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NUMB3RS Activity: Shaken, Not Stirred In “Democracy”

Charlie tries to convince baseball statistics expert Oswald Kitner (who originally appeared in the NUMB3RS episode “Hard Ball”) to join Cal-Sci’s academic program by giving him the following problem:

Suppose there are **five couples** at a party. People shake hands, but no one shakes hands with the person they came with. At one point, one man asks the nine others how many hands they shook and gets nine different answers. How many hands did the man himself shake?

**To develop a problem-solving strategy, begin with a simpler problem. Suppose there are only two couples, namely two people who each have a “partner.” (4 total)**

1. If no one shakes hands with his or her partner, or with himself or herself, what is the maximum number of hands anyone can shake?

2. If one person, call him the “host,” asks the other three people how many hands they shook, and gets three different answers, what do these numbers have to be?

**Now, suppose there are three couples, namely three people who each have a “partner.” (6 total)**

3. If no one shakes hands with his or her partner, or with himself or herself, what is the maximum number of hands anyone can shake?

4. If one person, call him the “host,” asks the other three people how many hands they shook, and gets three different answers, what do these numbers have to be?

5. Represent each person at the party with a point (called a vertex) by labeling the points with the number of hands that person shook (use an H for the host). Draw a line segment (called an edge) to connect a pair of vertices if those people shook hands. This representation is called a graph, although it is different from the graph of an equation or of statistical data.

**Now, suppose there are four couples, namely three people who each have a “partner.” (8 total)**

6. If no one shakes hands with his or her partner, or with himself or herself, what is the maximum number of hands anyone can shake?

7. If one person, call him the “host,” asks the other three people how many hands they shook, and gets three different answers, what do these numbers have to be?

8. Represent each person at the party with a point (called a vertex) by labeling the points with the number of hands that person shook (use an H for the host). Draw a line segment (called an edge) to connect a pair of vertices if those people shook hands. This representation is called a graph, although it is different from the graph of an equation or of statistical data.

BONUS (Answer the original problem)

Suppose there are **five couples** at a party. People shake hands, but no one shakes hands with the person they came with. At one point, one man asks the nine others how many hands they shook and gets nine different answers. How many hands did the man himself shake?