Risk-Limiting Audits

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Risk-Limiting Audit Kick-off Meeting
Denver, CO
Things to keep in mind

The difference between theory and practice is smaller in theory than it is in practice. (Various)

The purpose of elections is to convince the losers that they lost. (D. Wallach)

The [main] purpose of election audits is to convince everybody that the losers lost. (PBS)
What should audits do?

Pro forma audits
Most audit laws have no clear goal: “count and stop,” or “count and report/explain discrepancies.”

Compliance vs. materiality audits
Compliance: Were proper procedures followed? (e.g., secure chain of custody?)
Materiality: Did any errors that occurred despite compliance matter?

Effective materiality audit
Correct the outcome if it is wrong.
Can require counting the entire audit trail by hand.
Big Idea

Risk-limiting Audit

Large, known chance of a full hand count if the outcome is wrong, thereby correcting the outcome.

*Risk* is maximum chance of failing to correct an apparent outcome that is wrong, no matter what caused the outcome to be wrong.
Risk-Limiting Audits in California

Marin County (February 2008; November 2008, 2009)
Orange County (March 2011)
Yolo County (November 2008, 2009)
Santa Cruz County (November 2008)
Monterey County (May 2011)

Measures requiring super-majority, simple measures, multi-candidate contests, vote-for-\(n\) contests.

Contest sizes ranged from about 200 ballots to 121,000 ballots.
Counting burden ranged from 32 ballots to 7,000 ballots.
Cost per audited ballot ranged from nil to about $0.55.
2008 Yolo County, CA Measure W Audit
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<tr>
<th>Goal of auditing</th>
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<th>Ballot-level audits</th>
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The tables on the page appear to be tally sheets for counting votes, with columns for different measures and rows indicating the number of votes for each candidate or measure. The sheets are filled with numbers, indicating the count of votes for each option.
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Presidential General Election

YOLO COUNTY

November 04, 2008

Proposition 8

SAME-SEX COUPLES TO MARRY: INITIATIVE CONSTITUTIONAL AMENDMENT

Changes California Constitution to eliminate the right of same-sex couples to marry. Provides that any marriage between a man and a woman is valid and recognized in California.

Yes

No

Proposition 9

CRIMINAL JUSTICE SYSTEM: VICTIMS’ RIGHTS: PAROLE INITIATIVE CONSTITUTIONAL AMENDMENT AND STATUTE

Requires notification to victims and opportunity for input during phases of criminal justice process, including bail, plea, sentencing, and parole. Establishes victim services. Provides victim compensation awards. Protects victim confidentiality.

Yes

No

Proposition 10

ALTERNATIVE FUEL VEHICLES AND RENEWABLE ENERGY: BONDS INITIATIVE STATUTE

Authorizes $5 billion in bonds to improve local transit agencies, develop new technology, and increase renewable energy and alternative fuel vehicles. Projects include: improvements to public transportation systems, including new rail lines; development of renewable energy projects; and development of alternative fuel vehicles.

Yes

No

Proposition 11

REDIRECTING INITIATIVE CONSTITUTIONAL AMENDMENT AND STATUTE

Requires the Governor to allocate a certain percentage of state money to specific projects, including education, health care, and infrastructure. Projects include: construction of a new hospital, development of a new park, and construction of a new road.

Yes

No

Proposition 12

VETERANS BOND ACT OF 2008

This act provides for a bond issue of up to $2 billion to improve veterans facilities, services, and programs. Projects include: construction of new veterans facilities, construction of new veterans housing, and development of new veterans programs.

Yes

No

Davis Joint Unified School District

Presidio 100003

Vote Both Sides

Proposition W

DANITA V. DAVIS DISTRICT SCHOOL DISTRICT MEASURE W

Provides that the Davis Joint Unified School District shall establish a bond issue for the construction and improvement of school facilities, including construction of new schools, renovation of existing schools, and maintenance and repair of existing facilities.

Yes

No

Los Rios Community College District

Measure M

Authorizes the Los Rios Community College District to issue up to $900 million in bonds to support the construction of new and expanded facilities, including the expansion of existing facilities, the construction of new facilities, and the purchase of land.

Yes

No
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---|---|---|---

Vote Both Sides

Precinct 100063

Davis Joint Unified School District Measure W Shall the Davis Joint Unified School District maintain existing classroom programs including math and science, English, music, physical education, librarians, secondary class size reduction, athletics and co-curricular programs including drama, debate, and journalism by being authorized to levy a special tax for a period of three years not to exceed the annual rate of $50.00 per dwelling unit, $120.00 per multi-dwelling parcels and $120.00 per parcel for all other parcels?

☐ Yes
☐ No

Bonds Yes

Bonds No

City of Davis Measure N Shall the Proposed Charter of the City of Davis be adopted?

☐ Yes
☐ No
2011 Orange County, first audit under AB 2023
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Commercial development adopted?

☐ Yes
☐ No

Contest: Vote for 1
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commercial development adopted?

Yes

No

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Batch size matters

100 bags of 100 jelly beans, various flavors. What fraction are coconut?

Compare pulling a bag at random to stirring all the beans together in a big pot and sampling 100 beans.

Vote-tabulation errors are like coconut jelly beans. Less information in checking bags of beans—or batches of ballots—than in checking the same number drawn individually from the “pot.”

Yolo County Measure P, November 2009: For 10% risk limit, initial sample 6 batches, 1,437 ballots (11.33%).

Could have gotten 10% risk limit by checking 6 individual ballots (less than 0.05%).
Orange County Statutory Audit

Votes in one precinct counted by hand. No errors found.

Chance the 1% audit would find no errors even if the outcome is wrong could be over 88%.

The error rate in the sample says little about the error rate in the whole contest because the batch is large:
One bag might have no coconut jelly beans, even though the rest have many.
Orange County Audits: Costs

Statutory Audit: $257.68
Scales as the size of the contest: a contest twice as large would cost about twice as much to audit.

AB 2023 risk-limiting audit (10% risk): $483.79 (not including my time or airfare)
Would have cost essentially the same for any contest with the same percentage margin, no matter how large the contest.

Only have to taste a teaspoon of soup to tell if the soup is too salty, no matter how big the pot—if it’s stirred well.
Advantages of ballot-level RLA

Like sampling jelly beans from a big pot, instead of sampling bags of jelly beans.

- cheap (if technology supports it—working with vendors)
- fast and observable
- easy computations
- easy to explain

Tested in Yolo, Orange, and Monterey Counties.

Expect to audit two contests simultaneously in San Luis Obispo in September 2011.

Hope to have ballot-level audits in at least 15 California jurisdictions in 2012.

Secret sauce: have to associate individual CVRs with ballots.
Strategies for Colorado

- Need to understand systems at the county level: systems, procedures, logistical constraints.
- Parallel system versus modifications to existing systems.
- Parallel probably easier, closer to one-size-fits-all. Pros and cons.
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Big-picture questions

• Need audit trail: paperless DREs are a problem.
• Need to curate audit trail.
• Need to check the integrity of the audit trail before the audit starts ("compliance audit")
• Need to “commit” to results before the audit starts.
• Need rules for public observation, etc.
• Need simple, usable rules for determining initial sample size, selecting batches or ballots at random, and stopping the audit.
• Need to figure out how to coordinate audits of multi-jurisdictional contests.