SINGLE TRANSFERABLE VOTE

There are many different ways of conducting an STV election. The version to be used in the current LMS election is known as Meek's method. It has the approval of the Electoral Reform Society and is used by other reputable organisations such as the Royal Statistical Society. From an elector's point of view, the system is simple: numbers have to be placed against candidates' names on the ballot paper to indicate the voter's order of preference. Equal rankings are allowed, and not all candidates have to be given a rank.

Two basic principles govern the counting. First, if a candidate needs v votes to be elected but actually has $n > v$, then a fraction $(n - v) / n$ of each of these votes is passed on to candidates ranked lower on each relevant ballot paper. Naturally this means that some 'votes' have become fractional, but this causes no problems. Secondly if, after the above procedure has been iterated as far as possible, there are still vacant seats, all the votes of the candidate with the lowest total vote are redistributed in the same way. (If two candidates are tied at the lowest vote, one is chosen by a random process.) A precise description of the procedure follows.

1. Each candidate, at any stage of the election, is either *elected, hopeful* or *excluded*. Initially everyone is hopeful.

2. At each stage of the count, each candidate x has an associated weight w_x. At this stage the candidate keeps a proportion w_x of any vote or fraction of a vote received, and the remaining proportion $(1 - w_x)$ is passed on to another candidate (or in equal shares to a group of candidates if these have equal rankings). Excluded candidates have weight 0, so keep nothing. Hopeful candidates have weight 1 and keep everything which is passed to them. Elected candidates have weights between 0 and 1 determined as in §4.

3. If on a ballot paper a candidate a is ranked first, b second, c third and so on, then, at any stage a receives from that elector w_a of the vote, b receives $(1 - w_a)\, w_b$ of the vote, c receives $(1 - w_a)(1 - w_b)\, w_c$ of the vote, and so on. Notice that if any candidate listed is hopeful, all fractions transferred to later candidates are 0. If any part of the vote remains to be passed on after the whole list has been dealt with (which could happen easily if the ballot paper ranks only one candidate), that part is counted as *excess*. Initially there is no excess.

4. The *quota* – the vote a candidate must exceed at any stage in order to be elected – is defined to be (*total votes – total excess*) / (*number of seats* + 1). The *weights* for elected candidates at each stage are determined (uniquely) by the requirement that the vote which remains with each of them is equal to the current quota; these weights are calculated by an iterative procedure.

5. At each stage the quota and weights are calculated according to §4, and then the procedures of §§2,3 are applied. Any candidate with more than the current quota of votes is declared elected and retains this status thereafter. If this means that at least one hopeful candidate changes to an elected candidate, the procedure is repeated.

6. If no hopeful candidate was elected in §5, the hopeful candidate with the lowest total vote at this stage (or one such chosen at random if there are many) is declared excluded, and the procedure is repeated with that candidate's weight changed to 0.

7. When the total number of elected candidates is equal to the number of seats the process stops.

NOTE: The description above is the same as in the May 1999 *Newsletter* and is essentially taken from the paper *Single transferable vote by Meek's method* by I.D. Hill, B.A. Wichmann and D.R. Woodall (*Computer J* **30** (1987) 277–281), where more details are presented.