



VoTeR Center

UConn Voting Technology Research Center

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Statistical Analysis of the Post-Election Audit Data 2011 September Primary Election

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Abstract

This report presents the analysis of the post-election audit returns performed in the State of Connecticut following the September 2011 primary election. The audit involved the randomly selected 10% of the districts. The total of 83 audit records were submitted to the UConn Center for Voting Technology Research. Audit reports prepared by the towns did not reveal any returns with substantially high, unexplained differences between hand and machine counts. The vast majority of the records (96.4%) had no discrepancies. The discrepancy of 1 vote is recorded for the remaining (3.6%) records.

We note that the discrepancies reported in this audit are substantially smaller than those reported for prior, larger election audits. One can conclude that the hand counts in the current audit were better because of the relatively small number of ballots and candidates in question, thus presenting fewer opportunities for human counting errors. It is anticipated that in broader elections, with greater number of ballots and more races the discrepancies will be larger.

This analysis was performed on request of the Office of the Secretary of the State.

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Summary

The University of Connecticut Center for Voting Technology Research (VoTeR Center) received the data gathered in the post-election audit performed in the State of Connecticut following the September 2011 election. The audits involved the randomly selected 10% of the districts and the audit returns were conveyed by the Office of the Secretary of the State (SOTS) to the VoTeR Center on November 18th of 2011. The audit data received by the VoTeR Center contains 83 records, where each record represents information about a given candidate: date, district, machine seal number, office, candidate, machine counted total, hand counted total of the votes considered unquestionable by the auditors, hand counted total of the votes considered questionable by the auditors, and the hand counted total, that is, the sum of undisputed and questionable ballots. This report contains several statistical analyses of the audit returns.

This report presents the analysis of 83 records. The data presented in this analysis show that the absolute average reported discrepancy is lower than the number of questionable ballots (0.04 versus 0.93).

We note that the discrepancies reported in this audit are substantially smaller than those reported for prior, larger election audits. One can conclude that the hand counts in the current audit were better because of the relatively small number of ballots and candidates in question, thus presenting fewer opportunities for human counting errors. It is anticipated that in broader elections, with greater number of ballots and more races the discrepancies will be larger.

This analysis was performed on request of the Office of the Secretary of the State.

Preface

The University Of Connecticut Center for Voting Technology Research (VoTeR Center) received the data gathered in the post-election audit performed in the State of Connecticut following the September 2011 election. The audits of the randomly selected 10% of the districts were conducted in October of 2011, and the returns were conveyed by the Office of the Secretary of the State (SOTS) to the VoTeR Center on November 18th of 2011.

For the definition of the audit see Connecticut Public Act 07-194 AN ACT CONCERNING THE INTEGRITY AND SECURITY OF THE VOTING PROCESS, approved July 5, 2007. For the instructions on conducting the audit, see Audit Procedures Optical Scan Voting Equipment, Office of the Secretary of the State, November 2007.

In accordance with the Act, the SOTS office conveys the report documenting hand audit returns to the VoTeR Center, and the Center is in turn required to report on its analysis to the SOTS Office:

“(d)...Such report shall be filed with the Secretary of the State who shall immediately forward such report to The University of Connecticut for analysis. The University of Connecticut shall file a written report with the Secretary of the State regarding such analysis that describes any discrepancies identified. After receipt of such report, the Secretary of the State shall file such report with the State Elections Enforcement Commission.”

The following subsections of the audit law are also highly relevant:

“(i) If the audit officials are unable to reconcile the manual count with the electronic vote tabulation and discrepancies, the Secretary of the State shall conduct such further investigation of the voting machine or tabulator malfunction as may be necessary for the purpose of reviewing whether or not to decertify the voting machine or machines in question or to order the voting machine to be examined and recertified....

(o) As used in this section, “discrepancy” means any difference in vote totals between machine and manual counts in a voting district that exceeds one-half of one percent of the lesser amount of the vote totals between machine and manual counts where such differences cannot be resolved through an accounting of ballots...”

This analysis was performed on request of the Office of the Secretary of the State.

1 Overview of the Analysis

This report contains several statistical analyses of the audit returns. The VoTeR Center received 83 records on November 18th of 2011.

Among 83 (100%) records there are 80 (96.4%) records showing no discrepancy, 3 records (3.6%) showing discrepancy of 1 vote.

The average number of votes recorded for the candidates is 104. The overall average number of questionable votes per district is 0.93. The ballots are determined to be “questionable” by the human auditors: a ballot is questionable if the auditors believe that it is marked in such a way that the machine will likely not be able to read it properly. Note that this does not mean that the machine absolutely would

not read it. Given that this assessment is based on human judgment, it is anticipated that in some cases hand counts would not match machine counts.

The average absolute discrepancy between the machine count and the hand count performed in the audit is 0.04. This number is computed by taking the sum of the absolute (positive) values of the discrepancies in all records, then dividing this sum by the number of records. Thus on the average the reported discrepancy is smaller than the average number of reported questionable votes. Overall this is a good indication, suggesting that, on average, despite the presence of questionably marked ballots, the machine count is very close to the hand count.

The detailed analysis is in Section 3.

2 Introduction and Notation

Throughout this document we use the following notation:

- M is used to denote the machine counted ballots
- U is used to denote the number of undisputed hand counted ballots
- Q is used to denote the number of questionable hand counted ballots
- H is the sum of undisputed and questionable ballots, that is, $H = U + Q$
- D is the discrepancy between the hand counted total and machine total, that is, $D = H - M$

Thus for a given candidate, we define discrepancy D as the difference between H (the sum of the undisputed ballots U and the questionable ballots Q) and M (the machine count).

If the discrepancy D is positive then we say that we observe a machine undercount relative to the hand count H , i.e., the machine counted fewer ballots than the auditors.

If the discrepancy D is negative then we say that we observe a machine overcount relative to the hand count H , i.e., the machine counted more ballots than the auditors.

- $|D|$ is the absolute value of the discrepancy (or the positive value of D)

This means that if D is positive, then $|D| = D$, and if D is negative, then $|D| = -D$.

Note that this presupposes that the hand count does not contain (human counting) errors. This is not necessarily so in actuality. However, since in general it is not possible to ascertain whether the hand counted data contain errors, we assume that the hand counted data is reported correctly, unless a follow up investigation determined otherwise.

3 Statistical Analysis of 83 Records

Figure 1 is the graphical representation of the data distribution for discrepancies found in 83 records. We then analyze the absolute value of discrepancy, the pattern of undercounts and overcounts, and the percentage of the votes reported as questionable.

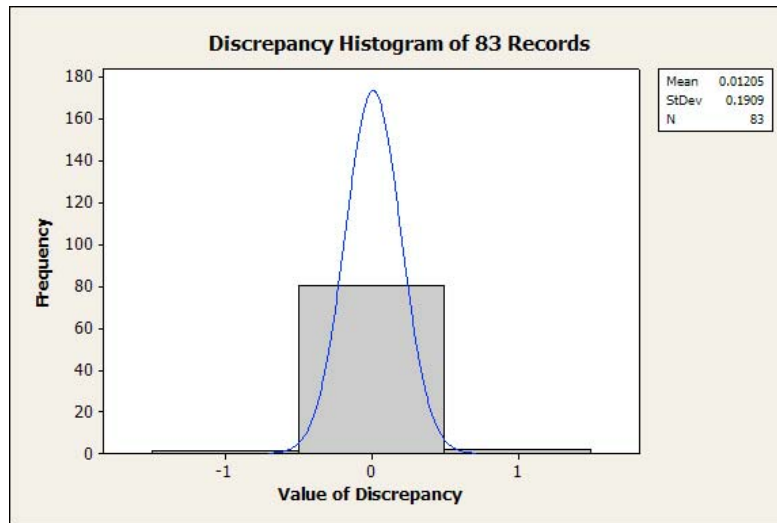


Figure 1

3.1 Absolute Value of Discrepancy

Here we give the analysis for the absolute number of discrepancies, $|D|$. For the 83 records considered here, the average absolute discrepancy is 0.04, and the standard deviation is 0.19, suggesting that the occurrences of discrepancies are clustered in the vicinity of the average. Table 1 presents tiered view of the absolute discrepancies.

Table 1: Absolute value of discrepancy.

Description	Counts	% of Counts
Records with discrepancy $ D $ of 0	80	96.4%
Records with discrepancy $ D $ of 1	3	3.6%
Totals:	83	100%

Table 2 presents tiered view of the absolute discrepancies by the percentage of discrepancy.

Table 2: By Percentage of Discrepancy

Description	Counts	% of Counts
Records with discrepancy of 0%	80	96.4%

Records with discrepancy > 0.5% to 1%	1	1.2%
Records with discrepancy > 1% to 2%	2	2.4%
Totals:	83	100%

3.2 Undercount and Overcount Discrepancies

When considering negative discrepancies (overcounts) and positive discrepancies (undercounts) for the 83 records, the average discrepancy is 0.01, and the standard deviation is 0.19.

Table 3 presents discrepancies for the records that indicate overcounts.

Table 3: Records indicating overcounting: 1 (1.2% of 83) records with negative values of discrepancy.

Description	Counts	% of Counts
Records with discrepancy D of -1	1	100%
Totals:	1	100%

Table 4 presents discrepancies for the records that indicate undercounts.

Table 4: Records indicating undercounting: 2 (2.4% of 83) records with positive values of discrepancy.

Description	Counts	% of Counts
Records with Discrepancy D of 1	2	100%
Totals:	2	100%

3.3 Statistics for Questionable Ballot Counts

The average number of questionable votes per record is 0.93.

Table 5 presents statistics with respect to the questionable ballots per candidate.

Table 5: Questionable Ballot Counts.

Description	Counts	% of Counts
Records with questionable count Q of 0	61	73.5%
Records with questionable count Q > 0 to 2%	11	13.25%
Records with questionable count Q > 2% to 5%	11	13.25%
Totals:	83	100%

4 Conclusions

The analysis observes that on the average the absolute number of reported discrepancies is smaller than the average number of the reported questionable votes. This is consistent with prior audits. Here one may conclude that the machines counts are mostly not affected by the questionable ballots, resulting in small differences between the reported machine totals and the hand counted totals.

Additionally, it is noted that the discrepancies reported in this audit are substantially smaller than those reported for prior, larger election audits. One can conclude that the hand counts in the current audit were better because of the relatively small number of ballots and candidates in question, thus presenting fewer opportunities for human counting errors. It is anticipated that in broader elections, with greater number of ballots and more races the discrepancies will be larger.

Future improvements should address the reporting of the analysis and the analysis itself. A major change planned for future analysis is to assess the impact of the perceived discrepancies on the election outcomes. This is going to be important for the cases where a race may be very close, but where the difference between candidates is over 0.5% (thus not triggering an automatic recount).

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