

Auditing Election Equipment — The Real Scoop!

Auditing has become a hot topic among those who are concerned about our election processes. Many are saying we need "statistically significant" audits of the equipment. However, the continuum required for a statistically significant sampling does not exist in this context.

Each election has a unique set of contests and candidates, and each county prepares many different, unique ballots since different districts and even different precincts can offer a different set of choices to voters. Each ballot with a unique set of choices is called a "ballot style." In counties that rotate candidates on the ballot, each rotation is also a unique ballot style.

Ballot programming, which determines how voters' selections are converted into computer data, is unique for each election and each ballot style. There is no correlation between the accuracy of one ballot style and the accuracy of another, and no predictability from one to the next. Either the conversion process for a ballot style is accurate or it is flawed, and auditing a sampling of ballot styles cannot tell us anything about the unsampled ballot styles.

So, a "statistically significant" sampling is a meaningless phrase in this context. The following example demonstrates this.

August 2002. Clay County, Kansas. The tabulation machine showed that one candidate for commissioner had won, but a hand recount showed that his opponent had won by a landslide. **In one ward, the computer had mistakenly reversed the totals.**¹

Note that the reversal occurred in **one ward**. Hand counting **every other** ward could not have revealed the vote-reversal in that ward.



Auditing a random selection of precincts is like picking marbles from a jar. If the jar contains 90 red marbles and 10 blue marbles, and you pick out 2 marbles, what are the chances you will pick even one of the blue ones?

Or, what if there are 5% blue marbles and you pick 2% of them? There is a formula for calculating these probabilities — the hypergeometric distribution formula.

¹ "Aug. 6 ballot problems alleged: Clay, Barton county candidates seek review of races." Lawrence Journal-World. August 22, 2002. Associated Press. http://www2.ljworld.com/news/2002/aug/22/aug_6_ballot/

Here's what the hypergeometric distribution formula tells us about doing a 2% audit in a county with 5% bad ballot styles, that is, with tabulation errors in the programming of 5% of the ballot styles.

# Ballot Styles	# Audited	# Bad Ones	Chance of Finding at Least One Bad One	Chance of Finding at Least Two Bad Ones	# Unaudited
10	1	1	10.000%	0.000%	9
20	1	1	5.000%	0.000%	19
40	1	2	5.000%	0.000%	39
80	2	4	9.810%	0.190%	78
160	4	8	18.712%	1.255%	156
320	7	16	30.410%	4.256%	313
640	13	32	48.998%	13.400%	627
1,280	26	64	74.003%	37.680%	1,254
2,560	52	128	93.245%	74.362%	2,508
5,120	103	256	99.519%	96.858%	5,017

So, in a county with 640 different ballot styles, if 5% of those ballot styles have tabulation programming errors, there is a very real possibility that the outcome could be affected. If 2% of the ballot styles are audited, there is only a 49% chance that ONE of the 32 problems will be found.

That's less than a 50/50 chance that ONE of the badly programmed ballot styles will be picked for the audit! Only a 13% chance that TWO of the bad styles will be picked. And even if they are picked, that leaves 30 bad ballot styles completely undetected by the audit. **Programming errors in 30 ballot styles could reverse the outcome of an election.**

Try it yourself, or watch the [brief demo](#).²

Here's an [Excel spreadsheet](#)³ you can download in case you want to experiment with the numbers, find out the chances for the number of precincts (or ballot styles) in your county, and/or share that information with legislators or your county election director.

² <http://homepage.mac.com/sheltonlankford/.Public/RandomSample.mov>

³ <http://www.votersunite.org/info/AuditEffectivenessCalculator.xls>