6. Small Mock Election for Hand Tally

To provide a sample STV tally, we have created a small (40 valid ballots) mock election, with seven candidates (named, alphabetically, "Candidate A" through "Candidate G") competing for three open seats on a committee.

The ballots in grid format have been given serial numbers. The serial numbers allow tracking of transfers of individual ballots. The selection of votes cast should make the election a reasonably informative and typical example.

A printed version of the complete mock election is included at the end of this chapter, suitable for printing.

There are no duplicate rankings, and there are no gaps in the rankings (essentially making the tally easier to follow). This section includes both blank ballots and all the marked ballots for the mock election, printed 12 to a page on card stock, so they may be cut apart and used in an actual "test run" hand tally.

Each ballot carries all the information available about the voter's intent. For STV tally purposes, ballots acquire two important additional items of information (which may change as a tally progresses): 1) ballot location, i.e. which candidate the ballot indicates is to receive the corresponding vote (which tray the ballot is in); and 2) the weight or value of that vote. Note that a ballot is a physical object, while a vote is a conceptual numerical value derived from the value of a ballot, possibly a fraction as a result of having been transferred. Since votes are derived directly from ballots, it doesn't really matter whether a discussion speaks, for example, of transferring ballots or transferring votes.

At any stage of an STV election, the vote count of each candidate is the sum of the values of all the ballots assigned to that candidate. As an STV election is tallied and rounds of candidate elimination or election and resulting ballot (and therefore vote) transfers take place, ballot locations and vote values change, and of course so do candidates' vote counts. At the beginning of an election, every ballot is assigned to the indicated first choice candidate, and the value of every ballot is 1. Ballot values may decrease as a result of candidates being elected with more votes than the required minimum. The value of a ballot can never exceed 1 nor reach o.

Just to make following this tally of the mock election easy, the candidates' popularity, as reflected in count of first-choice designations, diminishes in alphabetical order of candidate names. The initial or "Round 1" counts of first-choice designations are as follows: A: 9; B: 7; C: 6; D: 6; E: 5; F: 4; G: 3.

Serial or ID numbering of the 40 ballots is arbitrary, but it so happens the ballots were numbered by first-choice candidate in reverse alphabetical candidate name order. This ordering serves no particular purpose, other than to hopefully provide a useful aid in analyzing the paths of vote transfers.

A list of the 40 ballots in order of ID number (one line of the list equals one ballot) is pre-

СНОІСЕ						СНОІСЕ									
Ballot ID	1st	2 n d	3 r d	4th	5 t h	6th	7 t h	Ballot ID	1st	2 n d	3 r d	4th	5 t h	6th	7 t h
1.	G							21.	С						
2.	G	А	D	В	С	Е	F	22.	F	Е	D				
3.	G	F	В	А	Е	С	D	23.	С	G	В	D	F	Е	А
4.	F	G	А	D				24.	С	D	Е				
5.	F	В	Е	G				25.	В	А					
б.	F	Е	D					26.	В	С	G	D	Е		
7.	F	А	D					27.	В	Е	F	G	А		
8.	Е	А	D	С				28.	В		G	D	С		
9.	Е	F	В	D				29.	В						
10.	Е	G	А	В				30.	В	F	D				
11.	Е	В	С	D	G			31.	В	С	D				
12.	Е	D	С	G				32.	Α						
13.	D	Е	С					33.	Α	G	F	Е			
14.	D	А	G	С				34.	Α	В	С	D	Е	F	G
15.	D	В	С	А				35.	А	D	В	С			
16.	D							36.	А	D	Е	В			
17.	D	F	С					37.	А	С					

sented below. It should be easier to digest than the four sheets of grid format ballots:

It is recommended that election operators should try to do their own tally of the ballots represented above, referring to Section 5 for instructions.

38.

39.

AGFE

40. A D C E B

AGDCFBE

The self-tutorial tally could be done either by cutting apart the set of 40 physical ballots which we have included, and doing a tally involving actual individual ballot trays and transfer of ballots from one tray to another, or in a sort of narrative form keeping track of steps and rounds on paper, as follows here.

There are comments about the tally in the remainder of this section.

18. D C G B

19. C A D

20. C D G B

As applied to this mock tally, Step One is simple. Because all 40 ballots are valid, note that v = 40. The number of offices is 3. Plugging this information into the Droop threshold formula:

d (an integer - no rounding required) is 1 + 40/(3+1) = 11 votes

Step Two is quite simple as well for the mock tally. The grouping and counting by designated first choice candidate is already done.

Step Three becomes operative. Here follows a round-by-round analysis of the transfer and tally part of the mock election.

Round 1 No candidate has reached the threshold and none is therefore elected, so Candidate G, as the lowest vote getter with only 3 votes, is eliminated.

Round 2 begins with Action 3e, the transfer of the three ballots with Candidate G as first choice (G's ballots). One is a first-choice only ballot, so it is transferred to the exhausted pile. Another has A as second choice, and the last has F as second choice. After the transfer, the candidates' vote counts (in name order, followed by the exhausted ballot count) for **Round 2** are

A:	10
В:	7
C:	6
D:	6
E:	5
F:	5
G:	0
Exh:	1

No candidate has yet reached the threshold, which means returning to Action 3f, which eliminates the lowest vote getter. Candidates E and F are tied for last place with 5 votes each, necessitating exercise of some tie-break protocol.

NOTE! The protocol invoked by CP Pro is to eliminate F because at the previous round (actually to start

with), F had a lower vote count than did E. That works for this election, so to conform with the tie-breaking method of CP Pro, candidate F is declared eliminated, concluding both Action 4 and Round 2. But, if the decision had been made to conform to the Pacifica Bylaws prescription for resolving last place ties, straws would have been drawn, possibly yielding a different outcome.

Round 3 begins with transfer of Candidate F's ballots to his/her indicated second choices, with another trip through Action 3a, which tallies the new totals. Candidate A gets a vote from Ballot 4, which cannot transfer to Candidate G because G has been eliminated. Candidate A also picks up a vote from Ballot 7, to add to the one vote from Ballot 2 received when G was eliminated, and the first place votes from Ballots 32 - 40. Votes from Ballots 3 and 5 go to B, and Ballot 6 transfers its vote from F to E. The new vote count is:

A:	12
В:	9
C:	6
D:	6
E:	6
F:	0
G:	0
Exh:	1

Looking at A's new vote count, A is declared elected with 1 surplus vote, concluding Action 3b.

Round 4 involves first asking the question posed by Action 3c "Are all seats filled?" The answer is clearly "no", because only one candidate has been elected, and there are two seats remaining. The second question posed by Action 3c, "Do the open seats equal the remaining candidates?" is also answered "no" since there are a total of four candidates remaining for those two vacant seats.

Now Action 3a decrees that Candidate A's surplus shall be transferred. Recall that a candidate's surplus is transferred by reducing the value of all that candidate's received votes and transferring them all. The formula to determine the transfer value of each of A's votes must be employed. In this case 12 total votes, minus the threshold of 11 yields a surplus of exactly 1, which must be divided by the total number votes Candidate A had received:

$$(12 - 11)/12 = 1/12 = 0.08333...$$

Each of the 12 ballots which had been sitting in Candidate A's tray at the time of his/her elec-

tion will now be transferred to subsequent choices with a value of 0.08333... In hand tallies you may prefer to use standard fraction notation rather than decimals.

In this round both B and C, have each received a single ballot from A, so each have their vote counts increased by 0.083 (decimal precision limited to 3 places for display purposes). Candidate D received 7 transfers from A, so D's count increases by

and E's count increases by

The updated vote count at the end of **Round 4** looks VERY different than what has been seen so far, because of the fractional value of the transferred ballots:

A:	0
B:	9.083
C:	6.083
D:	6.583
E:	6.167
F:	0
G:	0
Exh:	2

Perhaps disappointingly, no remaining candidate has achieved the threshold count of 11 votes on this round, so Candidate C, who is now the lowest vote getter, with only 6.083 votes, is eliminated. All of Candidate C's votes must now be transferred.

NOTE! CP Pro at this point shows A not with 0 but with 11 votes (the threshold), and the exhausted tray number is 1.08333 rather than 2. This is apparently a matter of convention. CP Pro always shows elected candidates with the threshold number of votes, despite the fractional transfer of ALL the votes cast for elected candidates. CP Pro also shows for the exhausted pile the cumulative count of votes, but 2 is the integer number of "physical" ballots in the exhausted tray. For an example focused on hand tallies with likely actual physical ballots and ballot boxes, the numbers here seem to be more appropriate, and certainly avoid a possible source of confusion.

Observe the very tiny effect of the ballots from A! This is because all but one of these ballots is "used up", so to speak, in electing A (probably one reason why CP Pro leaves 11 ballots with A), and the effect of the ballot surplus is diluted by the transfer to several different candidates. This is a key property of STV when using fractional transfer method!

Round 5 begins with a transfer of eliminated Candidate C's 6.083 votes. At this point C has assigned 7 ballots with differing values: 19 through 24, each with a value of 1, and Ballot 37, which had been transferred from Candidate A with a value of 0.083. The transfer of C's votes is easy: Ballots 19, 20, 22, and 24 all go into Candidate D's tray (Ballot 19 could not be transferred to Candidate A who has been elected); Ballots 21 and 37 are sent to the exhausted tray, and Ballot 23 gets transferred to Candidate B. The new vote count at the end of **Round 5** is:

A: 0
B: 10.083
C: 0
D: 10.583
E: 6.167
F: 0
G: 0
Exh: 4

Again no remaining candidate has reached the threshold, so the question must be asked as per Action 3c "Do the open seats equal the remaining candidates?" Because there are 3 remaining candidates, and two open seats, the answer is "no". Proceeding to Action 3f, it is time to eliminate the lowest vote getter, in this case Candidate E with 6.167 votes. This concludes **Round** 5.

Round 6 begins with the distribution of Candidate E's 6.167 votes. At this point E has been assigned 8 ballots with differing values: Ballots 6, and Ballots 8 through 12, each with a value of 1, and Ballots 33 and 38, each with a value of 0.083.

The transfer of Candidate E's votes is straightforward: votes from 6, 8 and 12 are transferred to D (notice that Ballot 8 could not be transferred to Candidate A, who was already elected); Ballot 9 transfers to Candidate B's tray (Ballot 9 could not transfer to Candidate F, who was eliminated, you will recall, via CP Pro's previous round rule), Ballot 10 transfers to Candidate B (being unable to transfer to either G or A), and Ballot 11 transfers to Candidate B as well; while Ballots 33 and 38 go to the exhausted tray. With the next tally it is discovered that both candidates B and D have exceeded the threshold and are elected. The update vote count at the end of **Round 6** is:

- A: 0
 B: 13.083
 C: 0
 D: 13.583
 E: 0
 F: 0
 G: 0
- Exh: 6













