Quantstamp

Echelon Market

Executive Summary

This audit report was prepared by Quantstamp, the leader in blockchain security.

Type	Lending Protocol
Timeline	2025-03-05 through 2025-04-04
Language	Move
Methods	Architecture Review, Unit Testing, Functional Testing, Computer-Aided Verification, Manual Review
Specification	Gitbook Farming Changes
Source Code	• https://github.com/EchelonMarket/echelon-modules #dacbca6 • Initia Branch #Diff Initia ↔ Aptos Branches • Movement Branch #Diff Movement ↔ Aptos Branches
Auditors	• Adrian Koegl Auditing Engineer • Roman Rohleder Senior Auditing Engineer • Hamed Mohammadi Auditing Engineer

Documentation quality	Low
Test quality	Medium
Total Findings	21 Fixed: 7 Acknowledged: 11 Mitigated: 3
High severity findings	0
Medium severity findings	1 Fixed: 1
Low severity findings	10 Fixed: 4 Acknowledged: 4 Mitigated: 2
Undetermined severity findings	2 Acknowledged: 2
Informational findings	8 Fixed: 2 Acknowledged: 5 Mitigated: 1

Summary of Findings

Quantstamp has audited the Echelon Market lending protocol programmed in Move and deployed on Aptos, Movement, and Initia. The lending protocol developed by Echelon Market consists of a cross-collateral lending market, closely following the Aave v3 design, as well as an isolated lending market based on the Fraxlend model.

For both, we have audited the core lending (`lending_core` , `isolated_lending`) market logic including the farming logic, the leveraged lending component (`lending_leverage`) as well as the manager logic (`lending_manager`). The audits were based on code deployed on Aptos and we have audited the diffs for the changes made for Initia and Movement, respectively. The titles of any issues found specific to the diffs have been prepended with [Initia] or [Movement].

Overall the code is well-written and follows best practices. The Echelon team has demonstrated excellent attention to detail and great communication throughout the audit process. While we strongly recommend the technical documentation and testing suite to be improved, we have not identified any significant security vulnerabilities. We have identified one Medium and several Low & Informational severity findings that should be addressed.

Fix Review Updates: The client has addressed all issues by either acknowledging or fixing them. Overall, while the Medium severity vulnerability has been rectified, multiple issues remain acknowledged but not resolved, based on the client's assessment of their risk. Furthermore, the client introduced code changes beyond addressing the issues, which were not in scope for the fix review. Some of these code changes were included in the fix review commits.

ID	DESCRIPTION	SEVERITY	STATUS
ECH-1	[Initia] Removal of Accrual Functions Before Protocol Changes Leading to Interest Distortion	Medium	Fixed
ECH-2	Token Name Collision	Low	Acknowledged
ECH-3	Possible Object Account Address Collision	Low	Acknowledged
ECH-4	Allowing the Protocol Admins to Pause Liquidation Operations Can Lead to Bad Debt	Low	Acknowledged
ECH-5	Lack of Account Registration Check for Coin	Low	Fixed
ECH-6	Missing Global Pausability (All Pairs) Function for Quicker Reaction in Emergency	Low	Fixed
ECH-7	Missing Input Validation	Low	Mitigated
ECH-8	`MAX_LIQUIDATION_INCENTIVE_BPS` Can Be Bypassed when Creating New Pairs	Low	Mitigated
ECH-9	Positions can be made immediately liquidatable	Low	Acknowledged
ECH-10	[Initia] The `get_price_by_metadata` Function Fails to Check Oracle Price Staleness	Low	Fixed
ECH-11	[Initia] Overflow Mitigations Removed in `mul_div_rounded()`	Low	Fixed
ECH-12	[Initia] Discrepancy Between the Implementation of `accrue_pool_reward` Across Different Branches	Informational	Fixed
ECH-13	State Mutation in View Functions	Informational	Acknowledged
ECH-14	The `new_reward_for_pool` Function Does Not Exist	Informational	Fixed
ECH-15	Upgradability	Informational	Acknowledged
ECH-16	Application Monitoring Can Be Improved by Emitting More Events	Informational	Acknowledged
ECH-17	Efficiency Modes Limited to 255 Possible Combinations	Informational	Acknowledged
ECH-18	Code Improvements	Informational	Mitigated
ECH-19	Failure to Register the Recipient's Address in the `withdraw_reserve<CoinType>` Function	Informational	Acknowledged
ECH-20	[Movement] Meridian AMM Interface `pool.move` Contains Unusable Skeleton Code	Undetermined	Acknowledged
ECH-21	[Initia] Removal of Collateral Farming in `isolated_lending`	Undetermined	Acknowledged

Assessment Breakdown

Quantstamp's objective was to evaluate the repository for security-related issues, code quality, and adherence to specification and best practices.

> **Disclaimer**
> Only features that are contained within the repositories at the commit hashes specified on the front page of the report are within the scope of the audit and fix review. All features added in future revisions of the code are excluded from consideration in this report.

Possible issues we looked for included (but are not limited to):

- Transaction-ordering dependence
- Timestamp dependence
- Mishandled exceptions and call stack limits
- Unsafe external calls
- Integer overflow / underflow
- Number rounding errors
- Reentrancy and cross-function vulnerabilities
- Denial of service / logical oversights
- Access control
- Centralization of power
- Business logic contradicting the specification
- Code clones, functionality duplication
- Gas usage
- Arbitrary token minting

Methodology

1. Code review that includes the following
   1. Review of the specifications, sources, and instructions provided to Quantstamp to make sure we understand the size, scope, and functionality of the smart contract.
   2. Manual review of code, which is the process of reading source code line-by-line in an attempt to identify potential vulnerabilities.
   3. Comparison to specification, which is the process of checking whether the code does what the specifications, sources, and instructions provided to Quantstamp describe.
2. Testing and automated analysis that includes the following:
   1. Test coverage analysis, which is the process of determining whether the test cases are actually covering the code and how much code is exercised when we run those test cases.
   2. Symbolic execution, which is analyzing a program to determine what inputs cause each part of a program to execute.
3. Best practices review, which is a review of the smart contracts to improve efficiency, effectiveness, clarity, maintainability, security, and control based on the established industry and academic practices, recommendations, and research.
4. Specific, itemized, and actionable recommendations to help you take steps to secure your smart contracts.

Scope

Files Included

Aptos Branch: https://github.com/EchelonMarket/echelon-modules/tree/dacbca6af4966fc2f57cc3cde9fa59f2113be7dc
Directories: `lending_core/`, `lending_manager/`, `lending_leverage/`, `isolated_lending/`

Initia Branch: https://github.com/EchelonMarket/echelon-modules/tree/dcfff04bf3dd0ef39414ae30df134fec33315b63
Directories considered in diff: `lending_core/`, `lending_manager/`, `lending_leverage/`, `isolated_lending/`

Movement Branch: https://github.com/EchelonMarket/echelon-modules/tree/a3b278d489be35fd07fcc9a61ebb0bc01cc2839a
Directories considered in diff: `lending_core/`, `lending_manager/`, `lending_leverage/`, `isolated_lending/`

For the Initia and Movement branch, we audited the diff between the Main branch and the respective commit. The diff audits were limited to the directories mentioned above.

These are the diffs:
Diff Audit Initia Branch: https://github.com/EchelonMarket/echelon-modules/compare/dacbca6af4966fc2f57cc3cde9fa59f2113be7dc...dcfff04bf3dd0ef39414ae30df134fec33315b63

Diff Audit Movement Branch: https://github.com/EchelonMarket/echelon-modules/compare/dacbca6af4966fc2f57cc3cde9fa59f2113be7dc...a3b278d489be35fd07fcc9a61ebb0bc01cc2839a

Files Excluded

The following directories were excluded from scope for all branches:
`batch_sell_fees`, `batch_swap_interface`, `echelon_coin`, `echelon_lens`, `liquidator`, `rate_limiter`, `thala_aggregator_interface`, `thala_oracle_interface`, `thalaswap_v2_interface`, scripts & interfaces

Operational Considerations

- We assume any module upgrades undergo a thorough audit.
- We assume the integrated Oracles to be secure, operate reliably, and provide fresh data.
- We assume that any admin functionality, e.g. parameter updates, will not be misused, especially not to make positions liquidatable.

Key Actors And Their Capabilities

1. `isolated_lending` package:
    1. `isolated_lending::farming`:
        1. `manager`:
            1. `new_reward()`: Registers and adds a new reward coin (`RewardCoin`).
            2. `new_reward_fa()`: Adds a new fungible asset that is available for rewards.
            3. `new_epoch()`: Change the start and end times as well as the rewards per second of a pools reward epoch using the reward coin.
            4. `new_epoch_fa()`: Change the start and end times as well as the rewards per second of a pools reward epoch using fungible assets.
            5. `new_pool()`: Adds a new pool.
            6. `init_alloc_point()`: Initialize a pools allocation point.
            7. `update_alloc_point()`: Update a pools reward allocation point.
    2. `isolated_lending::isolated_lending`:
        1. `manager`:
            1. `set_interest_fee_bps()`: Change the interest fees (**0%-100%**).
            2. `set_liquidation_fee_bps()`: Change the liquidation fees (**0%-100%**).
            3. `set_pair_liquidation_incentive_bps()`: Change the liquidation incentive percentage (100%-150%).
            4. `set_pair_collateral_factor_bps()`: Change the collateral factor (**0%-100%**).
            5. `set_pair_collateral_dust_amount()`: Change the collateral dust amount, **which can be any arbitrary value between zero and** `MAX_U64`.
            6. `set_pair_paused()`: Pause/Unpause a pair for any interactions.
            7. `set_pair_supply_cap()`: Set an **arbitrarily high or low** supply cap to the pair.
            8. `set_pair_borrow_cap()`: Set an **arbitrarily high or low** borrow cap to the pair.
            9. `set_pair_jump_interest_rate_model()`: **Arbitrarily** change the jump interest rate model values for any pair.
            10. `withdraw_liability_fee()`: With draw liability fees to the manager address.
            11. `withdraw_collateral_fee()`: Withdraw collateral fees to the manager address.
            12. `withdraw_liability_fee_fa()`: Withdraw liability fees (fungible asset) to the manager address.
            13. `withdraw_collateral_fee_fa()`: Withdraw collateral fees (fungible asset) to the manager address.
            14. `create_pair_with_jump_model()`: Create a new pair using the jump model.
2. `lending_core` package:
    1. `lending::lending`:
        1. `manager`:
            1. `init_pause_flag()`: Initialize the `PauseFlag` struct with `paused = false`.
            2. `set_paused()`: Pause/Unpause all fund-related interactions with the contract.
            3. `set_market_liquidation_incentive_bps()`: Change a markets liquidation incentive (**0%-100%**, default: 100,5%).
            4. `set_close_factor_bps()`: Change the maximum liquidation factor/"close amount" (**0%-100**, default: 20%).
            5. `set_interest_fee_bps()`: Change the interest fee (**0%-100%**, default 15%).
            6. `set_liquidation_fee_bps()`: Change the liquidation fee (**0%-100%**, default 2%).
            7. `set_market_collateral_factor_bps()`: Change the markets collateral factor (ratio of collateral to borrowable assets) (**0%-100%**).
            8. `set_market_paused()`: Pause/Unpause a specific market for any interactions.
            9. `set_market_supply_cap()`: Change the markets supply cap.
            10. `set_market_borrow_cap()`: Change the markets borrow cap.
            11. `set_market_jump_interest_rate_model()`: Change a markets jump interest rate model.
            12. `set_market_liquidation_threshold_bps()`: Change a markets liquidation threshold.
            13. `set_market_origination_fee_bps()`: Change a markets origination/borrow fee (0%-10%, default 0.01%).
            14. `set_market_withdraw_rate_limit()`: Change a markets withdraw rate limit.
            15. `set_market_borrow_rate_limit()`: Change a markets borrow rate limit.
            16. `set_market_liquidation_paused()`: Pause/Unpause a specific market for liquidations.

17. `reconcile_20250218()` : Reconcile a known issue impacting the farming code.
18. `create_efficiency_mode_v2()` : Create a new efficiency mode struct.
19. `set_efficiency_mode_collateral_factor_bps()` : Change an efficiency modes collateral factor (**0%-100%**).
20. `set_efficiency_mode_liquidation_incentive_bps()` : Change an efficiency modes liquidation incentive (**100%-200%**).
21. `set_efficiency_mode_liquidation_threshold_bps()` : Change an efficiency modes liquidation threshold.
22. `market_enter_efficiency_mode()` : Add a market to an existing efficiency mode.
23. `market_quit_efficiency_mode()` : Remove a market from an existing efficiency mode.
24. `withdraw_reserve()` : Withdraw accumulated protocol fees.
25. `withdraw_reserve_fa()` : Withdraw accumulated protocol fees (fungible assets).
26. `deposit_reserve()` : Deposit funds into the protocol reserve.
27. `deposit_reserve_fa()` : Deposit funds into the protocol reserve (fungible assets).
28. `clear_bad_debt()` : Clear an accounts bad debt by seizing its collateral and cover the liabilities from the reserve.
29. `clear_bad_debt_batch()` : Perform multiple bad debt cleanups.
30. `create_market_with_jump_model_v2()` : Create a new market.
31. `create_market_with_jump_model_fa_v2()` : Create a new market (fungible assets).

Findings

ECH-1
[Initia] Removal of Accrual Functions Before Protocol Changes Leading to Interest Distortion

• Medium ⓘ Fixed

Update

Addressed in: `f43ade3` . The recommended accrual function calls are added.

File(s) affected: `isolated_lending/sources/isolated_lending.move`

Description: The following functions used to accrue interest before changing protocol parameters. This ensure that up to the point of the changes all interest would be accumulated as per the previous configuration.

1. `set_interest_fee_bps()` .
2. `set_pair_jump_interest_rate_model()` .

Removing the accrual functions would lead to distorted interests as pending interest accrual would assume the new values, which could lead to sudden unexpectedly high or low interest changes.

Recommendation: We recommend adding back the accrual functions to ensure a more fair protocol behavior.

ECH-2 Token Name Collision

• Low ⓘ Acknowledged

Update

The client provided the following explanation:

```
not a concern as this is manager controlled
```

File(s) affected: `lending_core/sources/farming.move`

Description: The two functions `new_reward<RewardCoin>` and `new_reward_fa` are used to register different tokens for reward payments. Under the hood, both of these functions call `new_reward_for_farming_internal` with the asset name. However, this can be problematic in the case of a name collision between an FA and a coin.

Recommendation: Consider making a small change to include the coin type as well. A very simple solution can be concatenating "FA_" for fungible assets and "C_" for coins to their names before passing them to `new_reward_for_farming_internal` .

ECH-3 Possible Object Account Address Collision

• Low ⓘ Acknowledged

Update

The client provided the following explanation:

```
not a concern
```

File(s) affected: `lending_core/sources/lending.move` , `isolated_lending/sources/isolated_lending.move`

Description: Different object accounts, such as `JumpInterestRateModel` , `MarketLiquidationThreshold` , `MarketLiquidationIncentive` , `MarketLiquidationPauseFlag` , `CoinInfo` , and `FungibleAssetInfo` , in various places are moved to global storage with the same `market_signer` object identifier. However, objects should be isolated to different accounts; otherwise, modifications to one object within an account can influence the entire collection.

Recommendation: Consider creating a new object reference for each struct and using the reference to generate a new address for each. For more information, refer to Aptos official recommendation.

ECH-4 Allowing the Protocol Admins to Pause Liquidation Operations Can Lead to Bad Debt

• Low ⓘ Acknowledged

Update

The client provided the following explanation:

```
not a concern
```

File(s) affected: `lending_core/sources/lending.move` , `isolated_lending/sources/isolated_lending.move`

Description: The protocol allows the administrator to pause different operations independently. One of these operations is liquidations. However, during high volatility, this can lead to huge amounts of bad debt piling up very quickly.

Recommendation: Consider pausing the liquidations as part of general market operations. It does not seem desirable to pause liquidations while users can continue to create positions, potentially further increasing bad debt.

ECH-5 Lack of Account Registration Check for Coin

• Low ⓘ Fixed

Update

Addressed in: `fc23228` . Added `coin::register` calls in `liquidate` and `borrow_entry` .

File(s) affected: `isolated_lending/sources/isolated_lending.move`

Description: Different functions in the `isolated_lending::isolated_lending` module work with Move Coin. However, they miss proper registration for the coin before calling the `coin::deposit` function.

Recommendation: Consider adding proper coin registration for addresses.

ECH-6 Missing Global Pausability (All Pairs) Function for Quicker Reaction in Emergency

• Low ⓘ Fixed

Update

Addressed in: `b521552` . Introduced the `set_all_pairs_paused()` function, which pauses all pools.

File(s) affected: `isolated_lending/sources/isolated_lending.move`

Description: The isolated lending pools, while can be individually paused, lack a global pausability function. Unlike the lending core module which supports global pause flag as well as individualized market paused flag. This may result in losing valuable time in case of a hack, since all pools would have to be iterated and paused individually.

Recommendation: We recommend adding a global pausability to the isolated lending pools, to improve reaction time in case of emergencies.

ECH-7 Missing Input Validation

• Low Mitigated

Update

Addressed in: `7f55712`. The client fixed 1.5.1, 2.1.2, and 2.1.3. The other issues remain unresolve

File(s) affected: `isolated_lending/sources/isolated_lending.move`, `lending_core/sources/lending.move`

Description: The following functions lack proper input validation:

1. `isolated_lending::isolated_lending`:
   1. `set_pair_collateral_dust_amount()`: `collateral_dust_amount` is unbound and may have any value between zero and `MAX_U64`.
   2. `set_pair_supply_cap()`: `supply_cap` neither has a lower nor an upper bound, allowing arbitrary caps, which may leave the pair temporarily in an inoperable state.
   3. `set_pair_borrow_cap()`: `borrow_cap` neither has a lower nor an upper bound, allowing arbitrary caps, which may leave the pair temporarily in an inoperable state.
   4. `set_pair_jump_interest_rate_model()`: All parameters are unbound and unchecked, with the exception of `utilization_kink_bps`, which however may assume any values between zero and `BPS_BASE`.
   5. `create_pair_internal()`:
      1. `liquidation_incentive_bps` not checked to be greater than or equal to `BASE_BPS` and smaller or equal to `MAX_LIQUIDATION_INCENTIVE_BPS`.
      2. `collateral_dust_amount` not checked to be within a reasonable bound.
      3. `base_rate_bps` not checked to be within `BASE_BPS`.
      4. `multiplier_bps` not checked to be within `BASE_BPS`.
      5. `jump_multiplier_bps` not checked to be within `BASE_BPS`.
2. `lending::lending`:
   1. `set_market_jump_interest_rate_model()`:
      1. `base_rate_bps`, `multiplier_bps` and `jump_multiplier_bps` are not checked to be smaller than `BPS_BASE` or otherwise reasonably bound.
      2. It is not checked that `jump_multiplier_bps < multiplier_bps`, leading to no jump in rates after the kink point.
      3. It is not checked that `utilization_kink_bps` is a reasonable value. Especially, it is not checked that `utilization_kink_bps  !== 0`. If `utilization_kink_bps === 0`, it would cause `borrow_interest_rate` to divide by zero. This *division by zero risk* is particularly concerning as it would cause transaction failures for all operations that depend on interest rate calculations, including borrowing, supplying, and liquidations, potentially rendering markets unusable.
   2. `set_market_rate_limit_internal()`: `window_max_qty` not checked to be non-zero or otherwise reasonably bound.
   3. `deposit_reserve_fa()`: Missing call to `validate_fa_info()`.

Recommendation: Consider adding the recommended input validations. Especially, make sure that `utilization_kink_bps !== 0`, as the protocol would otherwise become unusable.

ECH-8 `MAX_LIQUIDATION_INCENTIVE_BPS` Can Be Bypassed when Creating New Pairs

• Low Mitigated

Update

Addressed in `4bccbe5`. Mitigated by checking `liquidation_incentive_bps` to be less than or equal to `MAX_LIQUIDATION_INCENTIVE_BPS`. However, it is still not checked to be greater than or equal to `BASE_BPS`.

File(s) affected: `isolated_lending/sources/isolated_lending.move`

Description: When changing the liquidity incentive via `set_pair_liquidation_incentive_bps()`, it is constrained to be within 100% and `MAX_LIQUIDATION_INCENTIVE_BPS` (150%). However, when creating new pairs via `create_pair_internal()` no such checks exist, allowing potentially higher or lower values, given sufficiently low collateral factor values to pass the coverage checks.

Recommendation: Clarify if this is intentional and consider constraining the liquidation incentive accordingly when creating new pairs.

ECH-9 Positions can be made immediately liquidatable

• Low Acknowledged

Update

The client provided the following explanation:

```
acknowledged however we are fine with this - we understand risks and have already taken very
safe approaches to LT decreases in past.
```

File(s) affected: `lending_core/sources/lending.move`, `isolated_lending/sources/isolated_lending.move`

Description: There are three functions that allow the `manager` role to decrease the liquidation threshold for specific markets. This may cause positions in the affected markets to be immediately liquidatable:

1. `set_efficiency_mode_liquidation_threshold_bps` may decrease the liquidation threshold for all markets in a specific e-mode.
2. `set_market_liquidation_threshold_bps` may decrease the liquidation threshold for a specified market.
3. `market_quit_efficiency_mode` decreases the liquidation threshold of a market by changing its e-mode to the standard parameters.

In other lending protocols like Aave v3, the parameters can only be changed through on-chain governance. The governance process enforces a delay on the parameter changes, such that users can make necessary changes to their positions to prevent a strong impact.

Recommendation: Consider adding a delay to the parameter changes. This can be done through functions in the `lending_manager::manager` module that announce parameter changes and enforce a delay before the `manager` can apply the changes in the `lending::lending` and `isolated_lending::isolated_lending` modules.

ECH-10
[Initia] The `get_price_by_metadata` Function Fails to Check Oracle Price Staleness

• Low Fixed

Update

Addressed in: `080e441`. Introduced staleness check in `get_price_by_metadata()`.

File(s) affected: `echelon_oracle/sources/oracle.move`

Description: The `echelon_oracle::oracle::get_price_by_metadata` function is a view function that retrieves the current price of an asset from the oracles and returns it. However, unlike other functions such as `get_and_update_price_by_metadata`, it does not ensure that the returned price is not stale.

Recommendation: Consider verifying the `updated_at` timestamp of the oracle's returned value against the difference between `max_staleness_seconds` and the current time to ensure the price is not stale.

ECH-11
[Initia] Overflow Mitigations Removed in `mul_div_rounded()`

• Low Fixed

Update

Addressed in: `dbc37d0`. Re-added `(... as u128)` as per recommendation.

File(s) affected: `isolated_lending/sources/isolated_lending.move`

Description: To prevent overflows, the `mul_div_rounded()` function contained unsigned integer widenings `(... as u128)`, which, however, have been removed during the code port. This could unnecessarily lead to overflows and failing calls where `mul_div_rounded()` is being used.

Recommendation: We recommend adding back the unsigned integer widening `(... as u128)` to preempt overflows.

ECH-12
[Initia] Discrepancy Between the Implementation of `accrue_pool_reward` Across Different Branches

• Informational Fixed

Update
Addressed in: `268b163`. Fixed as per recommendation.

File(s) affected: `isolated_lending/sources/farming.move`

Description: A small change in the `accrue_pool_reward` function within the Initia branch can significantly affect protocol behavior. In the main branch, this function updates `pool_reward.last_rewards_sec` by setting it to the current time if `alloc_point` is 0 before returning. However, in the Initia branch, the function returns early if `alloc_point` is 0 without updating `pool_reward.last_rewards_sec`.

This can lead to a scenario where, after the first update of `alloc_point`, the next call to this function considers the new `alloc_point` for the entire duration from the pool's start until the moment of the call, rather than only from when the `alloc_point` was updated.

Recommendation: Consider determining the intended behavior and refactoring the code in either the Initia branch or the main branch to ensure consistent behavior across both.

ECH-13 State Mutation in View Functions

• Informational ⓘ Acknowledged

Update
The client provided the following explanation:

```
we wanna use the view functions off chain and so it is actually convenient for these to work
as they do - we can simulate the changes when calling off chain
```

File(s) affected: `isolated_lending/sources/isolated_lending.move`, `lending_core/sources/lending.move`

Description: Some view functions in different modules borrow global structs as mutable and modify their values. This contradicts the expected behavior of a view function.

Although a careful review of the code indicates that none of these state mutations can be abused at the current stage of the protocol, future updates or unknown side effects of these mutations could pose a threat to the protocol's overall security, especially since some of these functions are public.

Recommendation: Consider refactoring the code to remove any state mutation logic from view functions.

ECH-14 The `new_reward_for_pool` Function Does Not Exist

• Informational ⓘ Fixed

Update
Addressed in: `9398142`. Fixed as per recommendation.

File(s) affected: `lending_core/sources/farming.move`

Description: A comment above the `new_pool` function indicates that another function named `new_reward_for_pool` should exist to tie a pool with a specific reward. However, this function is nowhere to be found in the rest of the code.

Recommendation: Make sure that this function is no longer needed, and if so, adjust the comment accordingly.

ECH-15 Upgradability

• Informational ⓘ Acknowledged

Update
The client provided the following explanation:

```
acknowledged
```

Description: While upgradability is not a vulnerability in itself, protocol users should be aware that the lending protocol can be upgraded at any given time. This audit does not guarantee the behavior of future contracts that the token may be upgraded to.

Recommendation: The fact that the programs can be upgraded and reasons for future upgrades should be communicated to users beforehand.

ECH-16
Application Monitoring Can Be Improved by Emitting More Events

• Informational ⓘ Acknowledged

Update

The client provided the following explanation:

```
acknowledged
```

File(s) affected: `isolated_lending/sources/isolated_lending.move`, `isolated_lending/sources/farming.move`, `lending_core/sources/farming.move`, `lending_core/sources/lending.move`

Description: 1. `isolated_lending/farming.move` : 1. `new_reward_for_farming_internal()` : `farming.rewards` and `reward_name` . 1. `accrue_pool_reward()` : `pool_reward.acc_rewards_per_share` and `pool_reward.last_rewards_sec` . 1. `init_alloc_point()` : `Reward.total_alloc_point` and `pool.rewards` . 1. `init_staker_if_not_exists()` : `Staker` . 1. `init_user_pool_if_not_exists()` : `staker.user_pools` . 1. `accrue_user_pool_reward()` : `user_pool.rewards` , `user_reward.reward_amount` and `user_reward.last_acc_rewards_per_share` .

1. `isolated_lending/isolated_lending.move` :
    1. `set_interest_fee_bps()` : `isolated_lending.interest_fee_bps` .
    2. `set_liquidation_fee_bps()` : `isolated_lending.liquidation_fee_bps` .
    3. `set_pair_liquidation_incentive_bps()` : `pair.liquidation_incentive_bps` .
    4. `set_pair_collateral_factor_bps()` : `pair.collateral_factor_bps` .
    5. `set_pair_collateral_dust_amount()` : `pair.collateral_dust_amount` .
    6. `set_pair_paused()` : `pair.paused` .
    7. `set_pair_supply_cap()` : `pair.supply_cap` .
    8. `set_pair_borrow_cap()` : `pair.borrow_cap` .
    9. `set_pair_jump_interest_rate_model()` : `pair.interest_rate_model_type` and `JumpInterestRateModel` .
2. `lending_core/farming.move` :
    1. `new_reward_for_farming_internal()` : `farming.rewards` and `reward_name` .
    2. `accrue_pool_reward()` : `pool_reward.acc_rewards_per_share` and `pool_reward.last_rewards_sec` .
    3. `init_alloc_point()` : `Reward.total_alloc_point` and `pool.rewards` .
    4. `init_staker_if_not_exists()` : `Staker` .
    5. `init_user_pool_if_not_exists()` : `staker.user_pools` .
3. `lending_core/lending.move` :
    1. `init_pause_flag()` : `PauseFlag` .
    2. `set_paused()` : `flag.paused` .
    3. `set_market_liquidation_incentive_bps()` : `market_liquidation_incentive.value_bps` .
    4. `set_close_factor_bps()` : `lending.close_factor_bps` .
    5. `set_interest_fee_bps()` : `lending.interest_fee_bps` .
    6. `set_liquidation_fee_bps()` : `lending.liquidation_fee_bps` .
    7. `set_market_collateral_factor_bps()` : `market.collateral_factor_bps` .
    8. `set_market_paused()` : `market.paused` .
    9. `set_market_supply_cap()` : `market.supply_cap` .
    10. `set_market_borrow_cap()` : `market.borrow_cap` .
    11. `set_market_jump_interest_rate_model()` : `JumpInterestRateModel` .
    12. `set_market_liquidation_threshold_bps()` : `market_liquidation_threshold.value_bps` .
    13. `set_market_origination_fee_bps()` : `market_origination_fee.value_bps` .
    14. `set_market_liquidation_paused()` : `market_liquidation_pause_flag.paused` .
    15. `create_efficiency_mode_v2()` : `EfficiencyMode` .
    16. `set_efficiency_mode_collateral_factor_bps()` : `e_mode.collateral_factor_bps` .
    17. `set_efficiency_mode_liquidation_incentive_bps()` : `e_mode.liquidation_incentive_bps` .
    18. `set_efficiency_mode_liquidation_threshold_bps()` : `EmodeLiquidationThreshold` .
    19. `market_enter_efficiency_mode()` : `market.efficiency_mode_id` .
    20. `market_quit_efficiency_mode()` : `market.efficiency_mode_id` .
    21. `user_enter_efficiency_mode()` : `vault.efficiency_mode_id` .
    22. `user_quit_efficiency_mode()` : `vault.efficiency_mode_id` .
    23. `create_market_with_jump_model_internal()` : `JumpInterestRateModel` , `MarketLiquidationThreshold` , `MarketLiquidationIncentive` and `MarketLiquidationPauseFlag` .

Recommendation: Consider adding the events.

ECH-17 Efficiency Modes Limited to 255 Possible Combinations

• Informational Acknowledged

Update

The client provided the following explanation:

```
not a concern
```

File(s) affected: `lending_core/sources/lending.move`

Description: Since the efficiency mode id is using `u8` type, zero is reserved and only ever increasing, the protocol is limited to at most 255 different efficiency modes. Furthermore, efficiency modes cannot be deleted.

Recommendation: We recommend increasing the efficiency mode type to `u64` to have sufficient room for future modes and/or to free previous ID's after deletion.

ECH-18 Code Improvements

• Informational Mitigated

Update

Addressed in: `80f46b0`. The following issues were fixed: 4.1, 4.2, 4.3, and 4.5. The other issues remain unresolved.

File(s) affected: `isolated_lending/sources/isolated_lending.move`, `isolated_lending/sources/farming.move`, `lending_core/sources/farming.move`, `lending_core/sources/lending.move`

Description: The following code improvements have been identified:

1. `isolated_lending/isolated_lending.move`:
   1. Comment on `L133` (`Note that this can be overriden by emode's collateral_factor_bps`) mentions an `emode` which does not exist in this contract.
2. `isolated_lending/farming.move`:
   1. `new_epoch_internal()`: Consider changing `reward_per_day` to `reward_per_second` to move the computation of `reward_per_day / SECONDS_PER_DAY` to be off-chain.
   2. `init_alloc_point()`: The else-case in L262-L264 may be removed as it is never executed, due to the enforced assert in L244.
   3. `update_alloc_point()`: Consider moving the emission of the event into the if-statement, to only emit if any values have been changed. Otherwise, consider removing the if-statement and asserting the `new_alloc_point` to be different from `prev_alloc_point`.
   4. `isolated_lending::farming.move#L359`: Contrary to the functions comment, it is also callable from `withdraw_fa()`, `preview_withdraw()`, `liquidate_fa()`, `repay()`, `repay_fa()`, `preview_repay()`, `remove_collateral()`, `remove_collateral_fa()` and `preview_remove_collateral()`.
3. `lending_core/farming.move`:
   1. `new_epoch_internal()`: Consider changing `reward_per_day` to `reward_per_second` to move the computation of `reward_per_day / SECONDS_PER_DAY` to be off-chain.
   2. `init_alloc_point()`: The else-case in L262-L264 may be removed as it is never executed, due to the enforced assert in L244.
   3. `update_alloc_point()`: Consider moving the emission of the event into the if-statement, to only emit if any values have been changed. Otherwise, consider removing the if-statement and asserting the `new_alloc_point` to be different from `prev_alloc_point`.
   4. `lending_core::farming.move#L379`: Contrary to the functions comment, it is also callable from `clear_bad_debt()`, `clear_bad_debt_batch()`, `withdraw_fa`, `repay()`, `repay_fa()`, `liquidate_fa()`.
4. `lending_core/lending.move`:
   1. `MARKET_NAME_PREFIX`: Constant remains unused and may be removed.
   2. `ERR_LENDING_MARKET_ALREADY_INITIALIZED`: Error remains unused and may be removed.
   3. `ERR_LENDING_MARKET_INSUFFICIENT_SHARES`: Error remains unused and may be removed.
   4. Comment on `L176` (`Counter for protocol fee. The counter is reset to 0 when the protocol withdraws the fee.`) incorrectly describes the variable `total_reserve`.
   5. Typo on `L849`: `should not in` → `should not be in`.
   6. Functions `withdraw_reserve_fa()`, `withdraw_fa()` and `borrow_fa()` re-implement the code instead of calling `validate_fa_info()`. Consider replacing the code with aforementioned call to improve maintainability.

7. `create_market_internal()` : Consider addressing the pending todo (`dedup market by fullname or metadata`) by checking for duplicates prior to adding the market.

Recommendation: Consider implementing the recommended code changes.

ECH-19

Failure to Register the Recipient's Address in the `withdraw_reserve<CoinType>` Function

• Informational ⓘ Acknowledged

Update

The client provided the following explanation:

```
not a concern
```

File(s) affected: `lending_core/sources/lending.move`

Description: The `withdraw_reserve<CoinType>` function is used to initiate a reserve withdrawal by the protocol manager. It allows specifying a recipient address for the funds. However, it only calls `coin::register<CoinType>` for the recipient if the recipient is the manager address itself. This can lead to errors when attempting to withdraw funds to a non-manager address.

Recommendation: Consider removing the check and registering the recipient's address regardless of whether it is the manager's address or not.

ECH-20

[Movement] Meridian AMM Interface `pool.move` Contains Unusable Skeleton Code

• Undetermined ⓘ Acknowledged

Update

The client provided the following explanation:

```
this is simply to enable for compilation – we have confirmed behaviour manually and know the behaviour of the interface, so not a concern.
```

File(s) affected: `meridian_amm_interface/sources/pool.move`

Description: For the Movement port the Thala aggregator interface has been replaced with the Meridian AMM interface. However, the corresponding `pool.move` only contains empty functions that abort on call.

Recommendation: Clarify if this is intentional or consider finishing the implementation.

ECH-21

[Initia] Removal of Collateral Farming in `isolated_lending`

• Undetermined ⓘ Acknowledged

Update

The client provided the following explanation:

```
acknowledged
```

File(s) affected: `isolated_lending/sources/isolated_lending.move`

Description: As part of the code porting, staking and unstaking of provided collateral using the farming module has been removed.

Recommendation: Clarify if this is intentional or consider reintroducing said changes.

Auditor Suggestions

S1 Name Collision Between Move Scripts and Module Name

Acknowledged

Update

The client provided the following explanation:

```
acknowledged
```

File(s) affected: `lending_core/sources/scripts.move`,

Description: The module name `lending::scripts` is confusing, considering scripts are a native concept in Move indicated with `script` blocks.

Recommendation: Consider renaming this module.

S2 Undermined Coin Type

Acknowledged

Update

The client provided the following explanation:

```
acknowledged
```

File(s) affected: `lending_leverage/sources/leverage.move`

Description: Various functions in the `leverage::leverage` module are dealing with Move coins. However, they miss determining the coin type while calling coin functions such as `coin::deposit` or lending module functions such as `lending::supply`.

Recommendation: Consider adding these missing generic types.

S3 Enforce Minimum Borrow Amount

Acknowledged

Update

The client provided the following explanation:

```
not a concern
```

File(s) affected: `lending_core/sources/lending.move`

Description: A user can currently borrow arbitrarily small amounts. Due to performed rounding, the origination fee may have a much higher bps for very small borrow amounts.

Recommendation: Consider enforcing a minimum borrow amount.

Definitions

- **High severity** – High-severity issues usually put a large number of users' sensitive information at risk, or are reasonably likely to lead to catastrophic impact for client's reputation or serious financial implications for client and users.
- **Medium severity** – Medium-severity issues tend to put a subset of users' sensitive information at risk, would be detrimental for the client's reputation if exploited, or are reasonably likely to lead to moderate financial impact.
- **Low severity** – The risk is relatively small and could not be exploited on a recurring basis, or is a risk that the client has indicated is low impact in view of the client's business circumstances.
- **Informational** – The issue does not post an immediate risk, but is relevant to security best practices or Defence in Depth.

- **Undetermined** – The impact of the issue is uncertain.
- **Fixed** – Adjusted program implementation, requirements or constraints to eliminate the risk.
- **Mitigated** – Implemented actions to minimize the impact or likelihood of the risk.
- **Acknowledged** – The issue remains in the code but is a result of an intentional business or design decision. As such, it is supposed to be addressed outside the programmatic means, such as: 1) comments, documentation, README, FAQ; 2) business processes; 3) analyses showing that the issue shall have no negative consequences in practice (e.g., gas analysis, deployment settings).

Test Suite Results

All 444 test cases could be successfully executed, consisting of 242 tests for the `lending_core`, 199 tests for the `isolated_lending`, 1 test for the `lending_manager`, and 2 tests for the `lending_leverage` package. We highly recommend adding tests cases for all packages, especially for `lending_manager` and . `lending_leverage`.

Fix Review Update: During the fix review, were able to run all 458 tests, consisting of 250 tests for `lending_core`, 205 tests for `isolated_lending`, 1 test for the `lending_manager`, and 2 tests for the `lending_leverage`.

```
**lending_core**

[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::package::init_module_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_claim_rew
ard_invalid_reward_coin_2_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::package::publish_package_unau
thorized_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_claim_rew
ard_invalid_reward_coin_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::account_liq
uidity_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::account_liquid
ity_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_claim_rew
ard_last_acc_rewards_per_share_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::account_liq
uidity_with_emode_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_claim_rew
ard_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::account_liquid
ity_with_emode_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_claim_rew
ard_pool_not_exist_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::borrow_cap_
exceeded_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::borrow_cap_exc
eeded_err
[ PASS    ]
```

```
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_claim_rew
ard_staker_not_exist_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_claim_rew
ard_user_pool_not_exist_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::borrow_cap_
ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::borrow_cap_ok
[ PASS    ]
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_coin_uninitialized_err
[ PASS    ]
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fficient_balance_err
[ PASS    ]
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_invalid_reward_per_day_err
[ PASS    ]
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cient_balance_err
[ PASS    ]
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_invalid_time_err
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rest_rate_ok
[ PASS    ]
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_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::borrow_interes
t_rate_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_new_pool_
already_exist_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::borrow_inva
lid_market_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::borrow_invalid
_market_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_new_pool_
ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_new_rewar
d_for_farming_already_initialized_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::borrow_lend
ing_paused_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::borrow_lending
_paused_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_new_rewar
d_for_farming_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_new_rewar
```

```
d_for_pool_alloc_point_too_large_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::borrow_multipl
e_users_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::borrow_mult
iple_users_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_new_rewar
d_for_pool_not_exist_err
[ PASS    ]
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d_for_pool_ok
[ PASS    ]
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e_users_rate_limit_ok
[ PASS    ]
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iple_users_rate_limit_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_new_rewar
d_for_pool_reward_coin_uninitialized_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::borrow_origina
tion_fee_cap_exceeded_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::borrow_orig
ination_fee_cap_exceeded_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_stake_mul
tiple_users_ok
[ PASS    ]
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tion_fee_ok
[ PASS    ]
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ination_fee_ok
[ PASS    ]
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l_not_exist_err
[ PASS    ]
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tion_fee_shortfall_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::borrow_orig
ination_fee_shortfall_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_stake_sin
gle_user_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::borrow_shortfa
ll_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::borrow_shor
tfall_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_unstake_i
nvalid_amount_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_unstake_o
```

```
k
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::borrow_single_
user_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::borrow_sing
le_user_ok
[ PASS    ]
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ool_not_exist_err
[ PASS    ]
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[ PASS    ]
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taker_not_exist_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::borrow_sing
le_user_rate_limit_exceeded_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_unstake_u
ser_pool_not_exist_err
[ PASS    ]
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user_rate_limit_ok
[ PASS    ]
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le_user_rate_limit_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_update_al
loc_point_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::borrow_vault_n
ot_exists_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::borrow_vaul
t_not_exists_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_update_al
loc_point_pool_not_exist_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming_tests::test_update_al
loc_point_reward_uninitialized_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::clear_bad_debt
_collateral_market_paused_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::clear_bad_d
ebt_collateral_market_paused_ok
[ PASS    ]
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loc_point_too_large_err
[ PASS    ]
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_insufficient_reserve_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::clear_bad_d
ebt_insufficient_reserve_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::clear_bad_debt
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_no_bad_debt_err
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ebt_liability_market_paused_ok
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cy_mode_already_in_emode_err
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ending_paused_err
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n_incentive_err
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[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::set_market_liq
uidation_incentive_market_liquidation_incentive_less_than_emode_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::set_market_
liquidation_incentive_market_liquidation_incentive_less_than_emode_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::set_market_liq
uidation_incentive_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::set_market_
```

```
liquidation_incentive_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::set_market_origination_fee_gt_max_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::set_market_origination_fee_gt_max_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::set_market_rate_limit_multi_market_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::set_market_rate_limit_multi_market_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::set_market_rate_limits_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::set_market_rate_limits_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::set_market_withdraw_rate_limit_invalid_window_duration_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::set_market_withdraw_rate_limit_invalid_window_duration_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::set_market_withdraw_rate_limit_unauthorized_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::set_market_withdraw_rate_limit_unauthorized_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::set_pause_flag_already_initialized_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::supply_cap_exceeded_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::set_pause_flag_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::set_pause_flag_unauthorized_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::supply_cap_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::supply_cap_exceeded_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::supply_cap_with_interest_exceeded_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::supply_lending_paused_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::supply_cap_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::supply_with_borrow_large_decimals_ok
```

```
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::supply_cap_wit
h_interest_exceeded_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::supply_lending
_paused_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::supply_with
_borrow_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::supply_with
out_borrow_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::supply_with_bo
rrow_large_decimals_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::withdraw_al
l_collateral_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::supply_with_bo
rrow_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::withdraw_in
sufficient_balance_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::supply_without
_borrow_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::withdraw_le
nding_paused_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::withdraw_all_c
ollateral_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::withdraw_mu
ltiple_users_rate_limit_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::withdraw_insuf
ficient_balance_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::withdraw_lendi
ng_paused_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::withdraw_sh
ortfall_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::withdraw_multi
ple_users_rate_limit_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::withdraw_si
ngle_user_rate_limit_exceeded_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::withdraw_si
ngle_user_rate_limit_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::withdraw_short
fall_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::withdraw_va
ult_not_exists_err
```

```
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::withdraw_singl
e_user_rate_limit_exceeded_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::withdraw_wi
th_borrow_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::withdraw_singl
e_user_rate_limit_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_fa_tests::withdraw_wi
thout_borrow_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::withdraw_vault
_not_exists_err
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::withdraw_with_
borrow_ok
[ PASS    ]
0xc6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending_tests::withdraw_witho
ut_borrow_ok
Test result: OK. Total tests: 242; passed: 242; failed: 0



**isolated_lending**
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::package::init_module_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_claim_rewa
rd_invalid_reward_coin_2_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::add
_collateral_coin_info_mismatch_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::package::publish_package_unaut
horized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::add_co
llateral_coin_info_mismatch_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_claim_rewa
rd_invalid_reward_coin_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::add
_collateral_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_claim_rewa
rd_last_acc_rewards_per_share_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::add_co
llateral_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::bor
row_cap_exceeded_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_claim_rewa
rd_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::borrow
```

```
_cap_exceeded_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::bor
row_coin_info_mismatch_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_claim_rewa
rd_pool_not_exist_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::borrow
_coin_info_mismatch_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::bor
row_insufficient_asset_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_claim_rewa
rd_staker_not_exist_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::borrow
_insufficient_asset_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_claim_rewa
rd_user_pool_not_exist_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::bor
row_max_amount_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::borrow
_max_amount_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_new_epoch_
coin_uninitialized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::bor
row_max_amount_too_much_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_new_epoch_
invalid_reward_per_day_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::borrow
_max_amount_too_much_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_new_epoch_
invalid_time_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::bor
row_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::borrow
_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_new_epoch_
ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::bor
row_paused_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_new_pool_a
lready_exist_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::borrow
```

```
_paused_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_new_pool_o
k
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::bor
row_shortfall_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::borrow
_shortfall_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_new_reward
_for_farming_already_initialized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::cle
ar_bad_debt_collateral_amount_greater_than_dust_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::clear_
bad_debt_collateral_amount_greater_than_dust_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_new_reward
_for_farming_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::cle
ar_bad_debt_collateral_value_greater_than_liability_value_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_new_reward
_for_pool_alloc_point_too_large_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::clear_
bad_debt_collateral_value_greater_than_liability_value_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_new_reward
_for_pool_not_exist_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::cle
ar_bad_debt_paused_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::clear_
bad_debt_paused_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_new_reward
_for_pool_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::cle
ar_bad_debt_position_not_exists_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::clear_
bad_debt_position_not_exists_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_new_reward
_for_pool_reward_coin_uninitialized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::cle
ar_bad_debt_with_supply_cover_debt_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::clear_
bad_debt_with_supply_cover_debt_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_stake_mult
```

```
iple_users_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::cle
ar_bad_debt_with_supply_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::clear_
bad_debt_with_supply_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_stake_pool
_not_exist_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::cle
ar_bad_debt_without_supply_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::clear_
bad_debt_without_supply_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_stake_sing
le_user_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::cre
ate_pair_with_jump_model_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::create
_pair_with_jump_model_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_unstake_in
valid_amount_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::cre
ate_pair_with_jump_model_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::create
_pair_with_jump_model_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_unstake_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::liq
uidate_coin_info_mismatch_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_unstake_po
ol_not_exist_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::liquid
ate_coin_info_mismatch_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_unstake_st
aker_not_exist_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::liq
uidate_insufficient_collateral_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::liquid
ate_insufficient_collateral_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_unstake_us
er_pool_not_exist_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_update_all
oc_point_ok
```

```
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::liquid
ate_min_amount_out_unmet_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::liq
uidate_min_amount_out_unmet_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_update_all
oc_point_pool_not_exist_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_update_all
oc_point_reward_uninitialized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::liquid
ate_no_shortfall_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::liq
uidate_no_shortfall_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming_tests::test_update_all
oc_point_too_large_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::liquid
ate_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::liq
uidate_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::liquid
ate_paused_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::liq
uidate_paused_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::liquid
ate_repay_over_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::liq
uidate_repay_over_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::liquid
ate_self_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::liq
uidate_self_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::liquid
ate_with_clear_bad_debt_socialize_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::liq
uidate_with_clear_bad_debt_socialize_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::liquid
ate_with_clear_bad_debt_supply_cover_all_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::liq
uidate_with_clear_bad_debt_supply_cover_all_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::remove
_collateral_coin_info_mismatch_err
```

```
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::rem
ove_collateral_asset_type_mismatch_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::remove
_collateral_insufficient_asset_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::rem
ove_collateral_insufficient_asset_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::remove
_collateral_shortfall_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::rem
ove_collateral_shortfall_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::rem
ove_collateral_with_borrow_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::remove
_collateral_with_borrow_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::rem
ove_collateral_without_borrow_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::remove
_collateral_without_borrow_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::rem
ove_max_removable_collateral_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::remove
_max_removable_collateral_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::rem
ove_max_removable_collateral_too_much_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::remove
_max_removable_collateral_too_much_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::rep
ay_coin_info_mismatch_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::repay_
coin_info_mismatch_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::rep
ay_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::repay_
ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::rep
ay_paused_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::repay_
paused_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::rep
ay_shares_exceeds_borrow_shares_err
```

```
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::repay_shares_exceeds_borrow_shares_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set_interest_fee_bps_invalid_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_interest_fee_bps_invalid_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set_interest_fee_bps_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_interest_fee_bps_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set_interest_fee_bps_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_interest_fee_bps_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set_interest_fee_with_accrual_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_interest_fee_with_accrual_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set_liquidation_fee_bps_invalid_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_liquidation_fee_bps_invalid_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set_liquidation_fee_bps_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_liquidation_fee_bps_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set_liquidation_fee_bps_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_liquidation_fee_bps_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set_liquidation_incentive_bps_insufficient_coverage_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_liquidation_incentive_bps_insufficient_coverage_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set_liquidation_incentive_bps_invalid_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_liquidation_incentive_bps_invalid_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set_liquidation_incentive_bps_unauthorized_err
```

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[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_li
quidation_incentive_bps_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set
_liquidation_incentive_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_li
quidation_incentive_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set
_pair_borrow_cap_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_pa
ir_borrow_cap_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set
_pair_borrow_cap_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_pa
ir_borrow_cap_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set
_pair_collateral_dust_amount_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_pa
ir_collateral_dust_amount_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set
_pair_collateral_dust_amount_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_pa
ir_collateral_dust_amount_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set
_pair_collateral_factor_bps_insufficient_coverage_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_pa
ir_collateral_factor_bps_insufficient_coverage_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set
_pair_collateral_factor_bps_invalid_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_pa
ir_collateral_factor_bps_invalid_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set
_pair_collateral_factor_bps_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_pa
ir_collateral_factor_bps_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set
_pair_collateral_factor_bps_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_pa
ir_collateral_factor_bps_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set
_pair_jump_interest_rate_model_invalid_utilization_kink_err
```

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[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_pa
ir_jump_interest_rate_model_invalid_utilization_kink_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set
_pair_jump_interest_rate_model_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_pa
ir_jump_interest_rate_model_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set
_pair_jump_interest_rate_model_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_pa
ir_jump_interest_rate_model_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set
_pair_jump_interest_rate_model_with_accrual_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_pa
ir_jump_interest_rate_model_with_accrual_ok
[ PASS    ]
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_pair_paused_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_pa
ir_paused_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set
_pair_paused_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_pa
ir_paused_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set
_pair_supply_cap_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_pa
ir_supply_cap_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::set
_pair_supply_cap_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::set_pa
ir_supply_cap_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::sup
ply_asset_type_mismatch_err
[ PASS    ]
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_cap_exceeded_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::sup
ply_cap_exceeded_err
[ PASS    ]
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_coin_info_mismatch_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::sup
ply_with_borrow_ok
```

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[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::sup
ply_without_borrow_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::supply
_with_borrow_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::wit
hdraw_asset_type_mismatch_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::supply
_without_borrow_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::wit
hdraw_collateral_fee_coin_info_mismatch_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::withdr
aw_coin_info_mismatch_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::withdr
aw_collateral_fee_coin_info_mismatch_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::wit
hdraw_collateral_fee_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::wit
hdraw_collateral_fee_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::withdr
aw_collateral_fee_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::wit
hdraw_liability_fee_coin_info_mismatch_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::withdr
aw_collateral_fee_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::wit
hdraw_liability_fee_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::withdr
aw_liability_fee_coin_info_mismatch_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::wit
hdraw_liability_fee_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::withdr
aw_liability_fee_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::wit
hdraw_pair_insufficient_asset_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::withdr
aw_liability_fee_unauthorized_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::wit
hdraw_position_not_exists_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::withdr
aw_pair_insufficient_asset_err
```

```
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::wit
hdraw_user_insufficient_asset_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::withdr
aw_position_not_exists_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::wit
hdraw_with_borrow_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::withdr
aw_user_insufficient_asset_err
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_fa_tests::wit
hdraw_without_borrow_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::withdr
aw_with_borrow_ok
[ PASS    ]
0x24c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending_tests::withdr
aw_without_borrow_ok
Test result: OK. Total tests: 199; passed: 199; failed: 0

*`lending_manager`*
[ PASS    ]
0x21c0f7196d3b246f8ff7493a4539874db36f612a991d65097abd243765bb737f::package::init_module_ok
Test result: OK. Total tests: 1; passed: 1; failed: 0

*`lending_leverage`*
[ PASS    ]
0x86b77933b4eaa313d49fac1ae371204d2faf2efcb0a4de9542c1d7840b958fbe::package::init_module_ok
[ PASS    ]
0x86b77933b4eaa313d49fac1ae371204d2faf2efcb0a4de9542c1d7840b958fbe::package::publish_package_unau
thorized_err
```

Code Coverage

The `lending_core` package achieves a coverage of 75.84%, and `isolated_lending` achieves 86.59%. We highly recommend to getting these values (close) to 100% to make sure that the code works as intended. Particularly, `lending_manager` achieves only 20.10% and `lending_leverage` as little as 8.66%.

Fix Review Update: The coverage percentages have only marginally (<1%) changed after the fix review.

lending_core

```
+-------------------------+
| Move Coverage Summary   |
+-------------------------+
Module c6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::package
 >>> % Module coverage: 66.67
Module c6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::farming
 >>> % Module coverage: 88.55
Module c6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::lending
 >>> % Module coverage: 75.72
Module c6bc659f1649553c1a3fa05d9727433dc03843baac29473c817d06d39e7621ba::scripts
 >>> % Module coverage: 0.00
+-------------------------+
```

```
| % Move Coverage: 75.84  |
+-------------------------+
```

isolated_lending

```
+-------------------------+
| Move Coverage Summary   |
+-------------------------+
Module 024c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::package
>>> % Module coverage: 66.67
Module 024c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::farming
>>> % Module coverage: 88.66
Module 024c90c44edf46aa02c3e370725b918a59c52b5aa551388feb258bd5a1e82271::isolated_lending
>>> % Module coverage: 86.27
+-------------------------+
| % Move Coverage: 86.59  |
+-------------------------+
```

lending_manager

```
+-------------------------+
| Move Coverage Summary   |
+-------------------------+
Module 21c0f7196d3b246f8ff7493a4539874db36f612a991d65097abd243765bb737f::package
>>> % Module coverage: 64.06
Module 21c0f7196d3b246f8ff7493a4539874db36f612a991d65097abd243765bb737f::manager
>>> % Module coverage: 0.00
+-------------------------+
| % Move Coverage: 20.10  |
+-------------------------+
```

lending_leverage

```
+-------------------------+
| Move Coverage Summary   |
+-------------------------+
Module 86b77933b4eaa313d49fac1ae371204d2faf2efcb0a4de9542c1d7840b958fbe::package
>>> % Module coverage: 66.67
Module 86b77933b4eaa313d49fac1ae371204d2faf2efcb0a4de9542c1d7840b958fbe::leverage
>>> % Module coverage: 0.00
+-------------------------+
| % Move Coverage: 8.66  |
+-------------------------+
```

Changelog

- 2025-04-08 - Initial report
- 2025-05-12 - Final Report

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Quantstamp is a global leader in blockchain security. Founded in 2017, Quantstamp's mission is to securely onboard the next billion users to Web3 through its best-in-class Web3 security products and services.

Quantstamp's team consists of cybersecurity experts hailing from globally recognized organizations including Microsoft, AWS, BMW, Meta, and the Ethereum Foundation. Quantstamp engineers hold PhDs or advanced computer science degrees, with decades of combined experience in formal verification, static analysis, blockchain audits, penetration testing, and original leading-edge research.

To date, Quantstamp has performed more than 500 audits and secured over $200 billion in digital asset risk from hackers. Quantstamp has worked with a diverse range of customers, including startups, category leaders and financial institutions. Brands that Quantstamp has worked with include Ethereum 2.0, Binance, Visa, PayPal, Polygon, Avalanche, Curve, Solana, Compound, Lido, MakerDAO, Arbitrum, OpenSea and the World Economic Forum.

Quantstamp's collaborations and partnerships showcase our commitment to world-class research, development and security. We're honored to work with some of the top names in the industry and proud to secure the future of web3.

Notable Collaborations & Customers:

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- DeFi: Curve, Compound, Maker, Lido, Polygon, Arbitrum, SushiSwap
- NFT: OpenSea, Parallel, Dapper Labs, Decentraland, Sandbox, Axie Infinity, Illuvium, NBA Top Shot, Zora
- Academic institutions: National University of Singapore, MIT

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