

1. (4 points, 1 point each) True or false.

T F In a vote with four players, there are $4! = 24$ different sequential coalitions.

T F The quota in a weighted voting system can be less than 50% of the total votes.

T F In the weighted voting system $[9; 10, 3, 3, 2]$, player 1 (P_1) is a dictator.

T F In the weighted voting system $[100; 30, 30, 20, 20, 10]$, the coalition $\{P_1, P_3, P_4, P_5\}$ is a winning coalition.

2. (3 points) List all the winning coalitions in the voting system $[5; 3, 3, 2]$.

3. (3 points) Suppose that we have a voting system with 3 players, and we know that the winning coalitions in our voting system are $\{P_1, P_2, P_3\}$, $\{P_1, P_2\}$, and $\{P_1, P_3\}$. Find the Banzhaf power indices of these three players.

4. (3 points) Suppose our voting system is $[11; 5, 4, 3, 3, 2]$. In the sequential coalition $\langle P_1, P_3, P_5, P_2, P_4 \rangle$, who is the pivotal player?

5. (3 points) Suppose we have a voting system with 4 players, and we found that P_1 is pivotal in 12 sequential coalitions, P_2 is pivotal in 8 sequential coalitions, and P_3 and P_4 are pivotal in the same number of coalitions each. Find the Shapley-Shubik power indices of all 4 players. (You can leave your answer as a fraction if you prefer.)