

Suppose we are planning on a field trip for the whole class. We will travel as a group to Europe. There are 6 cities to choose from (London, Venice, Berlin, Prague, Paris, Zurich) and we decide to make decisions in a democratic way. There are two voting rules which we are interested in. Below is how you will do based on each voting rule.

1. Quadratic Voting (QV)

Everyone has a budget of 100 points. You are free to allocate any non-negative integer points for the cities. After the results are announced, there are no residual value for the points. But you're allowed to use up all your points or part of them.

As you enter a number for a city, there will be a number showing how much votes you cast and another number showing the coin budget left. The votes casted are calculated by taking the square root of the coins spent. After collecting all the surveys, we will select the top 2 cities by adding the votes together for each alternative. (Reminder: For the same alternative, an additional vote is more expensive than the previous vote. So please think carefully before you allocate your coins.)

2. Proportional Approval Voting (PAV)

Suppose we decide to start from beginning by using PAV instead of QV. Instead of incorporating true intensity of preferences, we only want to know your consent for each city. For the cities you approve of, put "1" for each of them; for the rest of which you disagree, put "0" instead. The way we calculate the results consist of two parts.

a. Case 1: We are travelling to 3 cities only.

The goal of PAV is to seek more fairness among the voters by choosing a city which can include more voters to approve instead of adding more values to the existing voters who have some cities already chosen.

If you want to go to all 3 chosen cities, your votes would contribute to $(1 + 1/2 + 1/3)$ of the total votes instead of $(1+1+1)$, which corresponds to diminishing marginal returns. We will select the top 3 cities with the highest PAV values.

b. Case 2: We will find the best route of the trip.

In the second case, you don't need to cast the votes again. We will only calculate the result in a different way. In addition to PAV, we have additional time budget for the whole group. The distance between two cities represents additional transportation costs for travelling. The program will select the best route starting and ending at the same city which satisfy the constraints so that we can all catch the plane from and back to RDU.

(Example, it may be optimal to travel: London -> Berlin -> Paris -> Zurich -> London)