STV Rules for manual counting to give effect to the Weighted Inclusive Gregory Method of transferring surpluses, with candidates' votes recorded as integer values.

Background and explanation

The 2007 local government elections in Scotland will use STV-PR to elect councillors in wards returning three or four members. In April 2005 the Scottish Executive indicated its intention that the ballot papers from these elections (and the Scottish Parliament elections held on the same day) should be scanned and counted electronically, subject to satisfactory trials.

The tender document issued to interested contractors specified that the STV counting rules were to be based on the "Weighted Inclusive Gregory Method" (WIGM) of transferring consequential surpluses. The tender document included a description of STV rules incorporating WIGM, based on the incomplete and defective description given in the Technical Report of the British Columbia Citizens' Assembly on Electoral Reform.

The rules below set out a complete implementation of WIGM described for manual sorting and counting. When e-counting goes ahead, these rules can be modified appropriately, but the principles and the calculations should remain the same. The e-counting version would probably best be written in the legislation separately rather than by modification of each clause of the manual version. [For an example of this, see the Australian Commonwealth Electoral Act 1918, Section 273 (Scrutiny of votes in Senate elections) and Section 273A (Computerised scrutiny of votes in Senate election).]

The text here is intended to slot into a larger document containing other election rules as, for example, in the Local Elections (Northern Ireland) Order 1985 (SI No 454). The text here is structured by 'Rule', 'paragraph', 'sub-paragraph' and 'sub-sub-paragraph', eg 2. (5) (a) (ii), and follows the standard convention of UK legislation in not repeating Rule numbers on each paragraph, paragraph numbers on each sub-paragraph, etc. Again, in accordance with UK convention, a reference to "paragraph (n)" means a paragraph within the same Rule, etc.

The key feature of WIGM is that when any surplus is transferred **all** of the ballot papers of the newly elected candidate are transferred. This is the "inclusive" approach. In line with this inclusive approach, non-transferable papers are set aside as non-transferable, taking with them the appropriate share of the surplus. When a consequential surplus is transferred it is necessary to weight each parcel of differently valued ballot papers to ensure that each voter contributes in total exactly one vote to the whole election. Votes are not transferred to already elected candidates at any stage. Thus these rules do not make any provision to overcome the anomaly that arises with WIGM when votes are not transferred to already elected candidates. I would propose that this anomaly should be ignored for the purposes of the Scottish STV elections in 2007.

In line with the inclusive approach, these rules do not include any sub-stages when a candidate is excluded, nor are papers with first preference votes kept separate from other papers with a current value of one vote when an exclusion is made. The

parcels of differently valued papers must be handled separately, but there is no provision for deeming a candidate elected before the transfer of all votes from the excluded candidate has been completed.

Because the calculation of transfer values will involve a two-step calculation when a consequential surplus is transferred, and because the vote values on many ballot papers are likely to become very small at later stages of the count, the precision of the calculations of transfer values and of transferred votes has been set at seven decimal places. This value has been chosen because more precision is not likely to reduce significantly the loss of votes on calculation, because it can be implemented exactly in a variety of ways in computer programs, and because hand-held electronic calculators with eight digit displays can display decimal fractions in division to seven decimal places. In all cases, these rules specify that any fractional remainder beyond seven decimal places should be ignored. This truncation is applied at each step of any multi-step calculation to ensure the specified precision throughout.

These rules follow the Australian Electoral Commission's practice in STV elections of recording candidates' votes only as whole numbers. The total of the fractional votes thus not transferred is recorded at each stage of the count. This will greatly simplify the presentation of the result sheet and so aid public understanding and acceptance of the voting system. The Australians use the term "Lost by fraction", but in these rules I have used the term "Vote fraction not transferred". This term is more explicit and does not carry the implication that any votes can be "lost". An example Result Sheet is included, based on one of the elections used at the acceptance phase demonstrations of e-counting held in Glasgow on 26-29 April 2006.

The text follows the conventional order of rules for STV counts and draws on the Northern Ireland legislation and the text that was included in the Local Governance (Scotland) Bill. [Those texts in turn drew on earlier STV regulations, especially The Education Authorities Election Order (Scotland) 1928 (Statutory Rules and Orders 1927 No.1138/S.58) and The University Elections (Single Transferable Vote) Regulations 1918 (Statutory Rules and Orders 1918 No. 1348).] Corrections and clarifications have been incorporated where these were needed, eg to remove confusions of 'ballot papers' and 'votes'.

Rule 4 "Subsequent stages" is intended to provide a 'flow chart' through the whole process of transferring votes from surpluses and exclusions. The details of the respective transfers are given in subsequent rules. There are separate rules for the transfer of surpluses comprising only first preference votes and for the transfer of consequential surpluses because the two procedures are slightly but importantly different and separate rules provided the simpler explanation.

Rules for the declaration of the result are usually included in a different 'Part' of the regulation document, but have been included here as Rule 11 for completeness. The requirements for publication have been expanded to include all details that should be shown on the result sheet and all the calculation sheets used in the transfers of votes. These are not specified in the Northern Ireland legislation, but all of this information should be put into the public domain once the election has been completed. Similarly, if e-counting is implemented, there should be added a requirement to publish on an appropriate website, anonymised versions of all the ballot papers for each ward showing the full set of preferences on every ballot paper.

These rules do not include any provisions for filling casual vacancies because policy decisions need to be made about how casual vacancies are to be filled before the appropriate rules can be drafted. There are strong arguments for not holding by-elections when the members are elected by any system of proportional representation. But if by-elections are prescribed, it would be best to write a separate rule when there is only one vacancy rather than use the "this paragraph shall not apply" approach. Suitable wording for such a rule, avoiding any references to "the quota" or "surpluses", already exists and has been used for many years.

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THE RULES

1. Rejected ballot papers

- (1) Any ballot paper—
 - (a) which does not bear the official mark; or
 - (b) on which the figure 1 standing alone is not placed so as to indicate a first preference for some candidate; or
 - (c) on which the figure 1 standing alone indicating a first preference is set opposite the name of more than one candidate; or
 - (d) on which anything is written or marked by which the voter can be identified; or
 - (e) which is unmarked or void for uncertainty,

shall be void and not counted, but the ballot paper shall not be void by reason only of carrying the words "one", "two", "three", (and so on) or any other mark instead of a figure if, in the opinion of the returning officer, the word or mark clearly indicates a preference or preferences.

- (2) The returning officer shall endorse "rejected" on any ballot paper which under this rule is not to be counted and if an election agent objects to this decision shall add to the endorsement the words "rejection objected to".
- (3) The returning officer shall prepare a statement showing the number of ballot papers rejected under each of sub-paragraphs (a), (b), (c), (d) and (e) of paragraph (1).
- (4) The decision of the returning officer on any question arising in respect of a ballot paper shall be final but shall be subject to review on an election petition.

2. First stage

- (1) The returning officer shall sort the valid ballot papers into parcels according to the candidates for whom the first preferences are indicated.
- (2) The returning officer shall then count the number of ballot papers for each candidate and shall record those numbers.

(3) The returning officer shall also ascertain and record the total number of valid ballot papers.

3. The quota

- (1) The returning officer shall divide the number of valid ballot papers by a number exceeding by one the number of members to be elected.
- (2) The result of the division under paragraph (1) (ignoring any fraction), increased by one, shall be the number of votes sufficient to secure the election of a candidate (in these rules referred to as "the quota").
- (3) Any candidate whose total vote at the end of a stage of the count equals or exceeds the quota shall be deemed to be elected.

4. Subsequent stages

- (1) If one or more vacancies remain to be filled and one or more candidates has a surplus, the returning officer shall, subject to paragraph (4), transfer the surplus votes in accordance with rule 5.
- (2) Subject to paragraph (4), the returning officer shall proceed to transfer surplus votes until no candidate who is deemed to be elected has a surplus or all of the vacancies have been filled.
- (3) Subject to paragraph (4), if, at any stage of the count, two or more candidates have surpluses, the surplus votes of the candidate with the largest surplus shall be transferred first, and if
 - (a) the surpluses determined in respect of two or more candidates are equal, the surplus votes of the candidate who had the highest recorded votes at the earliest preceding stage at which they had unequal votes, shall be transferred first, and
 - (b) the votes credited to two or more candidates were equal at all stages of the count, the returning officer shall decide between those candidates by lot and the surplus votes of the candidate on whom the lot falls shall be transferred first.
- (4) Votes shall not be transferred where any surplus or surpluses which, at a particular stage of the count, have not already been transferred, are
 - (a) less than the difference between the total vote then credited to the continuing candidate with the lowest recorded vote and the vote of the candidate with the next lowest recorded vote; or
 - (b) less than the difference between the total votes of the two or more continuing candidates, credited at that stage of the count with the lowest recorded total numbers of votes, and the candidate next above such candidates.
- (5) Each transfer of a surplus constitutes a stage of the count.

- (6) If one or more vacancies remain to be filled and no candidate has a surplus or the transfer of the surplus is deferred under paragraph (4), the returning officer shall, subject to rule 9, exclude one or more candidates and transfer the votes of the excluded candidates in accordance with rule 8.
- (7) Where the total number of votes credited to the two or more candidates with the lowest numbers of votes, together with any surpluses, is less than the number of votes then credited to the candidate next above such candidates, the returning officer shall in one operation exclude such two or more candidates, provided the exclusion of such two or more candidates would not prevent the filling of the remaining vacancies in accordance with rule 9.
- (8) If, when a candidate has to be excluded under this rule, two or more candidates each have the same number of votes and no other candidate has fewer votes -
 - (a) regard shall be had to the total number of votes credited to those candidates at the earliest stage of the count at which they had an unequal number of votes and the candidate with the lowest number of votes at that stage shall be excluded, and
 - (b) where the number of votes credited to those candidates was equal at all stages, the returning officer shall decide between those candidates by lot and the candidate on whom the lot falls shall be excluded.
- (9) The exclusion of a candidate, or of two or more candidates together, constitutes a stage of the count.
- (10) Where a ballot paper is so marked that it is unclear to the returning officer for which candidate the next preference is recorded, the returning officer shall treat any vote on that ballot paper as a non-transferable vote; and votes on a ballot paper shall be so treated where, for example, the names of two or more candidates (whether continuing candidates or not) are so marked that, in the opinion of the returning officer, the same order of preference is indicated or the numerical sequence is broken.

5. Transfer of surpluses comprising only first preference votes

- (1) Where the number of first preference votes for any candidate exceeds the quota, the returning officer shall sort all the ballot papers on which first preference votes are given for that candidate into parcels so that they are grouped—
 - (a) according to the next available preference given on those papers for any continuing candidate, or
 - (b) where no such preference is given, as a parcel of non-transferable papers.
- (2) The returning officer shall count the number of ballot papers in each parcel referred to in paragraph (1).
- (3) The returning officer shall transfer each parcel of ballot papers referred to in subparagraph (a) of paragraph (1) to the continuing candidate for whom the next available preference is given on those papers.

- (4) The returning officer shall set aside as non-transferable any papers in the parcel referred to in sub-paragraph (b) of paragraph (1).
- (5) The vote on each paper in each parcel of ballot papers referred to in paragraph (1) shall be at a value ("the transfer value") calculated by dividing the surplus of the candidate from whom the votes are being transferred by the total number of votes for that candidate, the calculation being made to seven decimal places (ignoring the remainder if any).
- (6) The number of votes to be transferred to each candidate to whom ballot papers are transferred under paragraph (3) shall be determined by multiplying the number of papers in each parcel of ballot papers by the transfer value specified in paragraph (5), ignoring any fraction.
- (7) The number of votes to be recorded as non-transferable shall be determined by multiplying the number of papers in the parcel of ballot papers referred to in subparagraph (b) of paragraph (1) by the transfer value specified in paragraph (5), ignoring any fraction.
- (8) The returning officer shall ascertain the total of any fractions of votes not transferred under paragraphs (6) and (7) and shall record this total as "vote fraction not transferred".

6. Transfer of consequential surpluses

- (1) Where the number of votes for any candidate exceeds the quota, the returning officer shall take all of the ballot papers for that candidate and shall sort each parcel of papers of different value into sub-parcels so that they are grouped
 - (a) according to the next available preference given on those papers for any continuing candidate, or
 - (b) where no such preference is given, as a sub-parcel of non-transferable papers.
- (2) The returning officer shall count the number of ballot papers in each sub-parcel referred to in paragraph (1).
- (3) The returning officer shall transfer each sub-parcel of ballot papers referred to in sub-paragraph (a) of paragraph (1) to the continuing candidate for whom the next available preference is given on those papers.
- (4) The returning officer shall set aside as non-transferable any papers in the sub-parcels referred to in sub-paragraph (b) of paragraph (1).
- (5) The returning officer shall calculate the proportion of each vote to be transferred (the "surplus fraction") by dividing the surplus of the candidate from whom the votes are being transferred by the total value of all the ballot papers held by that candidate, the calculation being made to seven decimal places (ignoring the remainder if any).

- (6) The vote on each paper in each sub-parcel of ballot papers referred to in paragraph (1) shall be at a value ("the transfer value") calculated by multiplying the current value of each paper by the surplus fraction specified in paragraph (5), the calculation being made to seven decimal places (ignoring the remainder if any).
- (7) The number of votes to be transferred by each sub-parcel of ballot papers referred to in paragraph (3) shall be determined by multiplying the number of papers in each sub-parcel by the transfer value of those ballot papers specified in paragraph (6), the calculation being made to seven decimal places.
- (8) The number of votes to be transferred to each candidate to whom ballot papers are transferred under paragraph (3) shall be the sum of the values of the sub-parcels transferred to each candidate determined in accordance with paragraph (7), ignoring any fraction.
- (9) The number of votes to be recorded as non-transferable shall be determined by multiplying the number of papers in each sub-parcel of ballot papers referred to in sub-paragraph (b) of paragraph (1) by the transfer values of the ballot papers in those sub-parcels specified in paragraph (6), ignoring any fraction.
- (10) The returning officer shall ascertain the total of any fractions of votes not transferred under paragraphs (8) and (9) and shall record this total as "vote fraction not transferred".

7. Supplementary provisions for transfers of surpluses

- (1) The returning officer shall, on completion of each transfer of surplus votes under rules 5 and 6
 - (a) record the total value of the votes transferred to each candidate;
 - (b) add that value to the previous total of votes recorded for each candidate and record the new total;
 - (c) record as non-transferable votes the value of the ballot papers set aside as non-transferable and add that value to the previously recorded total of non-transferable votes.
 - (d) record the value of the vote fraction not transferred and add that value to the previously recorded vote fraction not transferred, and
 - (e) compare
 - (i) the total number of votes then recorded for all of the candidates, together with total number of non-transferable votes and the total of the vote fraction not transferred, with
 - (ii) the recorded total of valid first preference votes.
- (2) All ballot papers transferred under rules 5 or 6 shall be clearly marked, either individually or as a sub-parcel, so as to indicate the transfer value recorded at that stage to each vote on that paper or, as the case may be, all the papers in that sub-parcel.

8. Exclusion of candidates

- (1) The returning officer shall take together all of the ballot papers of the candidate or candidates to be excluded and shall sort each parcel of papers of different value into sub-parcels so that they are grouped
 - (a) according to the next available preference given on those papers for any continuing candidate, or
 - (b) where no such preference is given, as a sub-parcel of non-transferable papers.
- (2) The returning officer shall count the number of ballot papers in each sub-parcel referred to in paragraph (1).
- (3) The returning officer shall transfer each sub-parcel of ballot papers referred to in sub-paragraph (a) of paragraph (1) to the continuing candidate for whom the next available preference is given on those papers.
- (4) The returning officer shall set aside as non-transferable any papers in the sub-parcels referred to in sub-paragraph (b) of paragraph (1).
- (5) The vote on each paper in each sub-parcel of ballot papers referred to in paragraph (1) shall be the value which the vote had when that paper was received by the excluded candidate.
- (6) The number of votes to be transferred by each sub-parcel of ballot papers referred to in paragraph (3) shall be determined by multiplying the number of papers in each sub-parcel by the current value of those ballot papers specified in paragraph (5), the calculation being made to seven decimal places.
- (7) The number of votes to be transferred to each candidate to whom ballot papers are transferred under paragraph (3) shall be the sum of the values of the sub-parcels transferred to each candidate determined in accordance with paragraph (6), ignoring any fraction.
- (8) The number of votes to be recorded as non-transferable shall be determined by multiplying the number of papers in each sub-parcel of ballot papers referred to in sub-paragraph (b) of paragraph (1) by the current values of those ballot papers specified in paragraph (6), ignoring any fraction.
- (9) The returning officer shall ascertain the total of any fractions of votes not transferred under paragraphs (7) and (8) and shall record this total as "vote fraction not transferred".
- (10) The returning officer shall, on completion of an exclusion under this rule —
 (a) record the total value of the votes transferred to each candidate;
 - (b) add that value to the previous total of votes recorded for each candidate and record the new total;

- (c) record as non-transferable votes the value of the ballot papers set aside as non-transferable and add that value to the previously recorded total of non-transferable votes.
- (d) record the value of the vote fraction not transferred and add that value to the previously recorded vote fraction not transferred, and
- (e) compare
 - (i) the total number of votes then recorded for all of the candidates, together with the total number of non-transferable votes and the total of the vote fraction not transferred, with
 - (ii) the recorded total of valid first preference votes.
- (11) All ballot papers transferred under this rule shall be clearly marked, either individually or as a sub-parcel, so as to indicate the transfer value recorded at that stage to each vote on that paper or, as the case may be, all the papers in that sub-parcel.

9. Filling of last vacancies

- (1) Where the number of continuing candidates is equal to the number of vacancies remaining unfilled, the continuing candidates shall be deemed elected.
- (2) Where only one vacancy remains unfilled and the number of votes then credited to any one continuing candidate ("the highest continuing candidate") is equal to or greater than the total number of votes then credited to the other continuing candidates together with any surpluses, the highest continuing candidate shall be deemed elected.
- (3) Where the last vacancies can be filled under this rule, no further transfer of votes shall be made.

10. Re-count

- (1) The returning officer on completion of each stage of the count shall, before proceeding with the next stage, inform all the candidates and their election agents then present of his intention, subject to a request for a re-count, to proceed to the next stage.
- (2) Before the returning officer so proceeds, any candidate or his election agent present at the count may request that a re-count be undertaken of the last completed stage.
- (3) If a request is made under paragraph (2), the returning officer shall then proceed to carry out the re-count of the last completed stage, but if no such request is made, the returning officer shall proceed with the next subsequent stage of the count.

- (4) The ballot papers may also be recounted either once or more often if the returning officer is not satisfied as to the accuracy of any stage.
- (5) Nothing in this rule shall require the returning officer to re-count the same parcel or sub-parcel of ballot papers more than once.
- (6) Where as a result of a re-count an error is discovered, the returning officer shall, where necessary, amend any results previously announced.

11. Declaration of result

In a contested election, when the result of the poll has been ascertained in respect of a ward the returning officer shall forthwith —

- (a) declare to be elected the candidates who are deemed to be elected under these rules; and
- (b) give public notice of
 - (i) the names of the candidates declared to be elected;
 - (ii) the number of first preference votes for each candidate whether elected or not:
 - (iii) all transfers of votes:
 - (iv) the total number of votes for each candidate at each stage of the count at which such transfer took place;
 - (v) the numbers of non-transferable votes at each stage of the count;
 - (vi) the numbers of any vote fraction not transferred at each stage of the count;
 - (vii) the numbers of ballot papers rejected for each of the reasons specified in rule 1;

together with the working papers in the forms prescribed showing all calculations of transfer values, vote transfers, non-transferable votes and vote fractions not transferred.

12. Interpretation

In these rules -

"consequential surplus" means a surplus arising at the second or later stage of the count when a candidate receives transferred votes.

"continuing candidate" means any candidate not deemed to be elected and not excluded;

"count" means all the operations involved in the counting of the first preferences recorded for candidates, the transfer of the surpluses of elected candidates, and the transfer of the votes of excluded candidates;

"deemed to be elected" means deemed to be elected for the purpose of the counting of the votes but without prejudice to the declaration of the result of the poll;

"mark" means a figure, a word written in a recognised language or a mark such as "X";

"non-transferable vote" means a ballot paper—

- (a) on which no second or subsequent preference is recorded for a continuing candidate, or
- (b) which is so marked that it is unclear to the returning officer at any stage of the count for which candidate the next preference is recorded.

"preference" as used in the following contexts has the meaning assigned below:—

- (a) "first preference" means the figure "1" or any mark or word which clearly indicates a first (or only) preference;
- (b) "next available preference" means a preference which is the second or, as the case may be, subsequent preference recorded in consecutive order for a continuing candidate (any candidate who is deemed to be elected or is excluded thereby being ignored), and
- (c) in this context, a "second preference" is shown by the figure "2" or any mark or word which clearly indicates a second preference, a third preference by the figure "3" or any mark or word which clearly indicates a third preference, and so on;

"quota" means the number of votes sufficient to secure the election of a candidate as calculated in accordance with rule 3.

"stage of the count" means—

- (a) the determination of the first preference vote for each candidate;
- (b) the transfer of a surplus of a candidate deemed to be elected; or
- (c) the exclusion of one or more candidates;

"surplus" means the number of votes by which the total number of votes for any candidate (whether first preference or transferred votes, or a combination of both) exceeds the quota;

"surplus fraction" means the proportion of each vote to be transferred when a consequential surplus is transferred in accordance with rule 6.

"transferable paper" means a ballot paper on which, following a first preference, a second or subsequent preference is recorded in consecutive numerical order for a continuing candidate;

"transferred vote" means a vote derived from a ballot paper on which a second or subsequent preference is recorded for the candidate to whom that paper has been transferred:

"transfer value" means the value of a transferred ballot paper calculated in accordance with rules 5, 6 or 8 as appropriate.

"vote fraction not transferred" means the fractional part of the value of any parcel or sub-parcel of ballot papers that is ignored when votes are transferred to a continuing candidate or are set aside as non-transferable.

STV-PR Weighted Inclusive Gregory Method Rules for Manual Counting

Specimen Result Sheet for STV WIGM election with candidates' votes recorded as integer values

(all calculations here have a precision of five decimal places, as for the demonstration count)

	Somewhere Council			Treetops Ward			28 April	2006			
	Election o	f 3 Counc	illors	Total val	id vote 78	35	Quota 19				
	Stage 1	Stag	ge 2	Stage 3		Stage 4		Stage 5		Stage 6	
Candidates	First		sion of	Exclusion of Eircheard Greumach		Exclusion of		Exclusion of		Exclusion of	
	preferences	Brighde F	Ramsaidh			Hydra E Pauer		James Sutherland		Da Gealing	
Flora Campbell	78		78		78	+1	79	+7	86	+2	88
Skye Fairweather	189		189	+2	191	+1	192	+1	193	+9	202
Da Gealing	49		49	+5	54	+3	57	+1	58	-58	-
Eircheard Greumach	28	+1	29	-29	-		-		-		-
Earl Grey	169	+2	171	+9	180	+2	182	+4	186	+26	212
Windy Miller	91	+3	94	+8	102	+6	108	+4	112	+12	124
Yu Nan	104		104	+1	105	+15	120	+24	144	+6	150
Hydra E Pauer	25	+6	31	+2	33	-33	-		-		-
Brighde Ramsaidh	15	-15	-		-		-		-		-
James Sutherland	37	+1	38		38	+4	42	-42	-		-
Non-transferable	0	+2	2	+2	4	+1	5	+1	6	+3	9
Vote fraction not transferred	0		0		0		0		0		0
Total	785	=	785	=	785	=	785	=	785	=	785

	Somewhe	re Counc	il	Treetops	Ward		28 April 2	28 April 2006		
	Election o	f 3 Cound	cillors	Total val	id vote 78	35	Quota 197			
	Stage 7		Stage 8		Stage 9		Stage 10			
Candidates	Surplus of			lus of	Exclusion of		Exclusion of			
	Earl Grey		Skye Fairweather		Flora Campbell		Yu Nan			
Flora Campbell	+1	89		89	-89	-		-		
Skye Fairweather		202	-5	197		197		197	Elected	
Da Gealing		-		-		-		-		
Eircheard Greumach		-		-		-		-		
Earl Grey	-15	197		197		197		197	Elected	
Windy Miller	+7	131	+2	133	+56	189	+136	325	Elected	
Yu Nan	+3	153	+1	154	+23	177	-177	-		
Hydra E Pauer		-		-		-		-		
Brighde Ramsaidh		-		-		-		-		
James Sutherland		-		-		-		-		
Non-transferable	2	11		11	+9	20	+41	61		
Vote fraction not transferred	2	2	2	4	+1	5		5		
Total	=	785	=	785	=	785	=	785		

All calculations involved in this demonstration election have been carried out to the specified precision, but only whole vote (integer) values have been transferred and credited to candidates. NB This must not be confused with 'rounding' for the presentational purposes of producing the result sheet, as the rules above specify that, for all purposes at all stages, the ballot paper values must be calculated to the stated precision but the candidates' votes must be determined as integer values.