

UCF Local Contest (Qualifying Round) — September 3, 2022

RCV Simplification

filename: rcv

Difficulty Level: Medium

Time Limit: 3 seconds

The following is from Ballotpedia [[https://ballotpedia.org/Ranked-choice_voting_\(RCV\)](https://ballotpedia.org/Ranked-choice_voting_(RCV))]:

Broadly speaking, the *ranked-choice voting process* unfolds as follows for single-winner elections:

1. Voters rank the candidates for a given office by preference on their ballots.
2. If a candidate wins an outright majority of first-preference votes (i.e., 50 percent plus one), he or she will be declared the winner.
3. If, on the other hand, no candidates win an outright majority of first-preference votes, the candidate with the fewest first-preference votes is eliminated.
4. All first-preference votes for the failed candidate are eliminated, lifting the second-preference choices indicated on those ballots.
5. A new tally is conducted to determine whether any candidate has won an outright majority of the adjusted voters.
6. The process is repeated until a candidate wins a majority of votes cast.

Example: Assume that there are four candidates in an election. The table below presents the raw first-preference vote totals for each candidate:

Raw first-preference vote tallies		
Candidate	First-Preference Votes	Percentage
Candidate A	475	46.34%
Candidate B	300	29.27%
Candidate C	175	17.07%
Candidate D	75	7.32%

In the above scenario, no candidate won an outright majority of first-preference votes. As a result, the candidate (Candidate D) with the smallest number of first-preference votes is eliminated. The ballots that listed candidate D as the first preference are adjusted, raising their second-preference candidates. Assume that, of the 75 first-preference votes for Candidate D, 50 listed Candidate A as their second preference and 25 listed Candidate B. The adjusted vote totals would be as follows:

Adjusted vote tallies		
Candidate	Adjusted First-Preference Votes	Percentage
Candidate A	525	51.22%
Candidate B	325	31.71%
Candidate C	175	17.07%

On the second tally, Candidate A secured 51.22 percent of the vote, thereby winning the election.

Note:

If several candidates are tied for the fewest first-preference votes, all such candidates are eliminated. So, candidates not eliminated must have at least one more first-preference vote than those eliminated.

The Problem:

We have received information on the percentage for the first-preference for each candidate, but we don't know how the candidates are listed as the second preference, third preference, etc. Help write a program to remove candidates that cannot possibly win. More specifically, given the current votes for a set of candidates, find the set of candidates that cannot possibly win.

The Input:

The first input line contains a single integer, N ($1 \leq N \leq 100,000$), representing the number of votes. Each of the following N input lines contains a candidate name receiving the first-place vote from that voter. Each candidate name is 1-25 letters (lowercase and uppercase), starting in column one.

The Output:

On the first output line, print a single positive integer, C , the number of candidates that cannot win. Each of the remaining C output lines should contain a candidate name that cannot win. The candidate names should be printed in lexicographical order (increasing order).

Sample Input**Sample Output**

5 Alice Alice Bob Bob Carol	1 Carol
2 Alice Bob	2 Alice Bob