

# Majority

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# Finding the election winner

- N people vote
- N is very, very large
- A voter can vote for one of the candidates
- A voter can also write in a new candidate
- Each candidate is assigned an integer ID
- Find the **majority** ID and declare the winner

# The first hundred votes ...



48	12	9	12	23	12	22	12	12	12
48	93	93	93	12	12	93	12	93	12
12	93	48	48	12	12	12	33	79	12
12	12	93	12	12	9	12	23	12	12
12	12	12	33	93	93	93	12	12	12
12	9	12	23	93	48	48	12	12	44
93	93	93	12	12	9	12	23	12	55
12	12	48	12	48	48	12	48	88	12
12	12	93	12	12	9	12	23	12	12
12	12	12	33	93	93	93	12	12	12



# Standard Approaches

- Keep a list of candidates and their counts
  - Every vote needs to be compared against every candidate in the worst case
- Sort the list and count
  - Sorting is the bottleneck
  - Can we avoid sorting?

48	12	9	12	23	12	22	12	12	12	48	48	12	12	12	33	79	12	9	12	93	93	12	12
48	93	93	93	12	12	93	12	93	12	93	12	12	9	12	23	12	93	93	93	12	9	12	23
12	93	48	48	12	12	12	33	79	12	12	33	93	93	93	12	12	93	48	48	93	93	93	12
12	12	93	12	12	9	12	23	12	12	12	23	93	48	48	12	12	12	93	12	93	48	48	12
12	12	12	33	93	93	93	12	12	12	93	12	12	9	12	23	12	12	12	33	12	9	12	23
12	9	12	23	93	48	48	12	12	44	48	48	12	48	88	12	12	9	12	23	48	48	12	48
93	93	93	12	12	9	12	23	12	55	12	9	12	23	12	12	93	93	93	12	12	9	12	23
12	12	48	12	48	48	12	48	88	12	93	93	93	12	12	12	93	12	48	12	93	93	93	12
12	12	93	12	12	9	12	23	12	12	12	9	12	23	12	55	12	12	93	12	12	33	79	12
12	12	12	33	93	93	93	12	12	12	12	12	12	33	93	93	93	12	12	12	12	23	12	12
48	48	12	12	12	33	79	12	12	33	93	93	93	12	12	93	48	12	33	79	93	12	12	12
93	12	12	9	12	23	12	12	12	23	93	48	48	12	12	12	93	12	23	12	48	12	12	44
12	33	93	93	93	12	12	12	93	12	12	9	12	23	12	12	12	93	12	12	12	23	12	55
12	23	93	48	48	12	12	44	48	48	12	48	88	12	12	9	12	48	12	12	48	88	12	12
93	12	12	9	12	23	12	55	12	9	12	23	12	12	93	93	93	12	23	12	12	23	12	12
48	12	48	48	12	48	88	12	93	93	93	12	12	12	93	12	48	12	48	88	12	23	12	12
93	12	12	9	12	23	12	12	12	9	12	23	12	55	12	12	93	12	23	12	93	12	12	12
93	12	12	9	12	23	12	12	12	23	93	48	48	12	12	12	93	12	23	12	48	12	12	44
12	33	93	93	93	12	12	12	93	12	12	9	12	23	12	12	12	93	12	12	12	23	12	55
12	23	93	48	48	12	12	44	48	48	12	48	88	12	12	9	12	48	12	12	12	48	88	12
93	12	12	9	12	23	12	55	12	9	12	23	12	12	93	93	93	12	23	12	12	23	12	12
48	12	48	48	12	48	88	12	93	93	93	12	12	12	93	12	48	12	48	88	12	23	12	12
48	48	12	12	12	33	79	12	12	33	93	93	93	12	12	93	48	12	33	79	93	12	12	12
93	12	12	9	12	23	12	12	12	23	93	48	48	12	12	12	93	12	23	12	48	12	12	44
12	33	93	93	93	12	12	12	93	12	12	9	12	23	12	12	12	93	12	12	12	23	12	55
12	23	93	48	48	12	12	44	48	48	12	48	88	12	12	9	12	48	12	12	12	48	88	12
93	12	12	9	12	23	12	55	12	9	12	23	12	12	93	93	93	12	23	12	12	23	12	12
48	12	48	48	12	48	88	12	93	93	93	12	12	12	93	12	48	12	48	88	93	93	12	12
93	12	12	9	12	23	12	12	12	9	12	23	12	55	12	12	93	12	23	12	9	12	23	12
12	23	93	48	48	12	12	44	48	48	12	48	88	12	12	9	12	48	12	12	48	88	12	12
93	12	12	9	12	23	12	55	12	9	12	23	12	12	93	93	93	12	23	12	12	23	12	12
48	12	48	48	12	48	88	12	93	93	93	12	12	12	93	12	48	12	48	88	12	23	12	12
93	12	12	9	12	23	12	12	12	9	12	23	12	55	12	12	93	12	23	12	93	12	12	12

# Reduction Approach

- How to reduce the problem?
- What if I pick two random votes and they turn out to be different?
  - Can I throw them out?
  - Why or why not?

# New Idea

- What if I pick two random votes and they turn out to be different?
  - Discard and reduce the problem size
- What if I pick two random votes and they are the same?
  - Well, this needs work and you will need to think about it!
  - Perhaps wait for it to be “canceled” later?

# Example

46	12	9	12	23	12	22	12	12	12
48	93	93	93	12	12	93	12	93	12
12	93	48	48	12	12	12	33	79	12
12	12	93	12	12	9	12	23	12	12
12	12	12	33	93	93	93	12	12	12
12	9	12	23	93	48	46	12	12	44
93	93	93	12	12	9	12	23	12	55
12	12	48	12	48	48	12	48	88	12
12	12	93	12	12	9	12	23	12	12
12	12	12	33	93	93	93	12	12	12