



Solana Labs – Solana v1.14.6 – v1.14.10 Solana Program Security Audit

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DOCUMENT REVISION HISTORY

| VERSION | MODIFICATION | DATE | AUTHOR |
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| 0.1 | Document Creation | 12/26/2022 | Guillermo Alvarez |
| 0.2 | Document Updates | 12/29/2022 | Michael Smith |
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| 0.4 | Draft Review | 12/30/2022 | Isabel Burrueto |
| 0.5 | Draft Review | 12/30/2022 | Piotr Cielas |
| 0.6 | Draft Review | 12/30/2022 | Gabi Urrutia |
| 1.0 | Remediation Plan | 05/19/2023 | Piotr Cielas |
| 1.1 | Remediation Plan Review | 05/19/2023 | Gabi Urrutia |

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EXECUTIVE OVERVIEW

1.1 INTRODUCTION

Solana is an open-source project implementing a new, high-performance, permissionless blockchain. Changes in scope affected several modules, the most important ones are briefly described. `Sealevel`, Solana's parallel smart contracts runtime, is a concurrent transaction processor. Transactions specify their data dependencies upfront, and dynamic memory allocation is explicit. By separating program code from the state it operates on, the runtime can choreograph concurrent access. `Gulf Stream` the transaction forwarding protocol, which is Solana's mempool-less solution for forwarding and storing transactions before processing them. The `Gossip` Service acts as a gateway to nodes in the control plane. Validators use the service to ensure information is available to all other nodes in a cluster. `TPU` (Transaction Processing Unit) is the logic of the validator responsible for block production.

`Halborn` conducted a security audit on the Solana v1.14.6 to v1.14.10 changes beginning on November 12th, 2022 and ending on December 30th, 2022 . The security assessment was scoped to the implementation of the updates up to v1.14.10 provided in the `solana` GitHub repository. Commit hashes and further details can be found in the `Scope` section of this report.

1.2 AUDIT SUMMARY

The team at Halborn was provided 2 weeks for the engagement and assigned 1 full-time security engineer to audit the security of the programs in scope. The security engineer is a blockchain and smart contract security expert with advanced penetration testing and smart contract hacking skills, and deep knowledge of multiple blockchain protocols.

The purpose of this audit is to:

- Identify potential security issues within the programs

In summary, Halborn did not identify any significant security risk affecting the new updates introduced in releases 1.14.6 to 1.14.10.

1.3 TEST APPROACH & METHODOLOGY

Halborn performed a combination of a manual review of the source code and automated security testing to balance efficiency, timeliness, practicality, and accuracy in regard to the scope of the program audit. While manual testing is recommended to uncover flaws in business logic, processes, and implementation; automated testing techniques help enhance coverage of programs and can quickly identify items that do not follow security best practices.

The following phases and associated tools were used throughout the term of the audit:

- Research into the architecture, purpose, and use of the platform.
- Manual program source code review to identify business logic issues.
- Mapping out possible attack vectors
- Thorough assessment of safety and usage of critical Rust variables and functions in scope that could lead to arithmetic vulnerabilities.
- Finding unsafe Rust code usage (`cargo-geiger`)
- Scanning dependencies for known vulnerabilities (`cargo audit`).
- Local runtime testing (`solana-test-framework`)

RISK METHODOLOGY:

Vulnerabilities or issues observed by Halborn are ranked based on the risk assessment methodology by measuring the **LIKELIHOOD** of a security incident and the **IMPACT** should an incident occur. This framework works for communicating the characteristics and impacts of technology vulnerabilities. The quantitative model ensures repeatable and accurate measurement while

enabling users to see the underlying vulnerability characteristics that were used to generate the Risk scores. For every vulnerability, a risk level will be calculated on a scale of 5 to 1 with 5 being the highest likelihood or impact.

RISK SCALE - LIKELIHOOD

- 5 - Almost certain an incident will occur.
- 4 - High probability of an incident occurring.
- 3 - Potential of a security incident in the long term.
- 2 - Low probability of an incident occurring.
- 1 - Very unlikely issue will cause an incident.

RISK SCALE - IMPACT

- 5 - May cause devastating and unrecoverable impact or loss.
- 4 - May cause a significant level of impact or loss.
- 3 - May cause a partial impact or loss to many.
- 2 - May cause temporary impact or loss.
- 1 - May cause minimal or un-noticeable impact.

The risk level is then calculated using a sum of these two values, creating a value of 10 to 1 with 10 being the highest level of security risk.

| | | | | |
|----------|------|--------|-----|---------------|
| CRITICAL | HIGH | MEDIUM | LOW | INFORMATIONAL |
|----------|------|--------|-----|---------------|

- 10 - CRITICAL
- 9 - 8 - HIGH
- 7 - 6 - MEDIUM
- 5 - 4 - LOW
- 3 - 1 - VERY LOW AND INFORMATIONAL

1.4 SCOPE

Code repositories:

1. Solana

- Repository: `solana`
- Releases v1.14.6-v1.14.10:
 - start: `be4242c5be89e13c920540703ebb30e2704906ea`
 - final: `df128573127c324cb5b53634a7e2d77427c6f2d8`

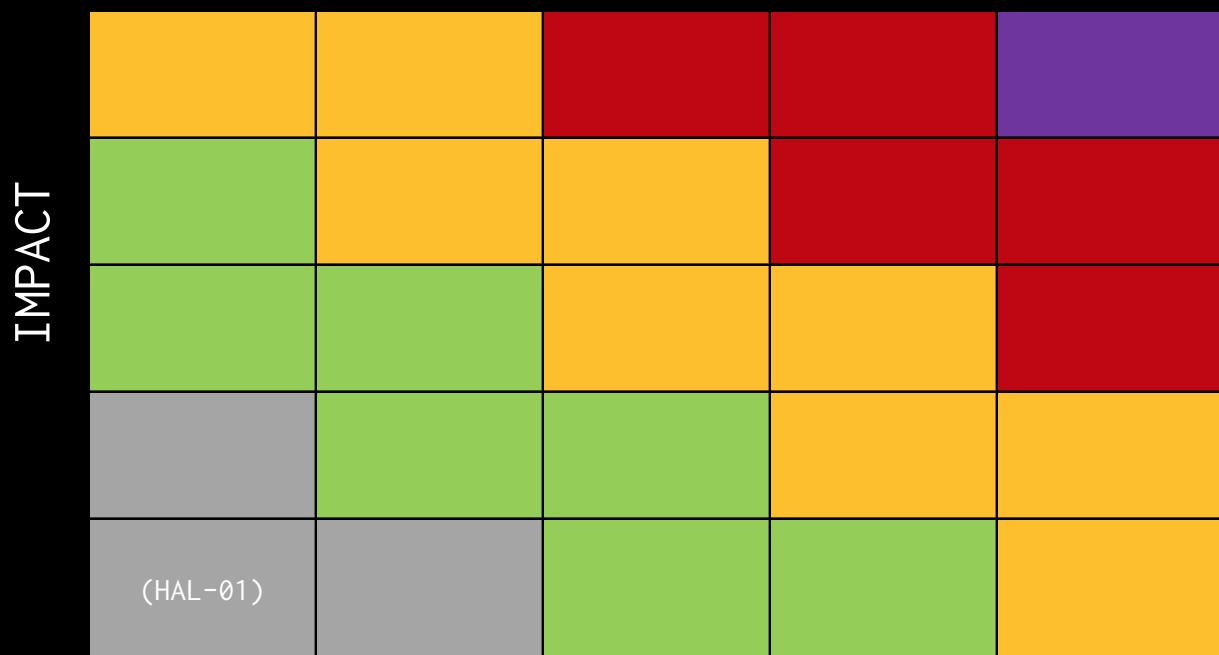
Out-of-scope:

- third-party libraries and dependencies
- financial-related attacks

2. ASSESSMENT SUMMARY & FINDINGS OVERVIEW

| CRITICAL | HIGH | MEDIUM | LOW | INFORMATIONAL |
|----------|------|--------|-----|---------------|
| 0 | 0 | 0 | 0 | 1 |

LIKELIHOOD



EXECUTIVE OVERVIEW

| SECURITY ANALYSIS | RISK LEVEL | REMEDIATION DATE |
|--|---------------|------------------|
| HAL-01 - POSSIBLE RUST PANICS DUE TO UNSAFE UNWRAP USAGE | Informational | ACKNOWLEDGED |



FINDINGS & TECH DETAILS



3.1 (HAL-01) POSSIBLE RUST PANICS DUE TO UNSAFE UNWRAP USAGE - INFORMATIONAL

Description:

The use of helper methods in Rust, such as `unwrap`, is allowed in dev and testing environment because those methods are supposed to throw an error (also known as `panic!`) when called on `Option::None` or a `Result` which is not `Ok`. However, keeping `unwrap` functions in the production environment is considered bad practice because they may lead to program crashes, which are usually accompanied by insufficient or misleading error messages.

Code Location:

Note: only `unwraps` introduced by the changes in scope are listed, justified usages such as in tests were excluded.

Listing 1

```
./core/src/banking_stage.rs:687      poh_recorder.read().unwrap().
↳ bank_start(),
./core/src/cluster_nodes.rs:230        .unwrap();
./gossip/src/crds_gossip.rs:95        let mut crds = self.crds
↳ .write().unwrap();
./gossip/src/crds_gossip_push.rs:277   let active_set = self.
↳ active_set.read().unwrap();
./gossip/src/crds_gossip_push.rs:1003  assert_eq!(push.
↳ active_set.read().unwrap().len(), 1);
./transaction-status/src/parse_token/extension/cpi_guard.rs:24
↳ let map = value.as_object_mut().unwrap();
```

Risk Level:

Likelihood - 1

Impact - 1

Recommendation:

It is recommended not to use the `unwrap` function in the production environment because its use causes `panic!` and may crash any affected module, program or, in the worst case, the runtime without verbose error messages. Crashing the system will result in a loss of availability and, in some cases, even private information stored in the state. Some alternatives are possible, such as propagating the error with `?` instead of unwrapping, or using the `error-chain` crate for errors.

Remediation Plan:

ACKNOWLEDGED: The Solana team acknowledged this issue.

MANUAL TESTING

In the manual testing phase, the following scenarios were simulated. The scenarios listed below were selected based on the severity of the vulnerabilities Halborn was testing the program for.

4.1 MULTI ITERATOR SCANNER

Description:

Commit [030eb5f2caadebeb5d656c1a0b2d2058ea4bd242](#) introduced `MultiIteratorScanner` which provides an interface for creating non-conflicting batches of transactions, taking into consideration priority, non-conflicting transactions are processed in parallel improving the banking stage performance. Previously, high-priority transactions could conflict with each other, with the new approach, multiple iterators can be used for creating batches of non-conflicting transactions.

The following requirements were tested:

- The iterator behaves correctly in edge cases, such as only conflicting transactions are present in the batch.
- Slices that contain `ProcessingDecision::Never` are not returned by the iterator.

Results:

No code vulnerabilities were identified.

4.2 DENIAL OF SERVICE

Description:

Commit [8a6028dea1a828813bad0b4d9c93e0026d8d1d52](#) backported a fix for the BigTable token refresh. Previously, no timeout was configured, thus if the connection with the BigTable service was lost, the token would not be refreshed and the service had to be manually restarted to reconnect. A 5 second timeout was introduced to prevent having to restart the node if the refresh token fails, however if the connection is unstable and the BigTable token expires before it is renewed, it would still be necessary to manually reboot the service. The implemented change was reviewed to check whether it could introduce deadlocks or Denial of Service conditions by intercepting, delaying, forwarding and dropping requests.

Results:

No code vulnerabilities were identified.

4.3 PARSE TOKEN

Description:

Commit `e39ad9762df672a463e9b24ba4490f72e5f530a7` introduces support for the `CPI-Guard` and `PermanentDelegate` token-2022 extensions in the `transaction-status` and `account-decoder` modules. Both of these modules are used to parse instruction data and encode them for different user interfaces, vulnerabilities in the parsing or encoding could mislead users on the results of a transaction. Both modules were tested with valid and invalid data to ensure they would perform as expected

Results:

No code vulnerabilities were identified.

AUTOMATED TESTING

5.1 AUTOMATED ANALYSIS

Description:

Halborn used automated security scanners to assist with the detection of well-known security issues and vulnerabilities. Among the tools used was [cargo-audit](#), a security scanner for vulnerabilities reported to the Rust-Sec Advisory Database. All vulnerabilities published in <https://crates.io> are stored in a repository named The RustSec Advisory Database. cargo audit is a human-readable version of the advisory database which performs a scanning on Cargo.lock. Security Detections are only in scope. All vulnerabilities shown here were already disclosed in the above report. However, to better assist the developers maintaining this code, the auditors are including the output with the dependencies tree, and this is included in the cargo audit output to better know the dependencies affected by unmaintained and vulnerable crates.

Results:

| ID | package | Short Description |
|-------------------|------------|--------------------------------------|
| RUSTSEC-2020-0071 | time | Potential segfault in the time crate |
| RUSTSEC-2021-0139 | ansi_term | ansi_term is unmaintained |
| RUSTSEC-2020-0016 | net2 | net2 crate has been deprecated |
| RUSTSEC-2021-0127 | serde_cbor | serde_cbor is unmaintained |

5.2 UNSAFE RUST CODE DETECTION

Description:

Halborn used automated security scanners to assist with the detection of well-known security issues and vulnerabilities. Among the tools used was [cargo-geiger](#), a security tool that lists statistics related to the usage of unsafe Rust code in a core Rust codebase and all its dependencies.

Results:

Symbols:

- = No `unsafe` usage found, declares #![forbid(unsafe_code)]
- = No `unsafe` usage found, missing #![forbid(unsafe_code)]
- = `unsafe` usage found

| Functions | Expressions | Impls | Traits | Methods | Dependency |
|-----------|-------------|---------|--------|---------|-------------------------|
| 0/0 | 35/35 | 0/0 | 0/0 | 0/0 | solana-runtime 1.14.10 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | arrayref 0.3.6 |
| 0/0 | 22/22 | 0/0 | 0/0 | 0/0 | bincode 1.3.3 |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | serde 1.0.138 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | serde_derive 1.0.138 |
| 0/0 | 12/12 | 0/0 | 0/0 | 3/3 | proc-macro2 1.0.41 |
| 0/0 | 4/4 | 0/0 | 0/0 | 0/0 | unicode-ident 1.0.2 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | quote 1.0.18 |
| 0/0 | 12/12 | 0/0 | 0/0 | 3/3 | proc-macro2 1.0.41 |
| 0/0 | 50/50 | 3/3 | 0/0 | 2/2 | syn 1.0.98 |
| 0/0 | 12/12 | 0/0 | 0/0 | 3/3 | proc-macro2 1.0.41 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | quote 1.0.18 |
| 0/0 | 4/4 | 0/0 | 0/0 | 0/0 | unicode-ident 1.0.2 |
| 2/78 | 29/3973 | 0/0 | 0/0 | 0/0 | blake3 1.3.1 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | arrayref 0.3.6 |
| 2/2 | 350/350 | 2/2 | 0/0 | 7/7 | arrayvec 0.7.2 |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | serde 1.0.138 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | cfg-if 1.0.0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | constant_time_eq 0.1.5 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | digest 0.10.3 |
| 0/0 | 16/16 | 0/0 | 0/0 | 0/0 | block-buffer 0.10.2 |
| 1/1 | 292/292 | 20/20 | 8/8 | 5/5 | generic-array 0.14.5 |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | serde 1.0.138 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | typenum 1.15.0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | crypto-common 0.1.3 |
| 1/1 | 292/292 | 20/20 | 8/8 | 5/5 | generic-array 0.14.5 |
| 0/0 | 15/15 | 0/0 | 0/0 | 0/0 | rand_core 0.6.3 |
| 1/4 | 47/149 | 1/1 | 0/0 | 3/3 | getrandom 0.2.3 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | cfg-if 1.0.0 |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | libc 0.2.126 |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | serde 1.0.138 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | typenum 1.15.0 |
| 0/0 | 3/3 | 0/0 | 0/0 | 0/0 | subtle 2.4.1 |
| 6/6 | 663/663 | 5/5 | 0/0 | 3/3 | rayon 1.5.3 |
| 0/0 | 451/451 | 6/6 | 0/0 | 6/6 | crossbeam-deque 0.8.1 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | cfg-if 1.0.0 |
| 3/3 | 421/433 | 9/9 | 0/0 | 26/26 | crossbeam-epoch 0.9.5 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | cfg-if 1.0.0 |
| 4/4 | 85/85 | 14/14 | 0/0 | 2/2 | crossbeam-utils 0.8.8 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | cfg-if 1.0.0 |
| 0/0 | 7/7 | 1/1 | 0/0 | 0/0 | lazy_static 1.4.0 |
| 0/0 | 0/49 | 0/6 | 0/0 | 0/3 | spin 0.5.2 |
| 0/0 | 7/7 | 1/1 | 0/0 | 0/0 | lazy_static 1.4.0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | memoffset 0.6.4 |
| 0/0 | 18/18 | 1/1 | 0/0 | 0/0 | scopeguard 1.1.0 |
| 4/4 | 85/85 | 14/14 | 0/0 | 2/2 | crossbeam-utils 0.8.8 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | either 1.7.0 |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | serde 1.0.138 |
| 5/5 | 485/488 | 2/2 | 0/0 | 20/20 | rayon-core 1.9.2 |
| 2/2 | 489/498 | 6/7 | 0/0 | 12/14 | crossbeam-channel 0.5.5 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | cfg-if 1.0.0 |
| 4/4 | 85/85 | 14/14 | 0/0 | 2/2 | crossbeam-utils 0.8.8 |
| 0/0 | 451/451 | 6/6 | 0/0 | 6/6 | crossbeam-deque 0.8.1 |
| 4/4 | 85/85 | 14/14 | 0/0 | 2/2 | crossbeam-utils 0.8.8 |
| 0/0 | 65/72 | 0/0 | 0/0 | 0/0 | num_cpus 1.13.1 |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | libc 0.2.126 |
| 2/2 | 206/206 | 0/0 | 0/0 | 7/7 | bv 0.11.1 |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | serde 1.0.138 |
| 18/18 | 370/397 | 339/340 | 9/9 | 0/0 | bytemuck 1.11.0 |

| | | | | | | |
|-------|---------|---------|-----|-------|---|--------------------------|
| 18/18 | 370/397 | 339/340 | 9/9 | 0/0 | ? | bytemuck 1.11.0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ bytemuck_derive 1.1.0 |
| 0/0 | 12/12 | 0/0 | 0/0 | 3/3 | ? | └ proc-macro2 1.0.41 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ quote 1.0.18 |
| 0/0 | 50/50 | 3/3 | 0/0 | 2/2 | ? | └ syn 1.0.98 |
| 1/1 | 193/193 | 0/0 | 0/0 | 0/0 | ? | byteorder 1.4.3 |
| 0/0 | 73/73 | 2/2 | 0/0 | 2/2 | ? | bzip2 0.4.3 |
| 1/1 | 1/1 | 0/0 | 0/0 | 0/0 | ? | └ bzip2-sys 0.1.11+1.0.8 |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | └ libc 0.2.126 |
| 0/3 | 0/650 | 0/25 | 0/1 | 0/16 | ? | └ futures 0.1.31 |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | └ libc 0.2.126 |
| 2/2 | 489/498 | 6/7 | 0/0 | 12/14 | ? | crossbeam-channel 0.5.5 |
| 2/2 | 143/143 | 32/32 | 0/0 | 6/6 | ? | dashmap 4.0.2 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ cfg-if 1.0.0 |
| 0/0 | 65/72 | 0/0 | 0/0 | 0/0 | ? | └ num_cpus 1.13.1 |
| 6/6 | 663/663 | 5/5 | 0/0 | 3/3 | ? | └ rayon 1.5.3 |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | └ serde 1.0.138 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ dir-diff 0.3.2 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ walkdir 2.3.2 |
| 0/0 | 3/3 | 0/0 | 0/0 | 0/0 | ? | └ same-file 1.0.6 |
| 0/2 | 41/118 | 0/2 | 0/0 | 0/2 | ? | flate2 1.0.24 |
| 0/6 | 0/156 | 0/0 | 0/0 | 0/0 | ? | └ crc32fast 1.2.1 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ cfg-if 1.0.0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ miniz_oxide 0.5.1 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ adler 1.0.2 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | fnv 1.0.7 |
| 1/1 | 122/122 | 2/2 | 0/0 | 4/4 | ? | im 15.1.0 |
| 0/0 | 100/100 | 0/0 | 0/0 | 9/9 | ? | └ bitmaps 2.1.0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ typenum 1.15.0 |
| 0/0 | 0/9 | 0/0 | 0/0 | 0/0 | ? | └ proptest 1.0.0 |
| 0/0 | 0/8 | 0/0 | 0/0 | 0/0 | ? | └ bit-set 0.5.2 |
| 0/0 | 0/4 | 0/0 | 0/0 | 0/2 | ? | └ bit-vec 0.6.3 |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | └ serde 1.0.138 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ bitflags 1.3.2 |
| 1/1 | 193/193 | 0/0 | 0/0 | 0/0 | ? | └ byteorder 1.4.3 |
| 0/0 | 7/7 | 1/1 | 0/0 | 0/0 | ? | └ lazy_static 1.4.0 |
| 0/0 | 6/12 | 0/0 | 0/0 | 0/0 | ? | └ num-traits 0.2.15 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ quick-error 2.0.1 |
| 0/0 | 0/32 | 0/0 | 0/0 | 0/0 | ? | └ rand 0.8.5 |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | └ libc 0.2.126 |
| 1/1 | 16/18 | 1/1 | 0/0 | 0/0 | ? | └ log 0.4.17 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ cfg-if 1.0.0 |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | └ serde 1.0.138 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ rand_chacha 0.3.1 |
| 0/2 | 165/712 | 0/0 | 0/0 | 16/25 | ? | └ ppv-lite86 0.2.15 |
| 0/0 | 15/15 | 0/0 | 0/0 | 0/0 | ? | └ rand_core 0.6.3 |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | └ serde 1.0.138 |
| 0/0 | 15/15 | 0/0 | 0/0 | 0/0 | ? | └ rand_core 0.6.3 |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | └ serde 1.0.138 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ rand_chacha 0.3.1 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ rand_xorshift 0.3.0 |
| 0/0 | 15/15 | 0/0 | 0/0 | 0/0 | ? | └ rand_core 0.6.3 |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | └ serde 1.0.138 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ regex-syntax 0.6.26 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ rusty-fork 0.3.0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ fnv 1.0.7 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ quick-error 1.2.3 |
| 0/0 | 25/71 | 0/0 | 0/0 | 0/0 | ? | └ tempfile 3.3.0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ cfg-if 1.0.0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | └ fastrand 1.6.0 |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | └ libc 0.2.126 |
| 0/0 | 0/79 | 0/0 | 0/0 | 0/0 | ? | └ remove_dir_all 0.5.3 |
| 0/0 | 0/66 | 0/0 | 0/0 | 0/0 | ? | └ wait-timeout 0.2.0 |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | └ tempfile 3.3.0 |
| 0/0 | 25/71 | 0/0 | 0/0 | 0/0 | ? | └ rand_core 0.6.3 |
| 0/0 | 15/15 | 0/0 | 0/0 | 0/0 | ? | └ rand_xoshiro 0.6.0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |

| | | | | | | |
|------|---------|-------|-----|-------|---|--|
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 15/15 | 0/0 | 0/0 | 0/0 | ? | rand_xoshiro 0.6.0 └── rand_core 0.6.3 |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | rayon 1.5.3 serde 1.0.138 |
| 6/6 | 663/663 | 5/5 | 0/0 | 3/3 | ? | sized-chunks 0.6.5 bitmaps 2.1.0 typenum 1.15.0 |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | typenum 1.15.0 |
| 0/1 | 323/643 | 0/0 | 0/0 | 20/39 | ? | index_list 0.2.7 |
| 0/0 | 100/100 | 0/0 | 0/0 | 9/9 | ? | itertools 0.10.3 either 1.7.0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | lazy_static 1.4.0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | log 0.4.17 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | lz4 1.24.0 libc 0.2.126 |
| 1/1 | 16/18 | 1/1 | 0/0 | 0/0 | ? | lz4-sys 1.9.4 └── libc 0.2.126 |
| 0/0 | 140/140 | 0/0 | 0/0 | 0/0 | ? | memmap2 0.5.3 └── libc 0.2.126 |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | stable_deref_trait 1.2.0 |
| 0/0 | 0/0 | 2/2 | 0/0 | 0/0 | ? | num-derive 0.3.3 proc-macro2 1.0.41 |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | quote 1.0.18 |
| 0/0 | 147/282 | 4/6 | 0/0 | 7/7 | ? | syn 1.0.98 |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | num-trait 0.2.15 |
| 0/0 | 0/0 | 18/18 | 2/2 | 0/0 | ? | num_cpus 1.13.1 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | once_cell 1.12.0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ouroboros 0.15.0 aliasable 0.1.3 └── stable_deref_trait 1.2.0 |
| 0/0 | 12/12 | 0/0 | 0/0 | 3/3 | ? | ouroboros_macro 0.15.0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | Inflector 0.11.4 lazy_static 1.4.0 regex 1.5.6 ahocorasick 0.7.18 memchr 2.4.1 └── libc 0.2.126 |
| 0/0 | 50/50 | 3/3 | 0/0 | 2/2 | ? | memchr 2.4.1 regex-syntax 0.6.26 |
| 0/0 | 6/12 | 0/0 | 0/0 | 0/0 | ? | proc-macro-error 1.0.4 proc-macro-error-attr 1.0.4 |
| 0/0 | 65/72 | 0/0 | 0/0 | 0/0 | ? | proc-macro2 1.0.41 quote 1.0.18 |
| 1/1 | 75/117 | 4/6 | 0/0 | 2/3 | ? | proc-macro2 1.0.41 quote 1.0.18 |
| 2/2 | 8/8 | 0/0 | 0/0 | 0/0 | ? | syn 1.0.98 |
| 0/0 | 68/68 | 14/14 | 0/0 | 2/2 | ? | stable_deref_trait 1.2.0 |
| 0/0 | 0/0 | 18/18 | 2/2 | 0/0 | ? | rand 0.7.3 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | getrandom 0.1.16 cfg-if 1.0.0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | libc 0.2.126 log 0.4.17 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | libc 0.2.126 log 0.4.17 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | rand_chacha 0.2.2 ppv-lite86 0.2.15 rand_core 0.5.1 getrandom 0.1.16 serde 1.0.138 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | rand_core 0.5.1 |
| 1/4 | 47/150 | 1/1 | 0/0 | 3/3 | ? | rayon 1.5.3 regex 1.5.6 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | serde 1.0.138 |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | |
| 1/1 | 16/18 | 1/1 | 0/0 | 0/0 | ? | |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | |
| 1/1 | 16/18 | 1/1 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/2 | 165/712 | 0/0 | 0/0 | 16/25 | ? | |
| 0/0 | 22/22 | 0/0 | 0/0 | 0/0 | ? | |
| 1/4 | 47/150 | 1/1 | 0/0 | 3/3 | ? | |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 22/22 | 0/0 | 0/0 | 0/0 | ? | |
| 6/6 | 663/663 | 5/5 | 0/0 | 3/3 | ? | |
| 0/0 | 34/34 | 1/2 | 0/0 | 2/2 | ? | |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | |

| | | | | | | |
|-------|-----------|---------|-----|-------|---|--|
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 22/22 | 0/0 | 0/0 | 0/0 | ? | |
| 18/18 | 370/397 | 339/340 | 9/9 | 0/0 | ? | |
| 1/1 | 16/18 | 1/1 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 6/12 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 26/30 | 0/0 | 0/0 | 0/0 | ? | |
| 1/4 | 47/149 | 1/1 | 0/0 | 3/3 | ? | |
| 1/1 | 75/117 | 4/6 | 0/0 | 2/3 | ? | |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | |
| 2/78 | 29/3973 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 6/6 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 3/3 | 0/0 | 0/0 | 0/0 | ? | |
| 1/1 | 292/292 | 20/20 | 8/8 | 5/5 | ? | |
| 0/0 | 1/1 | 0/0 | 0/0 | 0/0 | ? | |
| 0/8 | 10/202 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 6/6 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 1/1 | 14/14 | 0/0 | 0/0 | 0/0 | ? | |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 1/1 | 292/292 | 20/20 | 8/8 | 5/5 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 2/2 | 206/206 | 0/0 | 0/0 | 7/7 | ? | |
| 1/1 | 193/193 | 0/0 | 0/0 | 0/0 | ? | |
| 1/1 | 29/194 | 0/2 | 0/0 | 0/4 | ? | |
| 0/0 | 190/284 | 0/2 | 0/0 | 4/6 | ? | |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 1/1 | 292/292 | 20/20 | 8/8 | 5/5 | ? | |
| 1/4 | 47/150 | 1/1 | 0/0 | 3/3 | ? | |
| 1/1 | 1223/1367 | 21/24 | 1/1 | 62/69 | ? | |
| 0/0 | 26/30 | 0/0 | 0/0 | 0/0 | ? | |
| 4/6 | 389/1096 | 3/9 | 1/1 | 12/25 | ? | |
| 6/6 | 663/663 | 5/5 | 0/0 | 3/3 | ? | |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | |
| 1/1 | 122/122 | 2/2 | 0/0 | 4/4 | ? | |
| 0/0 | 7/7 | 1/1 | 0/0 | 0/0 | ? | |
| 1/1 | 16/18 | 1/1 | 0/0 | 0/0 | ? | |
| 0/0 | 147/282 | 4/6 | 0/0 | 7/7 | ? | |
| 1/1 | 75/117 | 4/6 | 0/0 | 2/3 | ? | |
| 1/1 | 75/117 | 4/6 | 0/0 | 2/3 | ? | |
| 0/0 | 15/15 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 16/16 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 4/7 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 41/46 | 1/1 | 0/0 | 0/0 | ? | |
| 1/1 | 1223/1367 | 21/24 | 1/1 | 62/69 | ? | |
| 6/6 | 663/663 | 5/5 | 0/0 | 3/3 | ? | |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 7/7 | 0/0 | 0/0 | 0/0 | ? | |
| 8/12 | 674/921 | 0/0 | 0/0 | 2/2 | ? | |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | |
| 0/8 | 4/196 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 1/1 | 14/14 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 12/12 | 0/0 | 0/0 | 3/3 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 50/50 | 3/3 | 0/0 | 2/2 | ? | |

| | | | | | | |
|-------|-----------|---------|-----|-------|---|--|
| 0/0 | 50/50 | 3/3 | 0/0 | 2/2 | ? | |
| 0/0 | 3/3 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 12/12 | 0/0 | 0/0 | 3/3 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 50/50 | 3/3 | 0/0 | 2/2 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 3/3 | 442/442 | 1/1 | 0/0 | 3/3 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 22/22 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 2/78 | 29/3973 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 7/7 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 12/12 | 0/0 | 0/0 | 3/3 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 50/50 | 3/3 | 0/0 | 2/2 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 12/12 | 0/0 | 0/0 | 3/3 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 50/50 | 3/3 | 0/0 | 2/2 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 41/46 | 1/1 | 0/0 | 0/0 | ? | |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 12/12 | 0/0 | 0/0 | 3/3 | ? | |
| 0/0 | 50/50 | 3/3 | 0/0 | 2/2 | ? | |
| 2/2 | 1064/1198 | 19/22 | 1/1 | 51/58 | ? | |
| 0/0 | 26/30 | 0/0 | 0/0 | 0/0 | ? | |
| 4/6 | 389/1096 | 3/9 | 1/1 | 12/25 | ? | |
| 6/6 | 663/663 | 5/5 | 0/0 | 3/3 | ? | |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 1/1 | 0/0 | 0/0 | 0/0 | ? | |
| 2/2 | 206/206 | 0/0 | 0/0 | 7/7 | ? | |
| 18/18 | 370/397 | 339/340 | 9/9 | 0/0 | ? | |
| 0/2 | 0/857 | 0/0 | 0/0 | 0/0 | ? | |
| 1/1 | 193/193 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 22/22 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 3/3 | 0/0 | 0/0 | 0/0 | ? | |
| 1/1 | 23/23 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 12/12 | 0/0 | 0/0 | 3/3 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 50/50 | 3/3 | 0/0 | 2/2 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/72 | 0/3 | 0/1 | 0/3 | ? | |
| 0/0 | 0/72 | 0/3 | 0/1 | 0/3 | ? | |
| 0/0 | 7/7 | 1/1 | 0/0 | 0/0 | ? | |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | |
| 0/0 | 4/4 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 1/1 | 292/292 | 20/20 | 8/8 | 5/5 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |

AUTOMATED TESTING

AUTOMATED TESTING

| | | | | | |
|-------|----------|---------|-----|-------|---|
| 0/0 | 12/12 | 0/0 | 0/0 | 3/3 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 50/50 | 3/3 | 0/0 | 2/2 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 4/6 | 389/1096 | 3/9 | 1/1 | 12/25 | ? |
| 1/1 | 16/18 | 1/1 | 0/0 | 0/0 | ? |
| 1/1 | 75/117 | 4/6 | 0/0 | 2/3 | ? |
| 0/0 | 12/12 | 0/0 | 0/0 | 3/3 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 50/50 | 3/3 | 0/0 | 2/2 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 1/1 | 23/23 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 2/2 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 22/22 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 12/12 | 0/0 | 0/0 | 3/3 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 50/50 | 3/3 | 0/0 | 2/2 | ? |
| 0/0 | 0/72 | 0/3 | 0/1 | 0/3 | ? |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? |
| 0/4 | 111/272 | 8/12 | 0/0 | 10/15 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 1/1 | 16/18 | 1/1 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 6/12 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 15/15 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 1/1 | 16/18 | 1/1 | 0/0 | 0/0 | ? |
| 3/3 | 445/445 | 1/1 | 0/0 | 3/3 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 22/22 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 7/7 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 1/1 | 0/0 | 0/0 | 0/0 | ? |
| 18/18 | 370/397 | 339/340 | 9/9 | 0/0 | ? |
| 1/1 | 193/193 | 0/0 | 0/0 | 0/0 | ? |
| 1/1 | 44/90 | 2/2 | 0/0 | 0/0 | ? |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 6/12 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 6/12 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? |
| 1/1 | 216/216 | 0/0 | 0/0 | 0/0 | ? |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? |
| 0/2 | 0/857 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/2 | 0/857 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 16/16 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 15/15 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 15/15 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 22/22 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 16/16 | 0/0 | 0/0 | 0/0 | ? |

AUTOMATED TESTING

AUTOMATED TESTING

| | | | | | | |
|-------|-----------|--------|-----|-------|---|---|
| 1/1 | 16/18 | 1/1 | 0/0 | 0/0 | ? | ? |
| 1/1 | 468/468 | 13/13 | 5/5 | 1/1 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |
| 1/1 | 468/468 | 13/13 | 5/5 | 1/1 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |
| 20/25 | 1474/1834 | 96/102 | 1/1 | 61/69 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/5 | 0/0 | 0/0 | 0/0 | ? | ? |
| 20/25 | 1474/1834 | 96/102 | 1/1 | 61/69 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |
| 17/17 | 538/630 | 11/13 | 1/1 | 15/19 | ? | ? |
| 0/1 | 54/72 | 2/13 | 0/1 | 3/3 | ? | ? |
| 0/0 | 0/36 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 7/7 | 1/1 | 0/0 | 0/0 | ? | ? |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | ? |
| 0/5 | 0/1572 | 0/22 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/643 | 0/12 | 0/4 | 0/12 | ? | ? |
| 1/1 | 44/90 | 2/2 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/3 | 0/0 | 0/0 | 0/2 | ? | ? |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | ? |
| 0/0 | 0/3 | 0/0 | 0/0 | 0/2 | ? | ? |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | ? |
| 1/1 | 16/18 | 1/1 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/3 | 0/0 | 0/0 | 0/2 | ? | ? |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 25/71 | 0/0 | 0/0 | 0/0 | ? | ? |
| 20/25 | 1474/1834 | 96/102 | 1/1 | 61/69 | ? | ? |
| 0/0 | 0/13 | 0/2 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/36 | 0/0 | 0/0 | 0/0 | ? | ? |
| 20/25 | 1474/1834 | 96/102 | 1/1 | 61/69 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 7/7 | 1/1 | 0/0 | 0/0 | ? | ? |
| 1/1 | 16/18 | 1/1 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/2 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/36 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 3/3 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 8/167 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/5 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 4/7 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 2/2 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 3/3 | 0/0 | 0/0 | 0/0 | ? | ? |
| 0/0 | 7/7 | 0/0 | 0/0 | 0/0 | ? | ? |
| 8/12 | 674/921 | 0/0 | 0/0 | 2/2 | ? | ? |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | ? |
| 20/25 | 1474/1834 | 96/102 | 1/1 | 61/69 | ? | ? |
| 0/0 | 0/13 | 0/2 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |
| 2/2 | 332/349 | 5/5 | 0/0 | 6/6 | ? | ? |
| 17/17 | 538/630 | 11/13 | 1/1 | 15/19 | ? | ? |
| 0/0 | 30/30 | 2/2 | 0/0 | 0/0 | ? | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | ? |

AUTOMATED TESTING

| | | | | |
|-------|-----------|--------|-----|-------|
| 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 2/2 | 0/0 | 0/0 | ? |
| 1/5 | 492/515 | 24/25 | 0/0 | 9/11 |
| 0/0 | 8/167 | 0/0 | 0/0 | 0/0 |
| 0/0 | 25/25 | 0/0 | 0/0 | 3/3 |
| 20/25 | 1474/1834 | 96/102 | 1/1 | 61/69 |
| 0/0 | 0/0 | 1/1 | 0/0 | 0/0 |
| 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 2/2 | 0/0 | 0/0 | 0/0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 |
| 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 |
| 0/0 | 20/20 | 0/0 | 0/0 | 0/0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 |
| 0/0 | 3/3 | 0/0 | 0/0 | 0/0 |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 |
| 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 3/3 | 445/445 | 1/1 | 0/0 | 3/3 |
| 3/3 | 445/445 | 1/1 | 0/0 | 3/3 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 |
| 3/3 | 445/445 | 1/1 | 0/0 | 3/3 |
| 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 38/38 | 0/0 | 0/0 | 0/0 |
| 1/1 | 16/18 | 1/1 | 0/0 | 0/0 |
| 0/0 | 147/282 | 4/6 | 0/0 | 7/7 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 |
| 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 12/12 | 0/0 | 0/0 | 3/3 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 |
| 0/0 | 50/50 | 3/3 | 0/0 | 2/2 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 |
| 0/0 | 15/15 | 0/0 | 0/0 | 0/0 |
| 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 3/3 | 445/445 | 1/1 | 0/0 | 3/3 |
| 0/0 | 25/71 | 0/0 | 0/0 | 0/0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 |
| 0/0 | 2/2 | 0/0 | 0/0 | 0/0 |
| 3/3 | 445/445 | 1/1 | 0/0 | 3/3 |
| 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 22/22 | 0/0 | 0/0 | 0/0 |
| 1/1 | 44/98 | 2/2 | 0/0 | 0/0 |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 |
| 0/0 | 2/2 | 0/0 | 0/0 | 0/0 |
| 3/3 | 445/445 | 1/1 | 0/0 | 3/3 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 |
| 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 10/10 | 0/0 | 0/0 | 0/0 |
| 0/0 | 2/2 | 0/0 | 0/0 | 0/0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 |
| 0/0 | 7/7 | 1/1 | 0/0 | 0/0 |
| 0/0 | 65/72 | 0/0 | 0/0 | 0/0 |
| 3/3 | 445/445 | 1/1 | 0/0 | 3/3 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 |
| 0/0 | 22/22 | 0/0 | 0/0 | 0/0 |
| 1/1 | 16/18 | 1/1 | 0/0 | 0/0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 |
| 0/0 | 6/12 | 0/0 | 0/0 | 0/0 |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 |
| 0/0 | 0/0 | 0/0 | 0/0 | ? |
| 0/0 | 10/10 | 0/0 | 0/0 | 0/0 |

| | | | | | | |
|-------|---------|---------|-----|-----|---|--|
| 0/0 | 10/10 | 0/0 | 0/0 | 0/0 | | |
| 0/0 | 2/2 | 0/0 | 0/0 | 0/0 | | |
| 3/3 | 445/445 | 1/1 | 0/0 | 3/3 | | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 22/22 | 0/0 | 0/0 | 0/0 | | |
| 1/1 | 16/18 | 1/1 | 0/0 | 0/0 | | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 6/12 | 0/0 | 0/0 | 0/0 | | |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 10/10 | 0/0 | 0/0 | 0/0 | | |
| 0/0 | 2/2 | 0/0 | 0/0 | 0/0 | | |
| 3/3 | 445/445 | 1/1 | 0/0 | 3/3 | | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 18/18 | 370/397 | 339/340 | 9/9 | 0/0 | | |
| 1/4 | 47/150 | 1/1 | 0/0 | 3/3 | | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 6/12 | 0/0 | 0/0 | 0/0 | | |
| 0/0 | 2/2 | 0/0 | 0/0 | 0/0 | | |
| 3/3 | 445/445 | 1/1 | 0/0 | 3/3 | | |
| 0/0 | 70/70 | 18/18 | 0/0 | 0/0 | | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 1/1 | 292/292 | 20/20 | 8/8 | 5/5 | | |
| 0/0 | 15/15 | 0/0 | 0/0 | 0/0 | | |
| 0/28 | 0/1860 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 1/1 | 292/292 | 20/20 | 8/8 | 5/5 | | |
| 1/1 | 14/14 | 0/0 | 0/0 | 0/0 | | |
| 0/0 | 3/3 | 0/0 | 0/0 | 0/0 | | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 3/3 | 0/0 | 0/0 | 0/0 | ? | |
| 0/3 | 0/137 | 0/0 | 0/0 | 0/2 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 1/1 | 14/14 | 0/0 | 0/0 | 0/0 | | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 1/1 | 292/292 | 20/20 | 8/8 | 5/5 | | |
| 0/0 | 3/3 | 0/0 | 0/0 | 0/0 | | |
| 1/1 | 23/23 | 0/0 | 0/0 | 0/0 | | |
| 0/0 | 3/3 | 0/0 | 0/0 | 0/0 | | |
| 1/1 | 23/23 | 0/0 | 0/0 | 0/0 | | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 22/22 | 0/0 | 0/0 | 0/0 | | |
| 18/18 | 370/397 | 339/340 | 9/9 | 0/0 | | |
| 1/1 | 193/193 | 0/0 | 0/0 | 0/0 | | |
| 0/0 | 7/7 | 0/0 | 0/0 | 0/0 | | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 126/126 | 0/0 | 0/0 | 3/3 | | |
| 1/1 | 292/292 | 20/20 | 8/8 | 5/5 | | |
| 0/2 | 0/857 | 0/0 | 0/0 | 0/0 | ? | |
| 1/4 | 47/150 | 1/1 | 0/0 | 3/3 | | |
| 0/0 | 0/72 | 0/3 | 0/1 | 0/3 | ? | |
| 0/0 | 7/7 | 1/1 | 0/0 | 0/0 | | |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | | |
| 1/1 | 193/193 | 0/0 | 0/0 | 0/0 | | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 15/15 | 0/0 | 0/0 | 0/0 | ? | |

| | | | | | | |
|---------|-------------|---------|-------|---------|---|--|
| 0/0 | 15/15 | 0/0 | 0/0 | 0/0 | ? | |
| 1/1 | 23/23 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 6/12 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 15/15 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 5/5 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 4/7 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 14/14 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 6/6 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 3/3 | 442/442 | 1/1 | 0/0 | 3/3 | ? | |
| 3/3 | 445/445 | 1/1 | 0/0 | 3/3 | ? | |
| 0/0 | 3/3 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 1/1 | 23/23 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 70/70 | 18/18 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 12/12 | 0/0 | 0/0 | 3/3 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/1 | 0/1 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 50/50 | 3/3 | 0/0 | 2/2 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/47 | 0/0 | 0/0 | 0/0 | ? | |
| 2/2 | 52/52 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 35/78 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | |
| 9/11 | 88/175 | 0/0 | 0/0 | 0/0 | ? | |
| 1/21 | 10/368 | 0/2 | 0/0 | 5/40 | ? | |
| 0/0 | 25/71 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | ? | |
| 0/0 | 9/9 | 0/0 | 0/0 | 0/0 | ? | |
| <hr/> | | | | | | |
| 212/571 | 19561/40422 | 790/977 | 33/55 | 503/825 | | |

THANK YOU FOR CHOOSING
 HALBORN