

Instructions: Show all work. Answer each question as completely as possible. Use exact values. For counting problems you may use scientific notation (with three significant figures) for any numbers larger than a million.

1. Consider the weighted voting system [7: 5, 3, 2, 1].
 a. Are there any dictators? Dummies?

no dictators P4 is a dummy

- b. Does anyone have veto power?

P1 has veto power

- c. List all the winning coalitions.

*$\{ \underline{P1}, P2, P3, P4 \}$ $\{ \underline{P1}, \underline{P2} \}$
 $\{ \underline{P1}, P2, P3 \}$ $\{ \underline{P1}, \underline{P3} \}$
 $\{ \underline{P1}, \underline{P2}, P4 \}$
 $\{ \underline{P1}, \underline{P3}, P4 \}$*

- d. Underline the critical players in each coalition above and use that information to calculate the Banzhaf power index.

10 critical players

*$P1: \frac{6}{10} = 60\%$ $P3: \frac{2}{10} = 20\%$
 $P2: \frac{2}{10} = 20\%$ $P4: \frac{0}{10} = 0\%$*

- e. How does the power calculation compare to the proportion of total votes each voter holds. Is there any evidence that one of the players has substantially more power than the weight of their votes implies?

*$P1: \frac{5}{11} \approx 45\%$ $P3: \frac{2}{11} \approx 18\%$
 $P2: \frac{3}{11} \approx 27\%$ $P4: \frac{1}{11} \approx 9\%$*