Explorations in Modern Math - Fall 2019 - Dr. Smithies
Weighted Voting Quiz 1 - Answers

1. In the weighted voting system $[34 : 10, 7, 4, 4, 3, 3, 3, 1, 1]$ how many players are there?

   A) 9

2. In the weighted voting system $[34 : 10, 7, 4, 4, 3, 3, 3, 1, 1]$ what is the quota?

   C) 34

3. In the system $[34 : 10, 7, 4, 4, 3, 3, 3, 1, 1]$ what is the total number of votes?

   D) 36

4. In the weighted voting system $[9 : 11, 4, 2]$ which of these is true?

   C) P_1 is a dictator.

5. In the weighted voting system $[14 : 7, 7, 6]$ which of these is true?

   B) P_1 and P_2 have equal power, P_3 is a dummy.

6. In the weighted voting system $[10 : 5, 4, 2]$ which of these is true?

   D) Every player has veto power.

7. In the weighted voting system $[q : 10, 8, 6]$ a strict majority of the votes is needed for a motion to pass. What is the value of the quota q?

   A) 13

8. In the weighted voting system $[q : 20, 19, 16, 2, 1, 1]$ a two-thirds majority of the votes is needed for a motion to pass. What is the value of the quota q?

   D) 40

9. In the weighted voting system $[q : 12, 10, 5, 1, 1]$ what is the smallest possible value of the quota q?

   B) 15

10. In the weighted voting system $[30 : 24, 12, 8, 4, 2]$ what is the minimum percentage of votes needed to pass a motion?

    D) 60

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Weighted Voting Quiz 2 - Answers

Use the Banzhaf power definitions to answer the questions about the given weighted voting systems. Denote the players by P_1, P_2, etc.

1. In $[35 : 32, 15, 10, 3]$ what is the weight of the coalition $\{P_2, P_3, P_4\}$?

   A) 28

2. In $[35 : 32, 15, 10, 3]$ what are the winning coalitions?

   A) All coalitions with two or more players, one of which is P_1.

3. In $[35 : 32, 15, 10, 3]$ what is the number of winning coalitions?

   A) 7

4. In $[35 : 32, 15, 10, 3]$ which of the players in the coalition $\{P_1, P_3\}$ is critical?

   A) P_1 and P_3

5. In $[35 : 32, 15, 10, 3]$ which of the players in the coalition $\{P_1, P_3, P_4\}$ is critical?

   D) P_1 only.

6. In $[35 : 32, 15, 10, 3]$ what is the Banzhaf power distribution of the players?

   A) $P_1 : 70\%$, $P_2 : 10\%$, $P_3 : 10\%$, $P_4 : 10\%$.

7. In $[12 : 5, 5, 2, 2]$ what is the weight of the coalition $\{P_2, P_3, P_4\}$?

   D) 9

8. In $[12 : 5, 5, 2, 2]$ which of the players in the coalition $\{P_1, P_2, P_3, P_4\}$ is critical?

   C) P_1 and P_2 only

9. In $[12 : 5, 5, 2, 2]$ what is the total number of winning coalitions?

   A) 3

10. In $[12 : 5, 5, 2, 2]$ what is the Banzhaf power distribution of the players?

    C) $P_1 : 37.5\%$, $P_2 : 37.5\%$, $P_3 : 12.5\%$, $P_4 : 12.5\%$.

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Weighted Voting Quiz 3 - Answers

Use the Banzhaf power definitions to answer the questions about the given weighted voting systems. Denote the players by P_1, P_2, etc.

1. In $[25 : 16, 8, 6, 3]$ what is the weight of the coalition $\{P_1, P_2, P_3, P_4\}$?

   A) 33

2. In $[25 : 16, 8, 6, 3]$ which players are critical in the coalition $\{P_1, P_3, P_4\}$?

   B) All three players.

3. In $[25 : 16, 8, 6, 3]$ which players are critical in the coalition $\{P_1, P_2, P_3, P_4\}$?

   A) Only P_1.

4. In $[25 : 16, 8, 6, 3]$ which players have veto power?

   A) Only P_1.

5. In $[25 : 16, 8, 6, 3]$ what are the winning coalitions?

   D) All coalitions with three or more players, one of which is P_1.

6. In $[25 : 16, 8, 6, 3]$ what is the number of winning coalitions?

   A) 4

7. In $[25 : 16, 8, 6, 3]$ what is the Banzhaf power distribution of the players?

   A) $P_1 : 40\%, P_2 : 20\%, P_3 : 20\%, P_4 : 20\%$.

8. In the generic weighted voting sytem $[q : w_1, w_2, \cdots, w_N]$ which of the following is mathematically equivalent to the statement that P_1 is a dictator?

   A) $w_1 > q$

9. In the generic weighted voting sytem $[q : w_1, w_2, \cdots, w_N]$ which of the following is mathematically equivalent to the statement that P_1 has veto power?

   C) $w_2 + \cdots + w_N < q$ and $w_1 < q$

10. In the generic weighted voting sytem $[q : w_1, w_2, w_3, w_4, w_5]$ suppose that the winning coalitions are exactly those having 3 or more players. Which of the players are critical in the coalition $\{P_1, P_2, P_4, P_5\}$

    D) None of the players.