Data Export

Colorado Risk Limiting Audit Tool

2017

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Separate from the RLA application server and client software that supports the Department of State and the Counties in carrying out the Risk Limiting Audit, there is a command, called rla\_export, allowing export of data from the central server and the underlying database.

The command is part of a python package, whose technical description can be found in a README.rst file in the python site-packages directory tree wherever the package is installed. The most current online version (which may or may not match the version you have installed) is available in the [public code repository](https://github.com/FreeAndFair/ColoradoRLA/tree/auditcenter/server/eclipse-project/script/rla_export).

The README.rst file gives instructions for installing the python package, and describes various run-time options. For a catalog of the exports produced by the command, see below.

## Database Exports

The rla\_export command exports many of the files necessary for independent verification of the RLA, whether by candidates, parties, other organizations. Specific exports are detailed below.

### Minimum Data Required to Allow Public to Reproduce Audit Calculations

To allow independent verification of the RLA, the Colorado Department of State must provide to the public all the export files listed in this section, along with:

* all CVR files
* all ballot manifest files
* opportunity to observe the random seed selection
* opportunity to observe the activities of the County Audit Boards
* announced tabulated results for contests selected for audit
* the risk limit
* the error inflation factor

Providing the above to the public, along with the database exports listed below will fulfill the minimum requirements of a publicly-verifiable audit.

The data files in this section are generated based on sql query files. These are always produced in two formats: json and csv. The basename of each resulting file is the same as the basename of the query file. Thus, given the query file seed.sql, the files seed.json and seed.csv will be produced.

When a ballot extends across more than one piece of paper (a "card"), each card is tabulated independently. In counties which have any multi-card ballots, the ballot card counts provided will therefore not match turnout figures reported elsewhere.

#### m\_selected\_contest\_audit\_details\_by\_cvr

For each contest under audit, and for each cast vote record that contains the given contest and has been presented to the Audit Board for verification, the RLA system's record of the Audit Board's review of the physical ballot for that contest.

Note that the number of discrepancies each cast vote record contributes to the risk level calculation depends not only on the discrepancies found between the cast vote record and the Audit Board interpretation, but also on the number of times that cast vote record counts in the random sequence.

|  |  |  |
| --- | --- | --- |
| Field | Type | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Meaning\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| county\_name | Text String | Name of County |
| contest\_name | Text String | Name of contest |
| imprinted\_id | Text String | Combination of scanner number, batch number and position within batch that uniquely identifies the ballot card and may be imprinted on the card when the ballot is scanned |
| ballot\_type | Text String | BallotType from Dominion CVR export file, a code for the set of contests that should be present on the physical ballot card. Often known as *ballot style*. |
| duplicates\_in\_random\_sequence | Integer | Number of times that a discrepancy between the cast vote record with the given imprinted id and the audit board interpretation has been counted toward the risk level |
| choices\_per\_voting\_computer | List of Text Strings | List of voter choices in the given contest on the given ballot card, as interpreted by the vote-tabulation computer system (note: overvotes recorded as blank votes) |
| choices\_per\_audit\_board | List of Text Strings | List of voter choices in the given contest on the given ballot card, as interpreted by the Audit Board (note: overvotes recorded as a too-long list of choices) |
| consensus | YES/NO | YES if the Audit Board came to consensus on the interpretation of the given ballot card; NO if not; blank if the card has not been reviewed by the Audit Board. |
| audit\_board\_comment | Text String | Text of comment entered by Audit Board about the given contest on the given ballot card, or indication that the ballot was not found. |
| timestamp | Timestamp | Date and time of Audit Board's submission of their interpretation to the RLA Tool |
| cvr\_id | Integer | Internal database id for the cast vote record |

#### m\_selected\_contest\_static

List of contests selected to drive the audit, with information about the contest that doesn't change during the audit, namely the reason for the audit, the number of winners allowed in the contest, the tabulated winners of the contest, the numbers of ballot cards recorded as cast in the county (total number as well as the number containing the given contest) and the value of the error inflation factor (gamma).

|  |  |  |
| --- | --- | --- |
| Field | Type | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Meaning\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| county\_name | Text String | Name of County |
| contest\_name | Text String | Name of contest |
| audit\_reason | Text String | Reason for audit (STATE\_WIDE\_CONTEST and COUNTY\_WIDE\_CONTEST refer to the types of contests that must be chosen to drive the audit, per Rule 25.2.2(i)) |
| votes\_allowed | Integer | Maximum number of choices that can be recorded on one ballot in the given contest |
| winners\_allowed | Integer | Number of winners allowed for the contest (required to calculate diluted margin) |
| winners | List of Text Strings | List of all winners of the given contest in the given County. (Note that for multi-county contests this list includes the highest vote-getters within the County, even if these were not the winners across all Counties.) |
| min\_margin | Integer | The smallest margin between any winner and any loser |
| county\_ballot\_card\_count | Integer | The number of ballot cards recorded in the given County in the election (including cards that do not contain the contest in question) |
| contest\_ballot\_card\_count | Integer | The number of ballot cards recorded in the given County that contain the contest in question |
| gamma | Number | Error inflation factor defined in Stark's paper, Super-simple simultaneous single-ballot risk-limiting audits, which is cited in Lindeman and Stark's paper, A Gentle Introduction to Risk Limiting Audits, which is cited in Rule 25.2.2(j)) |

#### m\_selected\_contest\_dynamic

List of contests selected to drive the audit, with current status. Which contests are driving the audit, vs which are (by default) being audited opportunisticly? Which contests (if any) have been selected for hand count? How many discrepancies of each type are there?

|  |  |  |
| --- | --- | --- |
| Field | Type | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Meaning\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| county\_name | Text String | Name of County |
| contest\_name | Text String | Name of contest |
| current\_audit\_type | Text String | COMPARISON, HAND\_COUNT, NOT\_AUDITABLE or NONE. Note that NOT\_AUDITABLE means the contest can't drive an audit, but it still can be audited opportunisticly. |
| random\_audit\_status | Text String | NOT\_STARTED, NOT\_AUDITABLE, IN\_PROGRESS or ENDED. Because declaring a hand count ends the computerized portion of the audit, a contest that is being hand-counted will have the value ENDED in this field. |
| one\_vote\_over\_count | Integer | The number of ballot cards in the random sequence so far (with duplicates) on which there is a one-vote overstatement (per Lindeman & Stark's A Gentle Introduction to Risk Limiting Audits). |
| one\_vote\_under\_count | Integer | The number of ballot cards in the random sequence so far (with duplicates) on which there is a one-vote understatement (per Lindeman & Stark's A Gentle Introduction to Risk Limiting Audits). |
| two\_vote\_over\_count | Integer | The number of ballot cards in the random sequence so far (with duplicates) on which there is a two-vote overstatement (per Lindeman & Stark's A Gentle Introduction to Risk Limiting Audits). |
| two\_vote\_under\_count | Integer | The number of ballot cards in the random sequence so far (with duplicates) on which there is a two-vote understatement (per Lindeman & Stark's A Gentle Introduction to Risk Limiting Audits). |

#### m\_cvr\_hash

Hashes of CVR files

|  |  |  |
| --- | --- | --- |
| Field | Type | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Meaning\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| county\_name | Text String | Name of County |
| cvr\_export\_hash | Text String | Hash value entered by the given county after uploading the cast vote record file to be used in the audit |

#### m\_manifest\_hash

Hashes of ballot manifest files

|  |  |  |
| --- | --- | --- |
| Field | Type | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Meaning\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| county\_name | Text String | Name of County |
| ballot\_manifest\_hash | Text String | Hash value entered by the given county after uploading the ballot manifest file |

to be used in the audit

#### m\_tabulate.sql

|  |  |  |
| --- | --- | --- |
| Field | Type | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Meaning\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| county\_name | Text String | Name of County |
| contest\_name | Text String | Name of contest |
| choice | Text String | Name of candidate or for a ballot question "Yes" or "No" |
| votes | Integer | Number of votes recorded for the given choice in the given contest in the given County |

### Other Data Exports

The exports in this section, while not strictly necessary for independent verification of the audit calculations, will be of interest and value to the public.

#### all\_contest\_static

List of all contests, with information about the contest that doesn't change during the audit, namely the reason for the audit, the number of winners allowed in the contest, the tabulated winners of the contest, the numbers of ballot cards recorded as cast in the county (total number as well as the number containing the given contest) and the value of the error inflation factor (gamma).

|  |  |  |
| --- | --- | --- |
| Field | Type | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Meaning\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| county\_name | Text String | Name of County |
| contest\_name | Text String | Name of contest |
| audit\_reason | Text String | Reason for audit (STATE\_WIDE\_CONTEST and COUNTY\_WIDE\_CONTEST refer to the types of contests that must be chosen to drive the audit, per Rule 25.2.2(i); other reasons from the Rule include CLOSE\_CONTEST, TIED\_CONTEST, GEOGRAPHICAL\_SCOPE, CONCERN\_REGARDING\_ACCURACY, and COUNTY\_CLERK\_ABILITY; the audits of other contests on the ballot are OPPORTUNISTIC\_BENEFITS) |
| votes\_allowed | Integer | Maximum number of choices that can be recorded on one ballot in the given contest |
| winners\_allowed | Integer | Number of winners allowed for the contest (required to calculate diluted margin) |
| winners | List of Text Strings | List of all winners of the given contest in the given County. (Note that for multi-county contests this list includes the highest vote-getters within the County, even if these were not the winners across all Counties.) |
| min\_margin | Integer | The smallest margin between any winner and any loser |
| county\_ballot\_card\_count | Integer | The number of ballot cards recorded in the given County in the election (including cards that do not contain the contest in question) |
| contest\_ballot\_card\_count | Integer | The number of ballot cards recorded in the given County that contain the contest in question |
| gamma | Number | Error inflation factor defined in Stark's paper, Super-simple simultaneous single-ballot risk-limiting audits, which is cited in Lindeman and Stark's paper, A Gentle Introduction to Risk Limiting Audits, which is cited in Rule 25.2.2(j)) |

#### all\_contest\_dynamic

List of contests with current status. Which contests has the Secretary selected for audit? Which contests (if any) has the Secretary selected for hand count? How many discrepancies of each type have been found so far?

|  |  |  |
| --- | --- | --- |
| Field | Type | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Meaning\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| county\_name | Text String | Name of County |
| contest\_name | Text String | Name of contest |
| current\_audit\_type | Text String | Comparison audit, ballot polling audit or hand count |
| computerized\_audit\_status | Text String | Not started, in progress, risk limit achieved, or ended. Because declaring a hand count ends the computerized portion of the audit, a contest that is being hand-counted will have the value "ended" in this field. |
| one\_vote\_over\_count | Integer | The number of ballot cards in the random sequence so far (with duplicates) on which there is a one-vote overstatement (per Lindeman & Stark's A Gentle Introduction to Risk Limiting Audits). |
| one\_vote\_under\_count | Integer | The number of ballot cards in the random sequence so far (with duplicates) on which there is a one-vote understatement (per Lindeman & Stark's A Gentle Introduction to Risk Limiting Audits). |
| two\_vote\_over\_count | Integer | The number of ballot cards in the random sequence so far (with duplicates) on which there is a two-vote overstatement (per Lindeman & Stark's A Gentle Introduction to Risk Limiting Audits). |
| two\_vote\_under\_count | Integer | The number of ballot cards in the random sequence so far (with duplicates) on which there is a two-vote understatement (per Lindeman & Stark's A Gentle Introduction to Risk Limiting Audits). |

#### all\_contest\_audit\_details\_by\_cvr

For each contest and for each cast vote record that contains the given contest and has been presented to the Audit Board for verification, the RLA system's record of the Audit Board's review of the physical ballot for that contest.

Note that the number of discrepancies each cast vote record contributes to the risk level calculation depends not only on the discrepancies found between the cast vote record and the Audit Board interpretation, but also on the number of times that cast vote record counts in the random sequence.

|  |  |  |
| --- | --- | --- |
| Field | Type | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Meaning\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| county\_name | Text String | Name of County |
| contest\_name | Text String | Name of contest |
| imprinted\_id | Text String | Combination of scanner number, batch number and position within batch that uniquely identifies the ballot card and may be imprinted on the card when the ballot is scanned |
| ballot\_type | Text String | BallotType from Dominion CVR export file, a code for the set of contests that should be present on the physical ballot card. Often known as *ballot style*. |
| duplicates\_in\_random\_sequence | Integer | Number of times that a discrepancy between the cast vote record with the given imprinted id and the audit board interpretation has been counted toward the risk level |
| choices\_per\_voting\_computer | List of Text Strings | List of voter choices in the given contest on the given ballot card, as interpreted by the vote-tabulation computer system (note: overvotes recorded as blank votes) |
| choices\_per\_audit\_board | List of Text Strings | List of voter choices in the given contest on the given ballot card, as interpreted by the Audit Board (note: overvotes recorded as a too-long list of choices) |
| consensus | YES/NO | YES if the Audit Board came to consensus on the interpretation of the given ballot card; NO if not; blank if the card has not been reviewed by the Audit Board. |
| audit\_board\_comment | Text String | Text of comment entered by Audit Board about the given contest on the given ballot card, or indication that the ballot was not found. |
| timestamp | Timestamp | Date and time of Audit Board's submission of their interpretation to the RLA Tool |
| cvr\_id | Integer | Internal database id for the cast vote record |

#### sequence\_subsequence

|  |  |  |
| --- | --- | --- |
| Field | Type | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Meaning\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| county\_name | Text String | Name of County |
| round\_number | Integer | Round of the audit |
| ballot\_sequence | List of Integers | List of the internal database ids of the cast vote records presented to the Audit Board for review in the given County in the given round of the audit |
| audit\_subsequence | List of Integers | List of the internal database ids of the portion of the random sequence (with duplicates) included in the given round in the given County. |

#### auditboards

|  |  |  |
| --- | --- | --- |
| Field | Type | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Meaning\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| county\_name | Text String | Name of County |
| member | Text String | Name of audit board member |
| sign\_in\_time | Timestamp | Beginning of an audit board member's RLA Tool session |
| sign\_out\_time | Timestamp | End of the given session for the given audit board member |

#### batch\_count\_comparison

|  |  |  |
| --- | --- | --- |
| Field | Type | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Meaning\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| county\_name | Text String | Name of County |
| scanner\_id | Integer | the identification number of a scanner used to create the cast vote record from the physical ballot card |
| batch\_id | Integer | The identification number of a batch of ballot cards scanned by the given scanner |
| count\_per\_manifest | Integer | The number of ballot cards in the given batch on the given scanner, |

according to the ballot manifest file uploaded by the County count\_per\_cvr\_file | Integer | The number of ballot cards in the given batch on the given scanner, according to the cast-vote-record file export from the voting computer, uploaded by the County difference | Integer | The difference between the two counts, which will be zero for a correctly tabulated election. If positive, there are ballots listed in the manifest that are not found in the CVR file; if negative, there are ballots in the CVR file that are not listed in the manifest.

#### prefix\_length

|  |  |  |
| --- | --- | --- |
| Field | Type | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Meaning\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| county\_name | Text String | Name of County |
| audited\_prefix\_length | Integer | Length of the longest prefix of the random sequence of cvr selections containing only cvrs that have been audited |

#### seed

|  |  |  |
| --- | --- | --- |
| Field | Type | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Meaning\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| seed | 20-Digit String | the random seed for the pseudo-random number generator |

#### upload\_status

|  |  |  |
| --- | --- | --- |
| Field | Type | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Meaning\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| county\_name | Text String | Name of County |
| filename | Text String | Name of file |
| hash\_status | Text String | VERIFIED, MISMATCH, or NOT\_CHECKED |
| approx\_count | Integer | Approximate number of lines in the file |
| size | Integer | Size of file in bytes |
| status | Text String | IMPORTED\_AS\_BALLOT\_MANIFEST, IMPORTED\_AS\_CVR\_EXPORT or NOT\_IMPORTED |
| timestamp | Timestamp | Date and time of the most recent update to the upload status of the given file |

## State and County Audit Reports

Other export files are the same as the files available via the GUI interface, for example state\_report.xlsx.

## Technical Notes

### List Specifications

Lists of integers are formatted as json data, i.e., list enclosed in square brackets ([]) and items delimited by commas (,).