# 0.7

## IRON Finance Process Quality Review

Score: 47%

## Overview

This is a Process Quality Review of IRON finance completed on June 14th 2021. It was performed using the Process Review process (version 0.7.2) and is documented here. The review was performed by Nic of DeFiSafety. Check out our Telegram.

The final score of the review is 47%, a fail. The breakdown of the scoring is in Scoring Appendix. For our purposes, a pass is 70%.

### Summary of the Process

Very simply, the review looks for the following declarations from the developer's site. With these declarations, it is reasonable to trust the smart contracts.

- **Here are my smart contracts on the blockchain**
- **Here is the documentation that explains what my smart contracts do**
- **Here are the tests I ran to verify my smart contract**
- **Here are the audit(s) performed on my code by third party experts**
- **Here are the admin controls and strategies**

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views to change. All information is subject to possible correction. Information may quickly become unreliable for various reasons, including changes in market conditions or economic circumstances.



### Chain

This section indicates the blockchain used by this protocol.

> **Chain: Binance Smart Chain**

Guidance:
Ethereum
Binance

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## Code and Team

This section looks at the code deployed on the Mainnet that gets reviewed and its corresponding software repository. The document explaining these questions is here.  This review will answer the questions;

1) Are the executing code addresses readily available? (%)
2) Is the code actively being used?  (%)
3) Is there a public software repository? (Y/N)
4) Is there a development history visible?  (%)
5) Is the team public (not anonymous)? (Y/N)

### 1) Are the executing code addresses readily available? (%)

> Answer: 100%

They are available at website https://docs.iron.finance/iron-finance-on-polygon/smart-contracts as indicated in the Appendix.

Guidance:
100%  Clearly labelled and on website, docs or repo, quick to find
70%  Clearly labelled and on website, docs or repo but takes a bit of looking
40%  Addresses in mainnet.json, in discord or sub graph, etc
20%  Address found but labelling not clear or easy to find
0%  Executing addresses could not be found

**2) Is the code actively being used? (%)**

> ✓ Answer: 100%

Activity is 3000 transactions a day on contract *MasterChef.sol*, as indicated in the Appendix.

Percentage Score Guidance

| | |
|---|---|
| 100% | More than 10 transactions a day |
| 70% | More than 10 transactions a week |
| 40% | More than 10 transactions a month |
| 10% | Less than 10 transactions a month |
| 0% | No activity |

**3) Is there a public software repository? (Y/N)**

> ✓ Answer: Yes

GitHub: https://github.com/ironfinance

Is there a public software repository with the code at a minimum, but normally test and scripts also (Y/N). Even if the repo was created just to hold the files and has just 1 transaction, it gets a Yes. For teams with private repos, this answer is No.

**4) Is there a development history visible? (%)**

> ⚠ Answer: 20%

With 12 commits and 1 branch, this is an unhealthy software repository.

This checks if the software repository demonstrates a strong steady history. This is normally demonstrated by commits, branches and releases in a software repository. A healthy history demonstrates a history of more than a month (at a minimum).

Guidance:

| | |
|---|---|
| 100% | Any one of 100+ commits, 10+branches |
| 70% | Any one of 70+ commits, 7+branches |
| 50% | Any one of 50+ commits, 5+branches |
| 30% | Any one of 30+ commits, 3+branches |
| 0% | Less than 2 branches or less than 10 commits |

How to improve this score

Continue to test and perform other verification activities after deployment, including routine maintenance

updating to new releases of testing and deployment tools.  A public development history indicates clearly to the public the level of continued investment and activity by the developers on the application. This gives a level of security and faith in the application.

**5) Is the team public (not anonymous)? (Y/N)**

> ⚠ Answer: No

No public team info was found.

For a yes in this question the real names of some team members must be public on the website or other documentation. If the team is anonymous and then this question is a No.

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## Documentation

This section looks at the software documentation. The document explaining these questions is here.

Required questions are;

6)  Is there a whitepaper? (Y/N)
7)  Are the basic software functions documented? (Y/N)
8)  Does the software function documentation fully (100%) cover the deployed contracts? (%)
9)  Are there sufficiently detailed comments for all functions within the deployed contract code (%)
10) Is it possible to trace from software documentation to the implementation in
code (%)

**6) Is there a whitepaper? (Y/N)**

> ✓ Answer: Yes

Location: https://docs.iron.finance/

How to improve this score

Ensure the white paper is available for download from your website or at least the software repository. Ideally update the whitepaper to meet the capabilities of your present application.

**7) Are the basic software functions documented? (Y/N)**

> ✓ Answer: Yes

Most minimal and basic functions covered in this Medium article.

How to improve this score

Write the document based on the deployed code. For guidance, refer to the SecurEth System Description Document.

**8) Does the software function documentation fully (100%) cover the deployed contracts? (%)**

> ⚠ Answer: 20%

The only software function documentation they have is in this Medium article. They only cover base stablecoin functions.

Guidance:

100% All contracts and functions documented
80% Only the major functions documented
79-1% Estimate of the level of software documentation
0% No software documentation

How to improve this score

This score can improve by adding content to the requirements document such that it comprehensively covers the requirements. For guidance, refer to the SecurEth System Description Document . Using tools that aid traceability detection will help.

**9) Are there sufficiently detailed comments for all functions within the deployed contract code (%)**

> ⚠ Answer: 0%

Code examples are in the Appendix. As per the SLOC, there is 15% commenting to code (CtC).

The Comments to Code (CtC) ratio is the primary metric for this score.

Guidance:
100% CtC > 100 Useful comments consistently on all code
90-70% CtC > 70 Useful comment on most code
60-20% CtC > 20 Some useful commenting
0% CtC < 20 No useful commenting

How to improve this score

This score can improve by adding comments to the deployed code such that it comprehensively covers the code. For guidance, refer to the SecurEth Software Requirements.

**10) Is it possible to trace from software documentation to the implementation in code (%)**

> ⚠ Answer: 0%

No connection between software documentation and its implementation in code.

Guidance:
100% Clear explicit traceability between code and documentation at a requirement level for all code
60% Clear association between code and documents via non explicit traceability
40% Documentation lists all the functions and describes their functions
0% No connection between documentation and code

How to improve this score

This score can improve by adding traceability from requirements to code such that it is clear where each requirement is coded. For reference, check the SecurEth guidelines on traceability.

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## Testing

This section looks at the software testing available. It is explained in this document. This section answers the following questions;

11) Full test suite (Covers all the deployed code) (%)
12) Code coverage (Covers all the deployed lines of code, or explains misses) (%)
13) Scripts and instructions to run the tests (Y/N)
14) Report of the results (%)
15) Formal Verification test done (%)
16) Stress Testing environment (%)

**11) Is there a Full test suite? (%)**

> ⓘ Answer: 40%

Code examples are in the Appendix. As per the SLOC, there is 28% testing to code (TtC).

This score is guided by the Test to Code ratio (TtC). Generally a good test to code ratio is over 100%. However the reviewers best judgement is the final deciding factor.

Guidance:
100% TtC > 120% Both unit and system test visible
80% TtC > 80% Both unit and system test visible

40% TtC < 80% Some tests visible
0% No tests obvious

How to improve this score

This score can improve by adding tests to fully cover the code. Document what is covered by traceability or test results in the software repository.

**12) Code coverage (Covers all the deployed lines of code, or explains misses) (%)**

> ⓘ Answer: 30%

Minimal amount of tests.

Guidance:
100% Documented full coverage
99-51% Value of test coverage from documented results
50% No indication of code coverage but clearly there is a reasonably complete set of tests
30% Some tests evident but not complete
0% No test for coverage seen

How to improve this score

This score can improve by adding tests achieving full code coverage. A clear report and scripts in the software repository will guarantee a high score.

**13) Scripts and instructions to run the tests (Y/N)**

> ⚠ Answer: No

There are no evident scripts and instructions

How to improve this score

Add the scripts to the repository and ensure they work. Ask an outsider to create the environment and run the tests. Improve the scripts and docs based on their feedback.

**14) Report of the results (%)**

> ⚠ Answer: 0%

Guidance:

100%  Detailed test report as described below
70%  GitHub Code coverage report visible
0%  No test report evident

How to improve this score

Add a report with the results. The test scripts should generate the report or elements of it.

**15) Formal Verification test done (%)**

⚠ Answer: 0%

No evidence of a IRON Finance formal verification was found.

**16) Stress Testing environment (%)**

⚠ Answer: 0%

No evidence of any IRON Finance test-net smart contract addresses.

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## Security

This section looks at the 3rd party software audits done. It is explained in this document.  This section answers the following questions;

17) Did 3rd Party audits take place? (%)
18) Is the bounty value acceptably high?

**17) Did 3rd Party audits take place? (%)**

✓ Answer: 90%

Their BSC contracts were audited by Omniscia on April 1st 2021.

IRON Finance was launched in early March 2021.

Note: Major issues were fixed, while all the informational ones remain unfixed to this day.

Note: Peckshield audit coming soon for their Polygon contracts coming soon..

Guidance:
100%  Multiple Audits performed before deployment and results public and

implemented or not required
90% Single audit performed before deployment and results public and implemented or not required
70% Audit(s) performed after deployment and no changes required. Audit report is public

50% Audit(s) performed after deployment and changes needed but not implemented
20% No audit performed
0% Audit Performed after deployment, existence is public, report is not public and no improvements deployed OR smart contract address' not found, question

**18) Is the bounty value acceptably high (%)**

> ⚠ Answer: 0%

No IRON Finance bug bounty program found.

Guidance:

100% Bounty is 10% TVL or at least $1M AND active program (see below)
90% Bounty is 5% TVL or at least 500k AND active program
80% Bounty is 5% TVL or at least 500k
70% Bounty is 100k or over AND active program
60% Bounty is 100k or over
50% Bounty is 50k or over AND active program
40% Bounty is 50k or over
20% Bug bounty program bounty is less than 50k
0% No bug bounty program offered

Active program means a third party actively driving hackers to the site. Inactive program would be static mention on the docs.

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## Access Controls

This section covers the documentation of special access controls for a DeFi protocol. The admin access controls are the contracts that allow updating contracts or coefficients in the protocol. Since these contracts can allow the protocol admins to "change the rules", complete disclosure of capabilities is vital for user's transparency. It is explained in this document. The questions this section asks are as follow;

19) Can a user clearly and quickly find the status of the admin controls?
20) Is the information clear and complete?
2`) Is the information in non-technical terms that pertain to the investments?
22) Is there Pause Control documentation including records of tests?

**19) Can a user clearly and quickly find the status of the access controls (%)**

> ⚠ Answer: 0%

No admin control information in their whitepaper, GitHub, or Medium.

Guidance:
100% Clearly labelled and on website, docs or repo, quick to find
70% Clearly labelled and on website, docs or repo but takes a bit of looking
40% Access control docs in multiple places and not well labelled
20% Access control docs in multiple places and not labelled
0% Admin Control information could not be found

**20) Is the information clear and complete (%)**

> ⚠ Answer: 0%

No admin control information/documentation was found.

Guidance:
All the contracts are immutable -- 100% OR

a) All contracts are clearly labelled as upgradeable (or not) -- 30% AND
b) The type of ownership is clearly indicated (OnlyOwner / MultiSig / Defined Roles) -- 30% AND
c) The capabilities for change in the contracts are described -- 30%

How to improve this score

Create a document that covers the items described above. An example is enclosed.

**21) Is the information in non-technical terms that pertain to the investments (%)**

> ⚠ Answer: 0%

No admin control information/documentation was found.

Guidance:
100% All the contracts are immutable
90% Description relates to investments safety and updates in clear, complete non-software l language
30% Description all in software specific language
0% No admin control information could not be found

How to improve this score

Create a document that covers the items described above in plain language that investors can understand.

An example is enclosed.

**22) Is there Pause Control documentation including records of tests (%)**

> ⚠ Answer: 0%

No evidence of any pause control documentation.

Guidance:

| | |
|---|---|
| 100% | All the contracts are immutable or no pause control needed and this is explained OR |
| 100% | Pause control(s) are clearly documented and there is records of at least one test within 3 months |
| 80% | Pause control(s) explained clearly but no evidence of regular tests |
| 40% | Pause controls mentioned with no detail on capability or tests |
| 0% | Pause control not documented or explained |

How to improve this score

Create a document that covers the items described above in plain language that investors can understand. An example is enclosed.

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# Appendices

### Author Details

The author of this review is Rex of DeFi Safety.

Email : rex@defisafety.com Twitter : @defisafety

I started with Ethereum just before the DAO and that was a wonderful education. It showed the importance of code quality. The second Parity hack also showed the importance of good process. Here my aviation background offers some value. Aerospace knows how to make reliable code using quality processes.

I was coaxed to go to EthDenver 2018 and there I started SecuEth.org with Bryant and Roman. We created guidelines on good processes for blockchain code development. We got EthFoundation funding to assist in their development.

Process Quality Reviews are an extension of the SecurEth guidelines that will further increase the quality processes in Solidity and Vyper development.

DeFiSafety is my full time gig and we are working on funding vehicles for a permanent staff.

### Scoring Appendix

| PQ Audit Scoring Matrix (v0.7) | Total Points | IRON Finance Answer | IRON Finance Points |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Total | 260 | | 121.5 |
| **Code and Team** | | | 47% |
| 1) Are the executing code addresses readily available? (%) | 20 | 100% | 20 |
| 2) Is the code actively being used? (%) | 5 | 100% | 5 |
| 3) Is there a public software repository? (Y/N) | 5 | y | 5 |
| 4) Is there a development history visible? (%) | 5 | 20% | 1 |
| 5) Is the team public (not anonymous)? (Y/N) | 15 | N | 0 |
| **Code Documentation** | | | |
| 6) Is there a whitepaper? (Y/N) | 5 | Y | 5 |
| 7) Are the basic software functions documented? (Y/N) | 10 | Y | 10 |
| 8) Does the software function documentation fully (100%) cover the deployed contracts? (%) | 15 | 20% | 3 |
| 9) Are there sufficiently detailed comments for all functions within the deployed contract code (%) | 5 | 0% | 0 |
| 10) Is it possible to trace from software documentation to the implementation in code (%) | 10 | 0% | 0 |
| **Testing** | | | |
| 11) Full test suite (Covers all the deployed code) (%) | 20 | 40% | 8 |
| 12) Code coverage (Covers all the deployed lines of code, or explains misses) (%) | 5 | 30% | 1.5 |
| 13) Scripts and instructions to run the tests? (Y/N) | 5 | N | 0 |
| 14) Report of the results (%) | 10 | 0% | 0 |
| 15) Formal Verification test done (%) | 5 | 0% | 0 |
| 16) Stress Testing environment (%) | 5 | 0% | 0 |
| **Security** | | | |
| 17) Did 3rd Party audits take place? (%) | 70 | 90% | 63 |
| 18) Is the bug bounty acceptable high? (%) | 10 | 0% | 0 |
| **Access Controls** | | | |
| 19) Can a user clearly and quickly find the status of the admin controls | 5 | 0% | 0 |
| 20) Is the information clear and complete | 10 | 0% | 0 |
| 21) Is the information in non-technical terms | 10 | 0% | 0 |
| 22) Is there Pause Control documentation including records of tests | 10 | 0% | 0 |
| | | | |
| **Section Scoring** | | | |
| Code and Team | 50 | 62% | |
| Documentation | 45 | 40% | |
| Testing | 50 | 19% | |
| Security | 80 | 79% | |
| Access Controls | 35 | 0% | |

### Executing Code Appendix

# Smart-contracts

## Tokens

| Name | Address |
|---|---|
| IRON | 0xD86b5923F3AD7b585eD81B448170ae026c65ae9a |
| TITAN | 0xaAa5B9e6c589642f98a1cDA99B9D024B8407285A |

### LP tokens

| Name | Address |
| --- | --- |
| USDC-IRON SushiSwap | 0x85dE135fF062Df790A5f20B79120f17D3da63b2d |
| USDC-IRON QuickSwap | 0x099CE8F12D9824F7441950759d2999022b717ff2 |
| TITAN-MATIC SushiSwap | 0xA79983Daf2A92c2C902cD74217Efe3D8AF9Fba2a |
| TITAN-IRON SushiSwap | 0x35c1895DAC1e2432b320e2927b4F71a0D995602F |

### Farming contract

| Name | Address |
| --- | --- |
| MasterChef0 | 0x65430393358e55A658BcdE6FF69AB28cF1CbB77a |
| MasterChef1 | 0xb444d596273C66Ac269C33c30Fbb245F4ba8A79d |
| MasterChef2 | 0xa37DD1f62661EB18c338f18Cf797cff8b5102d8e |

### Pools

| Name | Address |
| --- | --- |
| PoolUsdc | 0xD078B62f8D9f5F69a6e6343e3e1eC9059770B830 |
| ZapPool | 0xC7b1F244397e2157036a89CE0D58F3A467A7Ed2F |
| CollateralReserve | 0xEc12B5d70a84895F819FE037dc4EABDbD24707f2 |

### Oracles

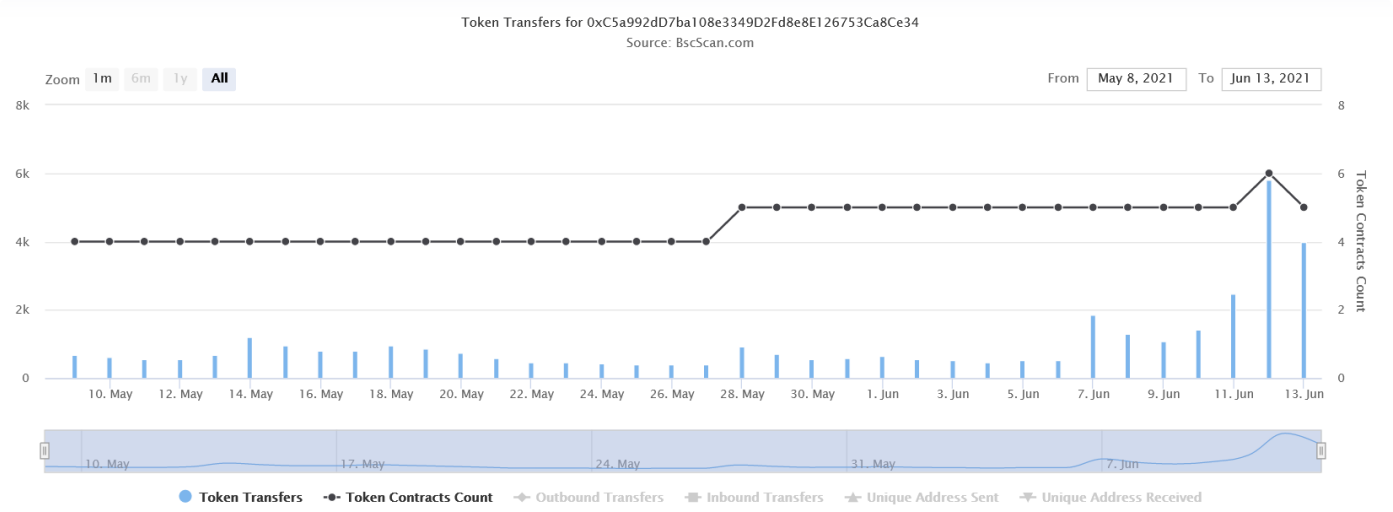
| Name | Address |
| --- | --- |
| CollateralOralce | 0x785808779131b0947f42b4b54537a4682ebeab86#code |
| DollarOracle | 0x681e672cf4ecf76d75d61f2981c20bc874d8bd6b |
| ShareOracle | 0x98843b46ee43ed11667ebd424306616cc31bdf4b |
| PairOracle_IRON_USDC | 0xe2c8386FB5Dc35d01602c2AA314b44Faab4d95c8 |
| PairOracle_TITAN_MATIC | 0x794c9423CFF0E55079708725d3D6879326a29ad1 |

### Others

| Name | Address |
| --- | --- |

| | |
|---|---|
| Timelock | 0xb348c6Aa6a6429C6d04eABA739F8a9dC7C50b4De |
| Treasury | 0x376b9e0Abbde0cA068DeFCD8919CA73369124825 |
| TreasuryPolicy | 0x4e370b2b787192D587889B8c7E8AB0d56446e40B |
| CollateralRatioPolicy | 0xDE3BaA1e28740e7fDbdBf65E78efcb3aA994b110 |
| TreasuryVaultAave | 0x21401319caBA905010Ee77A36f87BD176Edc4b96 |
| VaultController | 0xaDe32E79bDF422a83B091E39dd2A26BCE547Fc1b |

## Code Used Appendix




## Example Code Appendix

```
// SPDX-License-Identifier: MIT

pragma solidity >0.6.12;

import "@openzeppelin/contracts/token/ERC20/IERC20.sol";
import "@openzeppelin/contracts/token/ERC20/utils/SafeERC20.sol";
import "@openzeppelin/contracts/utils/math/SafeMath.sol";
import "@openzeppelin/contracts/access/Ownable.sol";
import "./interfaces/IConsolidatedFund.sol";

// MasterChef is the master of Sushi. He can make Sushi and he is a fair guy.
//
// Note that it's ownable and the owner wields tremendous power. The ownership
// will be transferred to a governance smart contract once STEEL is sufficiently
// distributed and the community can show to govern itself.
//
// Have fun reading it. Hopefully it's bug-free. God bless.
contract MasterChef is Ownable {

```

```
    using SafeMath for uint256;
    using SafeERC20 for IERC20;
    // Info of each user.
    struct UserInfo {
        uint256 amount; // How many LP tokens the user has provided.
        uint256 rewardDebt; // Reward debt. See explanation below.
        //
        // We do some fancy math here. Basically, any point in time, the amount of STEELs
        // entitled to a user but is pending to be distributed is:
        //
        //   pending reward = (user.amount * pool.accSushiPerShare) - user.rewardDebt
        //
        // Whenever a user deposits or withdraws LP tokens to a pool. Here's what happens:
        //   1. The pool's `accSushiPerShare` (and `lastRewardBlock`) gets updated.
        //   2. User receives the pending reward sent to his/her address.
        //   3. User's `amount` gets updated.
        //   4. User's `rewardDebt` gets updated.
    }
    // Info of each pool.
    struct PoolInfo {
        IERC20 lpToken; // Address of LP token contract.
        uint256 allocPoint; // How many allocation points assigned to this pool. STEELs to
        uint256 lastRewardBlock; // Last block number that STEELs distribution occurs.
        uint256 accRewardPerShare; // Accumulated STEELs per share, times 1e12. See below.
    }
    // The reward TOKEN!
    IERC20 public rewardToken;
    // reward tokens created per block.
    uint256 public rewardPerBlock;
    uint256 public BONUS_MULTIPLIER = 1;
    address public fund;
    // Info of each pool.
    PoolInfo[] public poolInfo;
    // Info of each user that stakes LP tokens.
    mapping(uint256 => mapping(address => UserInfo)) public userInfo;
    // Total allocation poitns. Must be the sum of all allocation points in all pools.
    uint256 public totalAllocPoint = 0;
    // The block number when reward mining starts.
    uint256 public startBlock;
    event Deposit(address indexed user, uint256 indexed pid, uint256 amount);
    event Withdraw(address indexed user, uint256 indexed pid, uint256 amount);
    event EmergencyWithdraw(address indexed user, uint256 indexed pid, uint256 amount);

    constructor(
        IERC20 _rewardToken,
        address _fund,
        uint256 _rewardPerBlock,
        uint256 _startBlock
    ) {
        rewardToken = _rewardToken;
        rewardPerBlock = _rewardPerBlock;
        startBlock = _startBlock;
        fund = _fund;
```

```
72
    }
73
74      function fundBalance() external view returns (uint256) {
75          return IConsolidatedFund(fund).balance(address(rewardToken));
76      }
```

**SLOC Appendix**

Solidity Contracts

| Language | Files | Lines | Blanks | Comments | Code | Complex |
|---|---|---|---|---|---|---|
| Solidity | 39 | 3348 | 572 | 355 | 2421 | 242 |

Comments to Code 355/2421 = 15%

Javascript Tests

| Language | Files | Lines | Blanks | Comments | Code | Complex |
|---|---|---|---|---|---|---|
| JavaScript | 9 | 807 | 98 | 23 | 686 | 23 |

Tests to Code 686/2421 = 28%