Risk-Limiting Audits and the Colorado Uniform Voting System Pilot

Colorado Pilot Election Review Committee Meeting

Office of the Colorado Secretary of State

Denver, Colorado

9 October 2015

Philip B. Stark http://www.stat.berkeley.edu/~stark

Department of Statistics, University of California, Berkeley

Why audit?

• many reasons
  – quality control
  – process improvement
  – detect whether outcome is wrong
  – correct the outcome if it is wrong: risk-limiting audit

• Risk-Limiting Audit (RLA)
  – have large, pre-specified chance of correcting the outcome (not count) if the outcome is wrong
  – do not necessarily check whether the voting system is working well, only whether it found the right winner(s)
  – risk limit is worst-case chance that a wrong outcome will not be corrected
  – minimize workload if the outcome is right
  – how can you tell?
    * random sampling–really random, not haphazard
    * like tasting soup–stirring, not just “blind”
    * don’t actually stir ballots: use computer to draw random sample
    * ideally, transparent, mechanical “seed” of randomness, e.g., dice
    * opportunity for public participation

Prerequisites for RLA

1. ballot security tracking / accounting / chain of custody
   • need to know that the audit trail is complete and accurate
2. ballot manifests
   - describes how the physical ballots are organized
   - independent count of the number of ballots
   - ideally, says how many ballots of each style are in each bundle, and even where in the bundle
   - should not rely on the voting system: used to check the voting system

Ballot polling audits

1. ballot-polling audits are like exit polls, but ballots have to talk to you and accurately remember how they were voted
2. only need results and ballot manifest
3. minimal requirements on voting systems: just who won.
4. but workload grows quickly as the margin shrinks (cutting margin in half roughly quadruples the workload)
5. work for many voting rules, but not all (e.g., not for IRV/RCV)

Ballot-level comparison audits

1. requires much more of the voting system, but audit workload is lower than for ballot-polling
2. requires export of CVRs
   - in a machine-tabulatable format
   - that is also human-readable
   - in a way that the ballot for each CVR can be retrieved
   - in a way that the CVR for each ballot can be retrieved
   - with a naming convention or ID for contests/candidates across jurisdictions
   - ideally, indicates overvotes and undervotes

Open questions

1. coordinating multi-jurisdictional audits
   - logistics
   - ballot manifest conventions
   - contest & candidate naming conventions
   - escalation
2. best ways to map CVRs to ballots
   - keep ballots in scan order?
   - imprint ballots before/after scanning?
   - mechanical counter & Bates stamper?
Decisions Colorado needs to make

1. risk limit
2. contests to audit--all?
3. dealing with adjudicated ballots