Improving California's 1% Manual Tally Procedures

Joseph Lorenzo Hall
UC Berkeley School of Information

USENIX/ACCURATE Electronic Voting Technology Workshop
28 July 2008

This material is based upon work supported by the National Science Foundation under A Center for Correct, Usable, Reliable, Auditable and Transparent Elections (ACCURATE), Grant Number CNS-0524745. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.

Outline

- Motivation
- California's Tallying Process
- Methodology
- Findings
  - Security
  - Transparency
  - Efficiency

Checking the Math

- If we can't get the access and oversight support we need, what then? Audit.
- By "audit", we compare two sets of software-independent records
  - 38 states keep independent records
  - Only 17 actually count them

High-Level: What to Audit?

- Post-election auditing lit. has exploded
- Brennan Center / Samuelson Clinic convened a blue ribbon panel
- Examined:
  - Fixed-percentage audits
  - Margin-dependent audits (tiered and non-)
  - Polling audits
- Margin-dependent audits with a floor.

Low-Level: How to Audit?

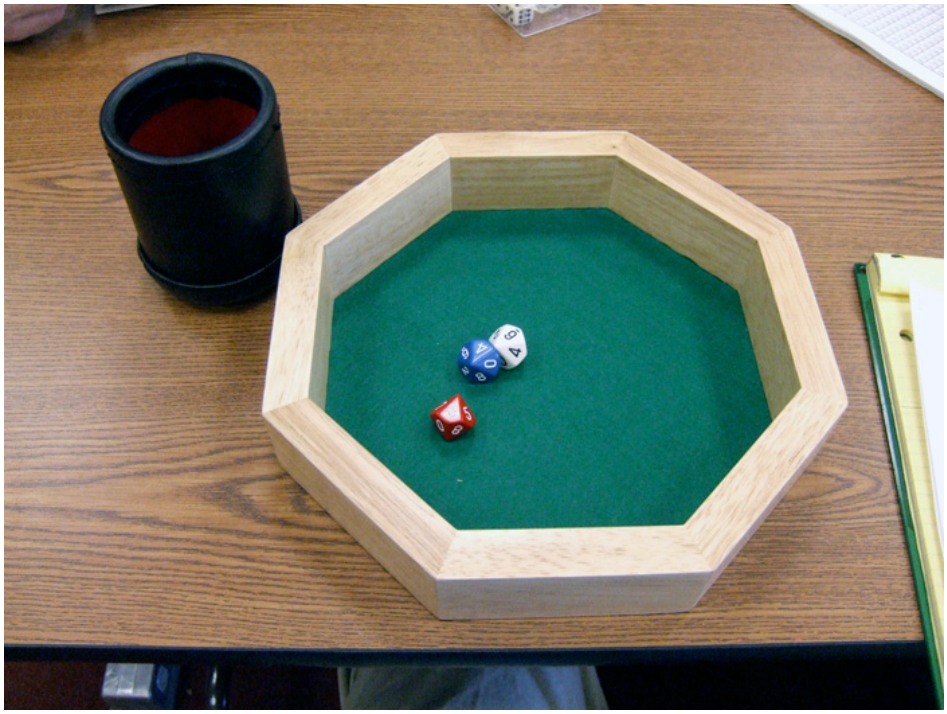
- CA has had manual tallies since 1965.
- Very little is prescribed by election law
  - Tally must compare ballots in 1% of precincts
  - Must be randomly chosen and completed before the canvass is over (28 cal. days)
  - Must include all types of ballots
- We set out with a group of researchers to improve the security, efficiency and transparency of CA's manual count.

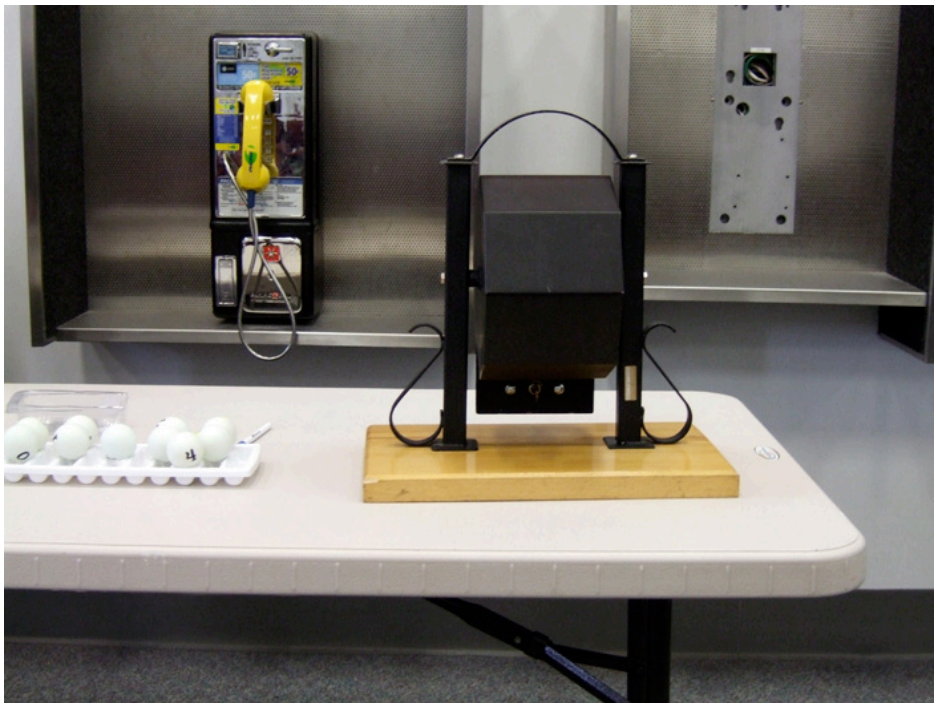
Low-Level: How to Audit?

- CA has had manual tallies since 1965.
- Very little is prescribed by election law
  - Tally must compare ballots in 1% of precincts
  - Must be randomly chosen and completed before the canvass is over (28 cal. days)
  - Must include all types of ballots
- We set out with a group of researchers to improve the security, efficiency and transparency of CA's manual count.

How Does the Tally Work?

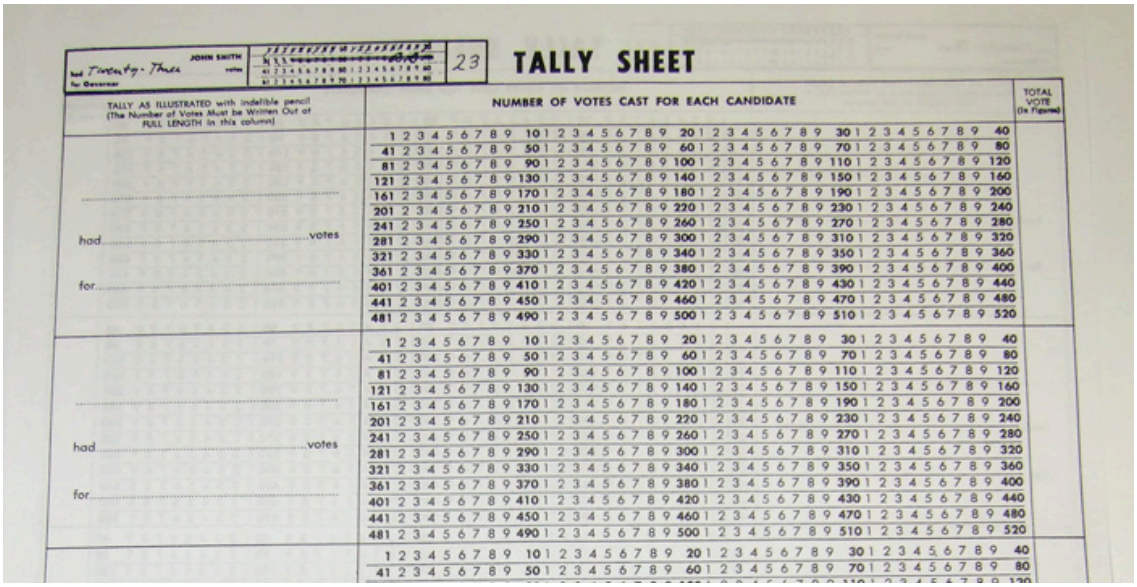
- Precincts chosen randomly
- Materials are retrieved, verified, sorted
- Typically four people perform tally: Caller, Witness and two Talliers
- Use a tally sheet and announce "10's"
- Hand tally is compared to electronic
- Discrepancies must be reconciled





How Does the Tally Work?

- Precincts chosen randomly
- Materials are retrieved, verified, sorted
- Typically four people perform tally: Caller, Witness and two Talliers
- Use a tally sheet and announce “10’s”
- Hand tally is compared to electronic
- Discrepancies must be reconciled



TALLY SHEET

23

JOHN SMITH had Twenty-Three votes for Governor

TALLY AS ILLUSTRATED with indelible pencil (The Number of Votes Must be Written Out at FULL LENGTH in this column)

NUMBER OF VOTES CAST FOR EACH CANDIDATE

TOTAL VOTE (As Figured)

had.....votes

for.....

How Does the Tally Work?

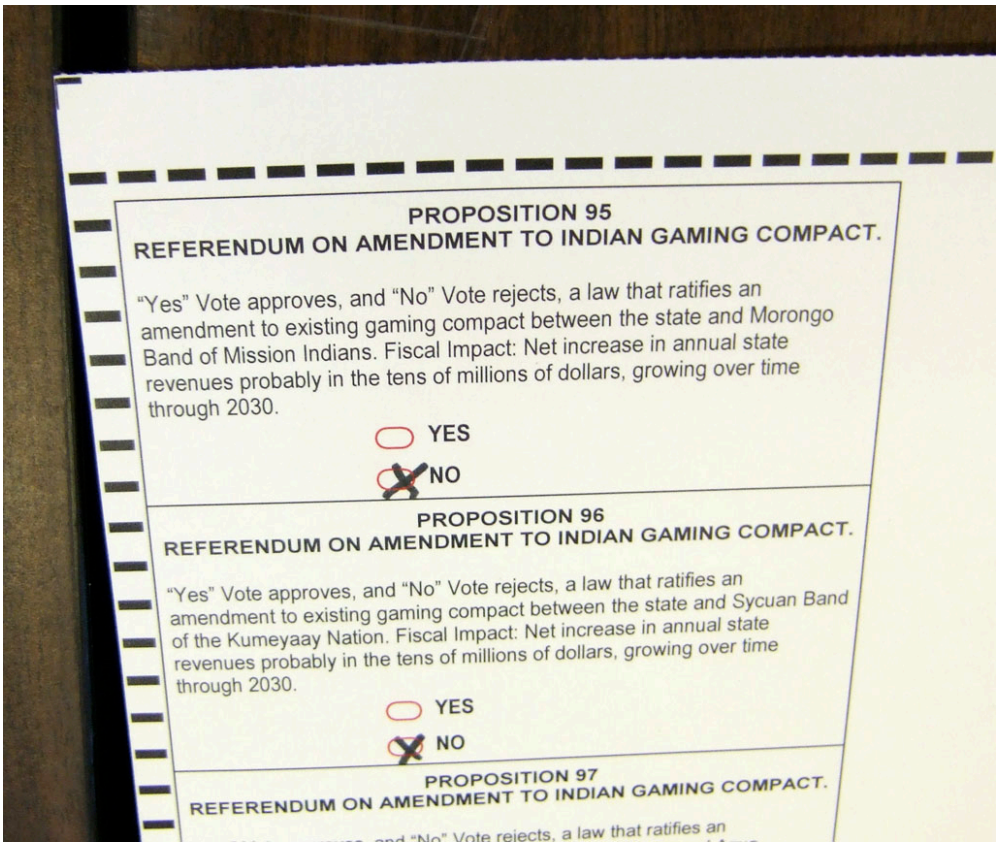
- Precincts chosen randomly
- Materials are retrieved, verified, sorted
- Typically four people perform tally: Caller, Witness and two Talliers
- Use a tally sheet and announce “10’s”
- Hand tally is compared to electronic
- Discrepancies must be reconciled

Methodology

- Examine existing procedures for the tally
- Worked with San Mateo in-depth
- Iteratively developed new procedures
- San Mateo used our interim procedures
- Observed tally process in San Mateo as well as Alameda and Marin.
- Revised and generalized procedures such that any CA county can use them.

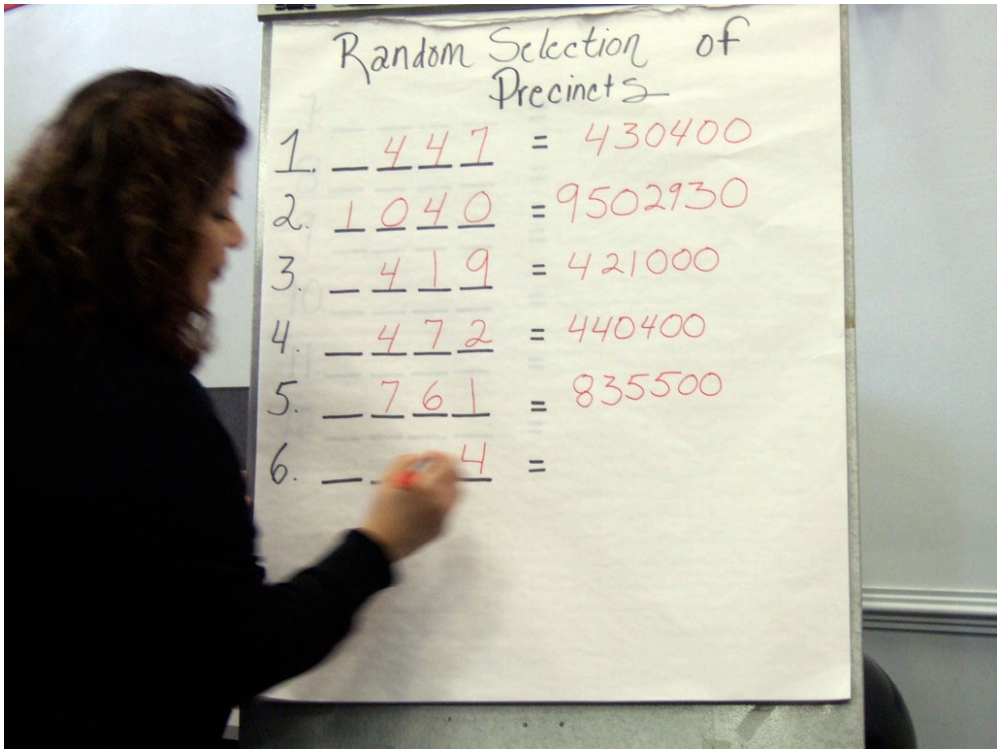
Findings: Security

- Selection and tally must take place *after* ballots are counted
- Tally should take place soon after selection and seals verified
- Counting must be blind (not *too* blind)
- Certain procedures need expert review when revised
- Tally process should be resistant to insider attacks



Findings: Security

- Selection and tally must take place *after* ballots are counted
- Tally should take place soon after selection and seals verified
- Counting must be blind (not *too* blind)
- Certain procedures need expert review when revised
- Tally process should be resistant to insider attacks



Findings: Security

- Selection and tally must take place *after* ballots are counted
- Tally should take place soon after selection and seals verified
- Counting must be blind (not *too* blind)
- Certain procedures need expert review when revised
- Tally process should be resistant to insider attacks

Findings: Transparency

- Provide public notice of the tally
- Publish tally procedures
- Publish useful data, digital & hardcopy
- Ensure clear lines of communication for observers

Findings: Efficiency

- Randomness w/ dice can be inefficient
- Electronic results need to be fine-grained
- Adverse effects of good team demeanor
- Pre-fill tally sheets
- Consider using RFIDs to ease pressure on chain-of-custody.

http://www.josephhall.org/dicebins.php

Dice Binning Calculator for Post-Election Audits

Joseph Lorenzo Hall (joehall@berkeley.edu), UC Berkeley School of Information

To increase the transparency of the 1% manual tally process, a few California counties have begun to use 10-sided dice to produce *publicly-verifiable* random numbers (See Cordero, Wagner and Dill 2006). Unfortunately, using 10-sided dice to 1) select from only a few precincts or 2) to select from many precincts can require a lot of re-rolling of the dice. To increase the efficiency of the process, Cordero et al. suggest "binning" the dice rolls so that each precinct has a *range* of corresponding values, of *equal width*, that allow a higher percentage of dice rolls to "hit". This calculator implements this idea. It can also output the binning data in a form that is easily pasteable into a spreadsheet. Please click here for source code and licensing information.

Settings

Number of dice: 2
Number of precincts: 13
(By default, it starts with 2 dice and 13 precincts.)

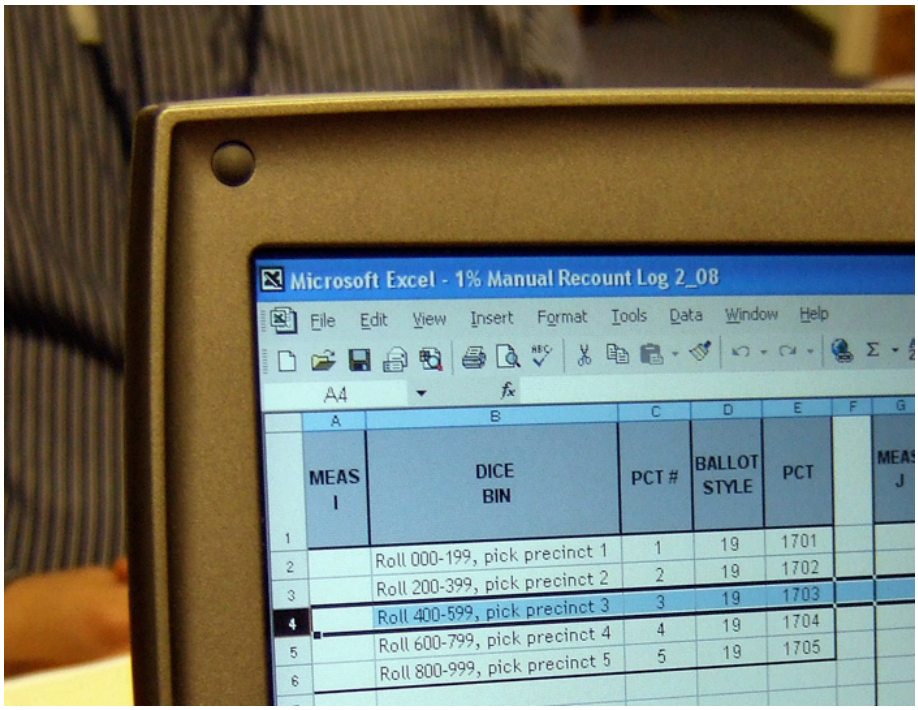
Calculate

Results

- Range is 100. (This is the quantity of random numbers 2 dice can produce.)
- Rounded interval is 7. (This is the number of random numbers per bin.)
- Interval modulus is 9 (9% of rolls). (This is the number of random numbers that will require a re-roll.)

Paste these bins into a spreadsheet

Roll 00-06, pick precinct 1
Roll 07-13, pick precinct 2
Roll 14-20, pick precinct 3



Findings: Efficiency

- Randomness w/ dice can be inefficient
- Electronic results need to be fine-grained
- Adverse effects of good team demeanor
- Pre-fill tally sheets
- Consider using RFIDs to ease pressure on chain-of-custody.

Alameda County
Registrar of Voters
M000319
cartridge
Turn Power off

Findings: Efficiency

- Randomness w/ dice can be inefficient
- Electronic results need to be fine-grained
- Adverse effects of good team demeanor
- Pre-fill tally sheets
- Consider using RFIDs to ease pressure on chain-of-custody.

General Procedures for CA

http://josephhall.org/procedures/ca_tally_procedures-2008.pdf

May your votes be cast and counted as you intended.

Questions?