Voting Methods Working Group (VMWG) , NIST Interoperability Working Group								
Modeling Subgroup for Voting Method Tabulation Methods 07/27/2018 DRAFT								
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DRAFT NIST SP 1500-10X Voting Methods , Section 3.1.3 Tabulation Methods, Test Conditions and Expected Outcomes								
The tabs in this spreadsheet define the Test Conditions and Expected Outcomes for each named Tabulation Method Variant.								
Tabulation Method tests and outcomes specification do not include the election contest decision rules, by design.								
For specification of election contest outcome tests, see the spreadsheet corresponding to Section 3.1.4 Voting Methods Test Conditions and Expected Outcomes.								
Voting Methods use one of more Tabulation Methods, and therefore the Tabulation Method's corresponding Tests specification.								
Voting methods Test Conditions and Expected Outcomes, in contrast to Tabulation Methods Tests, test the Voting Method Decision Rule Set for logic and accuracy of applying the election outcome decision rule(s).								

Regular Contests	Example 1		Example 2		Example 3		Example 4		Example 5		Example 6	
	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated
Contest A (vf 1) (1 of 4)												
Candidate 1	X	1			x				x			
Candidate 2									x			
Candidate 3			x		x				x			
Candidate 4			x		x				x			
overvote				1 (=vf)		1 (=vf)				1 (=vf)		
undervote								1 (vf-#sel)				
Total		1		1		1		1		1		
rule	any 1	# sel = vf	any 2	# sel > vf	any 3	# sel > vf	none	# sel < vf	all	# sel > vf		
Contest B (VF 2) (2 of 5)												
Candidate 5	x	1			x				x			
Candidate 6			x		x				x		x	1
Candidate 7			x						x			
Candidate 8	x	1			x				x			
Candidate 9			x		x				x			
Candidate 10												
overvote				2 (=vf)		2 (=vf)				2 (=vf)		
undervote								2 (vf-#sel)				1
Total		2		2		2		2		2		2
rule	any 2	# sel = vf	any 3	# sel > vf	any 4	# sel > vf	none	# sel < vf	all	# sel > vf	any 1	# sel < vf

Example 1	Straight Party selection with no other selections - No difference inclusive & exclusive
Example 2	Straight Party selection with selection for other candidate when party has a full slate. No difference inclusive & exclusive.
Example 3	Straight Party selection with selection for other candidate when party has an incomplete slate. **Inclusive & exclusive different in vf>1.**
Example 4	Straight Party selection with contest selection in same party. **Inclusive & exclusive different in vf>1.**
Example 5	Straight Party overvoted. Contests Tabulated regularly **except in Indiana.**
Example 6	No Straight Party. Contests use regular tabulation

Contest	Example 1			Example 2			Example 3			Example 4			Example 5				Example 6		
	Choices	Incl Tab	Excl Tab	Choices	Incl Tab	Excl Tab	Choices	Incl Tab	Excl Tab	Choices	Incl Tab	Excl Tab	Choices	Incl Tab	Excl Tab	IN Tab	Choices	Incl Tab	Excl Tab
Straight Party Selection																			
Republican	x	1	1	x	1	1													
Democratic										x	1	1	x						
Libertarian							x	1	1	x									
overvote														1	1	1			
undervote																		1	1
Total		1	1		1	1		1	1			1		1	1	1		1	1
rule	any 1						inc slate						ovrvt				No str pty		
Contest A (vf 1) (1 of 4)																			
Candidate 1 (Rep)		1 (pv=R)	1 (pv=R)														x	1	1
Candidate 2 (Dem)							x	1	1	x	1	1	x	1	1				
Candidate 3 (Lib)				x	1	1													
Candidate 4 (Non)																			
overvote																1 (=vf)			
undervote																			
Total		1	1		1	1		1	1		1	1		1	1	1		1	1
rule	sp sel			dir sel						reg tab							reg tab		
Contest B (VF 3) (3 of 8)																			
Candidate 5 (Rep)		1 (pv=R)	1 (pv=R)										x	1	1				
Candidate 6 (Rep)		1 (pv=R)	1 (pv=R)														x	1	1
Candidate 7 (Rep)		1 (pv=R)	1 (pv=R)				x	1	1				x	1	1				
Candidate 8 (Dem)											1 (pv=D)						x	1	1
Candidate 9 (Dem)				x	1	1				x	1	1							
Candidate 10 (Dem)											1 (pv=D)								
Candidate 11 (Lib)								1 (pv=L)											
Candidate 12 (Non)							x	1	1								x	1	1
overvote																3(=vf)			
undervote					2	2			1			2		1	1				
Total		3	3		3	3		3	3		3	3		3	3	3		3	3

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Example 4	Straight Party selection with contest selection in same party. **Inclusive & exclusive different in vf>1.**
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Contest	Example 1			Example 2			Example 3			Example 4			Example 5				Example 6		
	Choices	Incl Tab	Excl Tab	Choices	Incl Tab	Excl Tab	Choices	Incl Tab	Excl Tab	Choices	Incl Tab	Excl Tab	Choices	Incl Tab	Excl Tab	IN Tab	Choices	Incl Tab	Excl Tab
rule	none		# sel = vf				pty cross			same pty	incl	excl	reg tab			IN SP ov	reg tab		

Example 1	Standard Open Primary ballot voted as a Republican. (No Party Preference contest)
Example 2	Open Primary ballot with unvoted Party Preference contests voted as a Democratic.
Example 3	Open Primary ballot with Party Preference contest voted as Nonpartisan.
Example 4	Same as Example 1 with extra dem vote (crossover) No Party Preference contest.
Example 5	Same as Example 4 with unvoted Party Preference Contest
Example 6	Same as Example 4 with Rep voted in Party Preference Contest
Example 7	Same as Example 4 with overvoted Party Preference Contest

| Ballot Statistic | Republican | | Democratic | | Nonpartisan | | NonPartisan (xover) | | NonPartisan (xover) | | Republican | | NonPartisan (xover) | |
| Contest | Example 1 | | Example 2 | | Example 3 | | Example 4 | | Example 5 | | Example 6 | | Example 7 | |
	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated
Party Preference Selection	N/A						N/A							
Republican											x	1	x	
Democratic													x	
Libertarian														
overvote														1
undervote				1		1				1				
Total				1						1		1		1
rule	N/A		std		std		N/A		std		std		ov	
Contest A - REP (vf 1) (1 of 4)														
Candidate 1	x	1					x		x		x	1	x	
Candidate 2														
Candidate 3														
overvote														
undervote														
Total		1										1		
rule	std						xover		xover		PP		xover	
Contest B - REP (VF 3) (3 of 8)														
Candidate 4	x	1					x		x		x	1	x	

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Example 6	Same as Example 4 with Rep voted in Party Preference Contest
Example 7	Same as Example 4 with overvoted Party Preference Contest

Ballot Statistic	Republican		Democratic		Nonpartisan		NonPartisan (xover)		NonPartisan (xover)		Republican		NonPartisan (xover)	
Contest	Example 1		Example 2		Example 3		Example 4		Example 5		Example 6		Example 7	
	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated
Candidate 5														
Candidate 6	x	1					x		x		x	1	x	
Candidate 7														
Candidate 8														
Candidate 9	x	1					x		x		x	1	x	
Candidate 10														
Candidate 11														
overvote														
undervote														
Total		3										3		
rule	std						xover		xover		PP		xover	
Contest C - DEM (vf 1) (1 of 4)														
Candidate 12														
Candidate 13			x	1			x		x		x		x	
Candidate 14														
overvote														
undervote														
Total				1										
rule			std				xover				PP			

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Example 5	Same as Example 4 with unvoted Party Preference Contest
Example 6	Same as Example 4 with Rep voted in Party Preference Contest
Example 7	Same as Example 4 with overvoted Party Preference Contest

Ballot Statistic	Republican		Democratic		Nonpartisan		NonPartisan (xover)		NonPartisan (xover)		Republican		NonPartisan (xover)	
Contest	Example 1		Example 2		Example 3		Example 4		Example 5		Example 6		Example 7	
	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated
Contest D - DEM (VF 3) (3 of 8)														
Candidate 15														
Candidate 16														
Candidate 17														
Candidate 8			x	1										
Candidate 9														
Candidate 10			x	1										
Candidate 11														
Candidate 12														
overvote														
undervote				1										
Total				3										
rule			std											

Contest F - NON Referendum														
For	x	1	x	1	x	1	x	1	x	1	x	1	x	1
Against														
overvote														
undervote														
Total		1		1		1		1		1		1		1

Example 1	Standard Open Primary ballot voted as a Republican. (No Party Preference contest)
Example 2	Open Primary ballot with unvoted Party Preference contests voted as a Democratic.
Example 3	Open Primary ballot with Party Preference contest voted as Nonpartisan.
Example 4	Same as Example 1 with extra dem vote (crossover) No Party Preference contest.
Example 5	Same as Example 4 with unvoted Party Preference Contest
Example 6	Same as Example 4 with Rep voted in Party Preference Contest
Example 7	Same as Example 4 with overvoted Party Preference Contest

Ballot Statistic	Republican		Democratic		Nonpartisan		NonPartisan (xover)		NonPartisan (xover)		Republican		NonPartisan (xover)	
Contest	Example 1		Example 2		Example 3		Example 4		Example 5		Example 6		Example 7	
	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated
rule	std		std		std		std		std		std		std	

Example 1	No selection in Recall Controlling contest with votes in the controlled contest
Example 2	Selection in Controlling contest with no selection in controlled contest
Example 3	Normal vote pattern. Selections in both contests
Example 4	Controlling contest overvoted with votes in controlled contest

Contests	Example 1		Example 2		Example 3		Example 4		Example 5		Example 6	
	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated
Recall Control												
For Recall			x	1	x				x			
Against Recall					x				x			
overvote						1 (vf-#sel)				1 (=vf)		
undervote		1 (vf-#sel)										
Total		1		1		1		1		1		
rule	unvoted	# sel = vf										
Linked Contest (VF 2)												
Candidate 5	x				x	1	x					
Candidate 6							x				x	1
Candidate 7							x					
Candidate 8	x				x	1	x					
overvote										2 (=vf)		
undervote				2				2 (vf-#sel)				1
Total				2		2		2		2		2
rule	not elig	No tab	uv	# sel > vf	not elig		none	# sel < vf	all	# sel > vf	any 1	# sel < vf

Example 1	Pres vote for Cand B. Only Cand B Delegates voted. Male Delegates fully voted. Only 2 Female Delegates voted causing undervote.
Example 2	Pres vote for Cand A. Only Cand A Delegates considered. B3 & Uncom1 Male and D1 Female Delegates ignored causing undervotes
Example 3	Pres vote for Uncommitted. Only Uncommitted Delegates considered. All 3 B Male Delegates ignored causing undervotes. Only 2 Female Uncommitted delegates causing undervote
Example 4	Pres. Selection overvoted. No delegate vote will be counted. Both Male & Female Delegates fully undervoted.
Example 5	No vote for Pres. Selection. No delegate vote will be counted. Both Male & Female Delegates fully undervoted.
Example 6	Pres vote for cand B. Male delegate, even though all cand B, it is overvoted. Female delegate counted since all cand B
Example 7	Pres vote for Cand A. Only Cand A Delegates considered. Even though Male Delegate overvoted, extra vote is ignored since Cand B.

Contests	Example 1		Example 2		Example 3		Example 4		Example 5		Example 6		Example 7	
	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated
Party 1 Presidential Selection														
Candidate A			x	1			x						x	1
Candidate B	x	1									x	1		
Candidate C														
Candidate D														
Uncommitted					x	1	x							
overvote								1						
undervote										1				
Total		1		1		1		1		1		1		1
rule	Any 1 ok		Any 1 ok		Any 1 ok		ov		uv		any 1 ok		Any 1 ok	
Delegate Cong nn Male (vf 3)														
Candidate A1													x	1
Candidate A2			x	1			x		x					
Candidate A3							x		x				x	1
Candidate A4							x		x				x	1
Candidate B1	x	1			x						x			
Candidate B2					x						x			
Candidate B3	x	1	x		x						x		x	
Candidate B4											x			
Candidate B5	x	1												
Candidate C1														
Candidate C2														

	C1x	C1n	C2x	C2n	C3x	C3n	C4x	C4n	C5x	C5n	C6x	C6n	C7x	C7n
Candidate C3														
Candidate UnCom1			x											
Candidate UnCom1														
overvote												3		
undervote				2		3		3		3				
Total		3		3		3		3		3		3		3
rule	All B can		only A can		no Uncom		no pres		no pres		ov		only A can	

	C1x	C1n	C2x	C2n	C3x	C3n	C4x	C4n	C5x	C5n	C6x	C6n	C7x	C7n
Delegate Cong nn Female (vf 3)														
Candidate A1							x		x		x	1	x	1
Candidate A2			x	1			x		x		x	1	x	1
Candidate A3			x	1			x		x		x	1	x	1
Candidate B1	x	1												
Candidate B2	x	1												
Candidate B3														
Candidate C1														
Candidate C2														
Candidate C3														
Candidate D1			x											
Candidate D2														
Candidate D3														
Candidate D4														
Candidate UnCom1					x	1								
Candidate UnCom1					x	1								
overvote														
undervote		1		1		1		3		3				
Total		3		3		3		3		3		3		3
rule	1 uv B		only A can		2 sel		no pres		no pres		normal		normal	

Example 1	Single ballot selection credits all allowed votes to selected candidate.
Example 2	Selection of 2 candiates credits half of allowed votes to each candidate. (may be fractional)
Example 3	Selection of 3 candidates credits 1/3 of allowed votes to each candidate. (may be fractional)
Example 4	Selection of 4 candidates credits 1/4 of allowed votes to each candidate. (may be fractional)
Example 5	Selection of a number of candidates equal+B5 to allowed votes credits 1 vote to each candidate.
Example 6	Selection of more candidates than allowed creates an overvote as with any other contest.
Example 7	Selection of no candidate fully undervotes the contest and is the only way an undervote can be created.

Contest	Example 1		Example 2		Example 3		Example 4		Example 5		Example 6		Example 7	
Proportional	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated
Contest (vote for 5)														
Candidate 1	X	5			x	1 & 2/3			x	1				
Candidate 2							x	1 & 1/4	x	1	x			
Candidate 3			x	2 & 1/2	x	1 & 2/3			x	1	x			
Candidate 4							x	1 & 1/4			x			
Candidate 5														
Candidate 6							x	1 & 1/4			x			
Candidate 7							x	1 & 1/4	x	1	x			
Candidate 8			x	2 & 1/2	x	1 & 2/3			x	1	x			
overvote												5 (=vf)		
undervote														5
Total		5		5		5		5		5		5		5
rule	any 1	All votes	any 2	ea = 1/2 vf	any 3	ea = 1/3 vf	any 4	ea = 1/4 vf	any 5	each = 1/5 vf	ov		uv	

Example 1	Ballot selection designated all allowed votes to one candidate.
Example 2	Ballot selection split all allowed votes between 2 candidates, 3 to one and 2 to the other. (always whole number of votes)
Example 3	Ballot selection split all allowed votes between 3 candidates, 2 each with 2 votes and a third with 1 vote. (always whole number of votes)
Example 4	Ballot selection split all allowed votes between 4 candidates, 3 each with 1 vote and a third with 2 votes. (always whole number of votes)
Example 5	Ballot selection split all allowed votes between 5 candidates, each with 1 vote. (voted like a regular contest)
Example 6	The total vote allocation to the selected candidates exceeds the votes allowed. (4 votes to 1 candidate and 2 to a second candidate exceeds the 5 allowed votes)
Example 7	Selection of no candidate fully undervotes the contest.
Example 8	Ballot selection split all allowed votes between 2 candidates, 4 to one and 1 to the other, a variation of example 2. (illustrates the ability to determine the desired number of votes to allocate
Example 9	Ballot selection does not allocate all eligible votes. Any unallocated votes become undervotes. (3 votes allocated to 2 candidates leaving 2 unallocated votes)

Contest	Example 1		Example 2		Example 3		Example 4		Example 5		Example 6		Example 7		Example 8		Example 9	
Cumulative	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated
Contest (vote for 5)																		
Candidate 1	5	5			2	2			1	1								
Candidate 2					1	1	1	1	1	1	4							
Candidate 3			2	2					1	1					1	1	1	1
Candidate 4					2	2	1	1										
Candidate 5											2							
Candidate 6							1	1										

	All to 1	as voted	Split 2can	as voted	split 3can	as voted	splt 4 can	as voted	splt 5can	# sel > vf	ov		full uv		large split	as voted	partial uv	
Candidate 7							2	2	1	1								
Candidate 8			3	3					1	1					4	4	2	2
overvote												5 (=vf)						
undervote														5				2
Total	5					5		5		5		5		5		5		5
rule																		

Ballot Description	Ballot contains a full group, 2 incomplete groups, candidates running out outside a group and write-ins. This illustrates the different ballot conditions that may be encountered although not all actual ballots have multiple groups. Tabulation of group selects is optional and is not included in total contests votes. It is shown in the table as an "o" to indicate recognition but not necessarily results tabulation. Note that any group selection is equivalent to selecting all candidates in the group inidvidually.
Example 1	Selection of a full group only. All candidates in the group receive a vote.
Example 2	Selection of an incomplete group plus additional individual candidates for fill the available votes. The additional candidates may not be in a group, may be a write-in or even in another group.
Example 3	Selection of a full group and an additonal candidate. The additional candidate creates an overvote when added to the candidates selected by the group select.
Example 4	Selection of a group plus selection of some of the individual candidates within the group. The individual selections are inconsequention as all group candidates are always selected by the group selection.
Example 5	Selection of an incomplete group only that shows undervote tabulation.
Example 6	Selection of individual candidates without any group selections.
Example 7	Selection of 2 groups that result in an overvote
Example 8	Selection of 2 groups that do not result in an overvote

Contest	Example 1		Example 2		Example 3		Example 4		Example 5		Example 6		Example 7		Example 8	
	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated	Choices	Tabulated
Town Committee (vote for 15)																
Group A Select	x	o			x		x	o					x			
Candidate 1-GA		1						1								
Candidate 2-GA		1						1			x	1				
Candidate 3-GA		1					x	1								
Candidate 4-GA		1					x	1								
Candidate 5-GA		1					x	1								
Candidate 6-GA		1						1								
Candidate 7-GA		1						1			x	1				
Candidate 8-GA		1						1								
Candidate 9-GA		1	x	1			x	1			x	1				
Candidate 10-GA		1					x	1			x	1				
Candidate 11-GA		1					x	1			x	1				
Candidate 12-GA		1					x	1								
Candidate 13-GA		1						1								
Candidate 14-GA		1						1			x	1				
Candidate 15-GA		1						1								
Group B Select			x	o					x	o					x	o
Candidate 1-GB				1						1	x	1				1
Candidate 2-GB				1						1						1
Candidate 3-GB				1	x					1	x	1				1

Candidate 4-GB				1					1	x	1			1
Candidate 5-GB				1					1	x	1			1
Candidate 6-GB				1					1					1
Candidate 7-GB				1					1					1
Candidate 8-GB				1					1	x	1			1
Candidate 9-GB				1					1					1
Candidate 10-GB				1					1					1
Candidate 11-GB				1					1	x	1			1
Candidate 12-GB				1					1					1
Group C Select												x	x	o
Candidate 1-GC														1
Candidate 2-GC			x	1						x	1			1
Candidate 3-GC														1
Ungrouped Cand														
Candidate 1-UnGr														
Candidate 2-UnGr			x	1						x	1			
Candidate 3-UnGr														
Candidate 4-UnGr										x	1			
Candidate 5-UnGr														
Candidate 6-UnGr														
Write-in 1			x	1										
Write-in 2														
Write-in 3														
Write-in 4														
Write-in 5														
Write-in 6														
Write-in 7														
Write-in 8														
Write-in 9														
Write-in 10														
Write-in 11														
Write-in 12														
Write-in 13														
Write-in 14														
Write-in 15														

overvote						15								15		
undervote										3		1				
Total		15		15		15		15		15		15		15		15
rule	vt grp		grp + ind		grp+ov		GrpA+CA		Inc grp		Ind sel		ov grp		vt 2 grps	