c / a == b, "SafeMath: multiplication overflow");

        return c;
    }
    function div(uint256 a, uint256 b) internal pure returns (uint256) {
        return div(a, b, "SafeMath: division by zero");
    }
    function div(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        // Solidity only automatically asserts when dividing by 0
        require(b > 0, errorMessage);
        uint256 c = a / b;

        return c;
    }
    function mod(uint256 a, uint256 b) internal pure returns (uint256) {
        return mod(a, b, "SafeMath: modulo by zero");
    }
    function mod(uint256 a, uint256 b, string memory errorMessage) internal pure returns (uint256) {
        require(b != 0, errorMessage);
        return a % b;
    }
}

library Address {
    function isContract(address account) internal view returns (bool) {
        bytes32 codehash;
        bytes32 accountHash = 0xc5d2460186f7233c927e7db2dcc703c0e500b653ca82273b7bfad8045d85a470;
        // solhint-disable-next-line no-inline-assembly
        assembly { codehash := extcodehash(account) }
        return (codehash != 0x0 && codehash != accountHash);
    }
    function toPayable(address account) internal pure returns (address payable) {
        return address(uint160(account));
    }
    function sendValue(address payable recipient, uint256 amount) internal {
        require(address(this).balance >= amount, "Address: insufficient balance");

        // solhint-disable-next-line avoid-call-value
        (bool success, ) = recipient.call.value(amount)("");
        require(success, "Address: unable to send value, recipient may have reverted");
    }
}

library AddrArrayLib {
    using AddrArrayLib for Addresses;

    struct Addresses {
       address[]  _items;
    }

    /**
     * @notice push an address to the array
     * @dev if the address already exists, it will not be added again
     * @param self Storage array containing address type variables
     * @param element the element to add in the array
     */
    function pushAddress(Addresses storage self, address element) internal {
        if (!exists(self, element)) {
            self._items.push(element);
        }
    }

    /**
     * @notice remove an address from the array
     * @dev finds the element, swaps it with the last element, and then deletes it;
     *          returns a boolean whether the element was found and deleted
     * @param self Storage array containing address type variables
     * @param element the element to remove from the array
     */
    function removeAddress(Addresses storage self, address element) internal returns (bool) {
        for (uint i = 0; i < self.size(); i++) {
            if (self._items[i] == element) {
                self._items[i] = self._items[self.size() - 1];
                self._items.pop();
                return true;
            }
        }
        return false;
    }

    /**
     * @notice get the address at a specific index from array
     * @dev revert if the index is out of bounds
     * @param self Storage array containing address type variables
     * @param index the index in the array
```

```
     */
    function getAddressAtIndex(Addresses storage self, uint256 index) internal view returns (address) {
        require(index < size(self), "the index is out of bounds");
        return self._items[index];
    }

    /**
     * @notice get the size of the array
     * @param self Storage array containing address type variables
     */
    function size(Addresses storage self) internal view returns (uint256) {
      return self._items.length;
    }

    /**
     * @notice check if an element exist in the array
     * @param self Storage array containing address type variables
     * @param element the element to check if it exists in the array
     */
    function exists(Addresses storage self, address element) internal view returns (bool) {
        for (uint i = 0; i < self.size(); i++) {
            if (self._items[i] == element) {
                return true;
            }
        }
        return false;
    }

    /**
     * @notice get the array
     * @param self Storage array containing address type variables
     */
    function getAllAddresses(Addresses storage self) internal view returns(address[] memory) {
        return self._items;
    }

}

library SafeERC20 {
    using SafeMath for uint256;
    using Address for address;

    function safeTransfer(IERC20 token, address to, uint256 value) internal {
        callOptionalReturn(token, abi.encodeWithSelector(token.transfer.selector, to, value));
    }

    function safeTransferFrom(IERC20 token, address from, address to, uint256 value) internal {
        callOptionalReturn(token, abi.encodeWithSelector(token.transferFrom.selector, from, to, value));
    }

    function safeApprove(IERC20 token, address spender, uint256 value) internal {
        require((value == 0) || (token.allowance(address(this), spender) == 0),
            "SafeERC20: approve from non-zero to non-zero allowance"
        );
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, value));
    }

    function safeIncreaseAllowance(IERC20 token, address spender, uint256 value) internal {
        uint256 newAllowance = token.allowance(address(this), spender).add(value);
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, newAllowance));
    }

    function safeDecreaseAllowance(IERC20 token, address spender, uint256 value) internal {
        uint256 newAllowance = token.allowance(address(this), spender).sub(value, "SafeERC20: decreased
allowance below zero");
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector, spender, newAllowance));
    }
    function callOptionalReturn(IERC20 token, bytes memory data) private {
        require(address(token).isContract(), "SafeERC20: call to non-contract");

        // solhint-disable-next-line avoid-low-level-calls
        (bool success, bytes memory returndata) = address(token).call(data);
        require(success, "SafeERC20: low-level call failed");

        if (returndata.length > 0) { // Return data is optional
            // solhint-disable-next-line max-line-length
            require(abi.decode(returndata, (bool)), "SafeERC20: ERC20 operation did not succeed");
        }
    }
}

interface Controller {
    function withdraw(address, uint) external;
    function balanceOf(address) external view returns (uint);
    function earn(address, uint) external;
}
```

```
contract VaultUsdt is ERC20, ERC20Detailed {
    using SafeERC20 for IERC20;
    using Address for address;
    using SafeMath for uint256;
    using AddrArrayLib for AddrArrayLib.Addresses;

    IERC20 public token;

    uint public min = 9500;
    uint public constant max = 10000;
    uint public earnLowerlimit; //池内空余资金到这个值就自动 earn

    address public governance;
    address public controller;
    AddrArrayLib.Addresses userList;

    constructor (address _token, uint _earnLowerlimit) public ERC20Detailed(
        string(abi.encodePacked("Farmland ", ERC20Detailed(_token).name())),
        string(abi.encodePacked("farm", ERC20Detailed(_token).symbol())),
        ERC20Detailed(_token).decimals()
    ) {
        token = IERC20(_token);
        governance = tx.origin;
        controller = 0x3a725fe399641a0965c30e72bA18aAE6948c97b1;
        earnLowerlimit = _earnLowerlimit;
    }

    function balance() public view returns (uint) {
        return token.balanceOf(address(this))
                .add(Controller(controller).balanceOf(address(token)));
    }

    function setMin(uint _min) external {
        require(msg.sender == governance, "!governance");
        min = _min;
    }

    function setGovernance(address _governance) public {
        require(msg.sender == governance, "!governance");
        governance = _governance;
    }

    function setController(address _controller) public {
        require(msg.sender == governance, "!governance");
        controller = _controller;
    }
    function setEarnLowerlimit(uint256 _earnLowerlimit) public{
       require(msg.sender == governance, "!governance");
       earnLowerlimit = _earnLowerlimit;
  }

    // Custom logic in here for how much the vault allows to be borrowed
    // Sets minimum required on-hand to keep small withdrawals cheap
    function available() public view returns (uint) {
        return token.balanceOf(address(this)).mul(min).div(max);
    }

    function earn() public {
        uint _bal = available();
        token.safeTransfer(controller, _bal);
        Controller(controller).earn(address(token), _bal);
    }

    function depositAll() external {
        deposit(token.balanceOf(msg.sender));
    }

    function getUsers() public view returns (address[] memory) {
        return userList.getAllAddresses();
    }

    function deposit(uint _amount) public {
        uint _pool = balance();
        uint _before = token.balanceOf(address(this));
        token.safeTransferFrom(msg.sender, address(this), _amount);
        uint _after = token.balanceOf(address(this));
        _amount = _after.sub(_before); // Additional check for deflationary tokens
        uint shares = 0;
        if (totalSupply() == 0) {
            shares = _amount;
        } else {
            shares = (_amount.mul(totalSupply())).div(_pool);
        }
        _mint(msg.sender, shares);
        userList.pushAddress(msg.sender);
        if (token.balanceOf(address(this))>earnLowerlimit){
           earn();
```

```
            }
        }

        function withdrawAll() external {
            withdraw(balanceOf(msg.sender));
        }

        // No rebalance implementation for lower fees and faster swaps
        function withdraw(uint _shares) public {
            uint r = (balance().mul(_shares)).div(totalSupply());
            _burn(msg.sender, _shares);

            // Check balance
            uint b = token.balanceOf(address(this));
            if (b < r) {
                uint _withdraw = r.sub(b);
                Controller(controller).withdraw(address(token), _withdraw);
                uint _after = token.balanceOf(address(this));
                uint _diff = _after.sub(b);
                if (_diff < _withdraw) {
                    r = b.add(_diff);
                }
            }

            uint _max = balanceOf(msg.sender);
            if (_shares == _max) {
                userList.removeAddress(msg.sender);
            }
            token.safeTransfer(msg.sender, r);
        }

        function getPricePerFullShare() public view returns (uint) {
            return balance().mul(1e18).div(totalSupply());
        }
    }
```

6. Appendix B: Vulnerability risk rating criteria

Smart contract vulnerability rating standards	
Vulnerability rating	Vulnerability rating description
High-risk vulnerabilities	Vulnerabilities that can directly cause the loss of token contracts or user funds, such as: value overflow loopholes that can cause the value of tokens to zero, fake recharge loopholes that can cause exchanges to lose tokens, and can cause contract accounts to lose ETH or tokens. Access loopholes, etc.;
Mid-risk vulnerability	Vulnerabilities that can cause loss of ownership of token contracts, such as: access control defects of key functions, call injection leading to bypassing of access control of key functions, etc.;
Low-risk vulnerabilities	Vulnerabilities that can cause the token contract to not work properly, such as: denial of service vulnerability caused by sending ETH to malicious addresses, and denial of service vulnerability caused by exhaustion of gas.

7. Appendix C: Introduction to vulnerability testing tools

7.1 Manticore

A Manticore is a symbolic execution tool for analyzing binary files and smart contracts. A Manticore consists of a symbolic Ethereum virtual machine (EVM), an EVM disassembler/assembler, and a convenient interface for automatic compilation and analysis of the Solarium body.It also incorporates Ethersplay, a Bit of Traits of Bits visual disassembler for EVM bytecode, for visual analysis. Like binaries, Manticore provides a simple command-line interface and a Python API for analyzing EVM bytecode.

7.2 Oyente

Oyente is a smart contract analysis tool that can be used to detect common bugs in smart contracts, such as reentrancy, transaction ordering dependencies, and so on.More conveniently, Oyente's design is modular, so this allows power users to implement and insert their own inspection logic to check the custom properties in their contracts.

7.3 securify. Sh

Securify verifies the security issues common to Ethereum's smart contracts, such as unpredictability of trades and lack of input verification, while fully automated and analyzing all possible execution paths, and Securify has a specific language for identifying vulnerabilities that enables the securities to focus on current security and other reliability issues at all times.

7.4 Echidna

Echidna is a Haskell library designed for fuzzy testing EVM code.

7.5 MAIAN

MAIAN is an automated tool used to find holes in Ethereum's smart contracts. MAIAN processes the bytecode of the contract and tries to set up a series of transactions to find and confirm errors.

7.6 ethersplay

Ethersplay is an EVM disassembler that includes correlation analysis tools.

7.7 IDA - evm entry

Ida-evm is an IDA processor module for the Ethereum Virtual Machine (EVM).

7.8 want - ide

Remix is a browser-based compiler and IDE that allows users to build ethereum contracts and debug transactions using Solarium language.

7.9 KnownSec Penetration Tester kit

KnownSec penetration tester's toolkit, developed, collected and used by KnownSec penetration tester engineers, contains batch automated testing tools, self-developed tools, scripts or utilization tools, etc. dedicated to testers.