For simplicity, all votes are taken as complete, that is, they list all candidates; there are no ties, and no candidate gets the exact quota. If short votes are allowed, the principle is unchanged, but the process is a little more complicated. The treatment of short votes is important because some consider Meek inferior, while others think it greatly superior, to other methods in this respect.

As in all STV (Single Transferable Vote) systems, a Vote is a list of candidates in the voter's order of preference. Meek introduces, for each candidate, a Keep Value, between zero and one, which varies during the counting process. It is used, in a natural way, to distribute each vote among the candidates. All candidates start with a Keep Value of one, in which state they are called Hopefuls; they can change irreversibly into Excluded (Keep Value zero) or Elected (Keep Value adjustable between a small number and one). If the Keep Value of a voter's first preference is 0.6 , then he gets 0.6 , and 0.4 goes on to his second preference; if his Keep Value is 0.5 then he gets $0.5 \mathrm{x} 0.4=0.2$, and so on. This means that Excluded candidates are completely ignored, and Hopeful ones take all that comes to them, and pass nothing on. This leads to the important feature of STV, that until the fate of a candidate, Exclusion or Election, has been decided, no lower preferences are looked at. The Keep Values, operating on the votes, thus distribute all of them among the candidates. The Quota is Droop's quota, defined as

$$
\text { (Total number of Votes) } /(\text { number of seats }+1) \text {. }
$$

With the assumption of full votes, it does not vary during the counting process.

If, when the Keep Values have been adjusted to give each elected candidate the Quota (see below), one or more Hopefuls exceed the Quota, they become Elected, and the Keep Values of all elected candidates are immediately adjusted to give them all the Quota. This gives an equitable number of votes to each elected candidate, leaving the surpluses of the elected candidates to be distributed among the Hopefuls.

The counting process consists of adjusting the Keep Values according to the Flow-chart:-
$\downarrow$
Set all Keep Values to 1.0.
$\downarrow$


One or more candidates exceed the Quota
No candidate exceeds the Quota
that is, set his KV permanently to $\uparrow$ to zero. $\uparrow$


This process can only stop on the bottom line, when all places are filled. At this time, all elected candidates have the quota, and a Keep Value less than one. The remaining quota is divided among one or more Runners-up, each with their original Keep Value of one. The final Keep Values provide a plausible order of merit of the candidates, low values being good. Excluded candidates could be ranked in order of exclusion, later being good. [The order of merit needs improving, to allow for multiple runners-up].

If there are short votes, a pseudo-candidate, called Non-transferable, is added at the end of each vote, and he gets what is left over. His total does not count towards the Quota.

A simple, artificial, example, with four candidates for three places, which shows the principle, is:-


The first two columns, ordered lists of Preferences, each with its own number of votes, are the only input. The Flowchart, operating on them, produces the rest of the table. It can be proved that when the number of surviving candidates has been reduced to one more than the number of seats, then there is always a solution, in the sense that for each elected candidate a unique Keep Value can always be found to give each elected candidate, and the Runner-up, the Quota of votes.

The process of adjusting the Keep Values so that each elected candidate has the quota needs a lot of arithmetic, and until computers became widely available Meek was too tedious to be practicable. Once the final Keep Values have been found, it is easy to check their correctness, as in the above example. The correctness of exclusions could be checked by printing the above table immediately before each exclusion

A help in understanding Meek is to say that each elected candidate always has the quota, in the sense that as soon as they are elected the Keep Value of each elected candidate is adjusted to make this so.

The fact that Meek cannot easily be done manually raised some suspicions (even though it can be checked manually), and manual methods have continued in use, though they lack the elegance of Meek. They quite often give the same result, but where they differ the Meek result is more reasonable. New Zealand has successfully adopted Meek for local elections, and has barely heard of any other form of STV.

A longer example follows. For comparison, the results from a Borda election are also shown. If N is the number of candidates, Borda (J-C Borda, 1733-1799, who also described the Borda mouthpiece in hydraulics) gives N points for a first preference, $\mathrm{N}-1$ for a second, and so on.

```
7 Candidates for 4 Places. 7 Voting Patterns. Quota= 350.0000
```

Stage No. 1 F Elected, because he exceeds the Quota, 350. All his surplus goes to G.
Stage No. 2 G Elected, because F's surplus, 68, puts G above the Quota.
As soon as $F$ and $G$ are elected their $K V$ s are adjusted so that they each have the Quota, 350, giving the table below.

| Cand -> |  | A | B | C | D | E | F | G | Non-Trn |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Kp. val. -> |  | 1.00000 | 1.00000 | 1.00000 | 1.00000 | 1.00000 | 0.83732 | 0.89974 |  |
| Status -> |  | Hopeful | Hopeful | Hopeful | Hopeful | Hopeful | Elected | Elected | 1.0 |
| Prefs. | Votes |  |  |  |  |  |  |  |  |
| ABCDEFG | 123.000 | 123.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| BCDEFGA | 236.000 | 0.000 | 236.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| CDEFGAB | 189.000 | 0.000 | 0.000 | 189.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| DEFGABC | 284.000 | 0.000 | 0.000 | 0.000 | 284.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| EFGABCD | 179.000 | 0.000 | 0.000 | 0.000 | 0.000 | 179.000 | 0.000 | 0.000 | 0.000 |
| FGABCDE | 418.000 | 6.817 | 0.000 | 0.000 | 0.000 | 0.000 | 350.000 | 61.183 | 0.000 |
| GABCDEF | 321.000 | 32.183 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 288.817 | 0.000 |
| Totals | 1750.000 | 162.000 | 236.000 | 189.000 | 284.000 | 179.000 | 350.000 | 350.000 | 0.000 |
|  |  | A Excluded |  |  |  |  |  |  |  |

Stage No. 3 A Excluded, because he is the lowest, and no Hopeful exceeds the Quota.
Stage No. 4 B Elected, because all A's vote, 123, goes to B.
The KV of $B$ is adjusted to give him the Quota. Those of $F$ and $G$ do not need to be changed.

| Cand -> |  | A | B | C | D | E | F | G | Non-Trn |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Kp. val. -> |  | 0.00000 | 0.87940 | 1.00000 | 1.00000 | 1.00000 | 0.83732 | 0.89974 |  |
| Status -> |  | Excluded | Elected | Hopeful | Hopeful | Hopeful | Elected | Elected | 1.0 |
| Prefs. | Votes |  |  |  |  |  |  |  |  |
| ABCDEFG | 123.000 | 0.000 | 108.166 | 14.834 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| BCDEFGA | 236.000 | 0.000 | 207.538 | 28.462 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| CDEFGAB | 189.000 | 0.000 | 0.000 | 189.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| DEFGABC | 284.000 | 0.000 | 0.000 | 0.000 | 284.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| EFGABCD | 179.000 | 0.000 | 0.000 | 0.000 | 0.000 | 179.000 | 0.000 | 0.000 | 0.000 |
| FGABCDE | 418.000 | 0.000 | 5.995 | 0.822 | 0.000 | 0.000 | 350.000 | 61.183 | 0.000 |
| GABCDEF | 321.000 | 0.000 | 28.301 | 3.881 | 0.000 | 0.000 | 0.000 | 288.817 | 0.000 |
| Totals | 1750.000 | 0.000 | 350.000 | 237.000 | 284.000 | 179.000 | 350.000 | 350.000 | 0.000 |
|  |  |  |  |  |  | E Excluded |  |  |  |

Stage No. 5 E Excluded, because he is the lowest, and no Hopeful exceeds the Quota. There are now only two Hopefuls left, C and D. D, with 284, is ahead of C, with 237, but C is ahead of D in all the original votes except $\mathrm{D}^{\prime} \mathrm{s}$ own. The next stage is to adjust the KVs of all non-excluded candidates so that they each get the Quota.

| Cand -> |  | A | B | C | D | E | F | G | Non-Trn |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Kp. val. -> |  | 0.00000 | 0.60659 | 0.84135 | 1.00000 | 0.00000 | 0.58626 | 0.61620 |  |
| Status -> |  | Excluded | Elected | Elected | Runer-up | Excluded | Elected | Elected | 1.0 |
| Prefs. | Votes |  |  |  |  |  |  |  |  |
| ABCDEFG | 123.000 | 0.000 | 74.610 | 40.713 | 7.677 | 0.000 | 0.000 | 0.000 | 0.000 |
| BCDEFGA | 236.000 | 0.000 | 143.154 | 78.115 | 14.730 | 0.000 | 0.000 | 0.000 | 0.000 |
| CDEFGAB | 189.000 | 0.000 | 0.000 | 159.014 | 29.986 | 0.000 | 0.000 | 0.000 | 0.000 |
| DEFGABC | 284.000 | 0.000 | 0.000 | 0.000 | 284.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| EFGABCD | 179.000 | 0.000 | 17.242 | 9.408 | 1.774 | 0.000 | 104.941 | 45.635 | 0.000 |
| FGABCDE | 418.000 | 0.000 | 40.262 | 21.970 | 4.143 | 0.000 | 245.059 | 106.566 | 0.000 |
| GABCDEF | 321.000 | 0.000 | 74.732 | 40.779 | 7.690 | 0.000 | 0.000 | 197.799 | 0.000 |

D Excluded
The above table shows how each voter's vote is distributed among the candidates. In particular, it shows that the views of voters who voted for $D$, the runner-up, are not well represented. Non-STV voting systems treat all votes more equally, but have their own disadvantages.

In the following table the process of adjusting the Keep Values of all elected candidate has been continued until they each have the quota, as has the Runner-up, who has a Keep Value of one. It can then be seen how individual votes are distributed among preferences
And non-transferable. The excluded candidates, $A$ and $E$, are omitted.
7 Candidates for 4 Places. 7 Voting Patterns. Quota=350.0000

| Cand -> |  | B | C | D | F | G | Non-Trn |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Kp. val. | > | 0.60659 | 0.84135 | 1.00000 | 0.58626 | 0.61620 | 1.0 |
| Prefs. | Votes |  |  |  |  |  |  |
| ABCDEFG | 123.000 | 74.610 | 40.713 | 7.677 | - | - | - |
| BCDEFGA | 236.000 | 143.154 | 78.115 | 14.730 | - | - | - |
| CDEFGAB | 189.000 | - | 159.014 | 29.986 | - | - | - |
| DEFGABC | 284.000 | - | - | 284.000 | - | - | - |
| EFGABCD | 179.000 | 17.242 | 9.408 | 1.774 | 104.941 | 45.635 | - |
| FGABCDE | 418.000 | 40.262 | 21.970 | 4.143 | 245.059 | 106.566 | - |
| GABCDEF | 321.000 | 74.732 | 40.779 | 7.690 | - | 197.799 | - |
| Totals | 1750.000 | 350.000 | 350.000 | 350.000 | 350.000 | 350.000 | 0.000 |

In the following table positive numbers show elections, and the number is the final Keep Value of the candidate, multiplied by 100.
Negative numbers show exclusions, and the number is the candidate's vote at exclusion, as a percentage of the current quota.
Place is an order of merit, based on final Keep Values and votes at exclusion.

```
RES ULT T B Y S T A G E
```



Meek Order of merit. Elected candidates come before the gap-> FBGC DEA

```
B OR D A S CORES
```

| Cand. >- | A | B | C | D | E | F | G |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Score >- | 7059 | 6961 | 6534 | 6772 | 6275 | 7451 | 7948 |
| Place >- | 3 | 4 | 6 | 5 | 7 | 2 | 1 |

