	STEM Committee **Michigan Crossroads Council**	**Name:**	
	Supernova Activity Topic: Mathematics **A Paradox of Counting:** **Voting Methods and Fair Decisions**	**Troop:**	**Date:**

Supernova Activity Topic: Mathematics

Have you ever watched bungee jumpers and wondered why they don't hit the ground? You can make a model of your own and figure it out. Or, what about the Yellowstone geyser Old Faithful—how can you tell when it will erupt? What about voting—can you imagine how so many people in so many states can go in, cast a vote, and come out with a fair result? Mathematics is the key. Choose any one of these projects to learn how it's done.

A Paradox of Counting: Voting Methods and Fair Decisions

This activity can be done individually or with a group of two to six people, and requires cooperation from about 20 to 30 individuals.

The scenario: Your unit wants to plan a superactivity for next summer but cannot agree on what that activity should be. There are four options under consideration, and your unit decides to vote. Your task is to collect ballots and tabulate results using several different voting methods.

This is not a binding decision on your unit! This is an exercise, but one that will be more meaningful if you use real-life possibilities.

Part 1: Ballot Setup, Gathering, and Tabulating

1. Decide on four superactivities that your unit would genuinely be interested in doing next summer. Aim for four genuine options, none of which is likely to receive a majority of the votes. Discuss these options with your mentor before doing the following:
   A. Create ballots on which each voter can list his/her first, second, third, and fourth choices from among the four prospective superactivities.

   _____

   _____

   B. Find 20 to 30 unit members, prospective guests for the superactivity, unit leaders, parents, and so on, to complete one ballot each. Each voter should vote sincerely, without trying to strategize.

   _____

   _____

   C. Do some research and learn how to tabulate winners using each of the following four voting methods:

      1. Plurality method

         _____

         _____

      2. Borda count method

         _____

         _____

      3. Plurality-with-elimination method (sometimes called the instant runoff method)

         _____

         _____

4. Pair-wise comparison method (sometimes called Copeland's method)

_____

_____

Part 2: Analysis and Report

1. As you tabulate the results using each voting method, evaluate each method and discuss the following with your mentor.
   A. What do you notice? How fair is each method?

_____

_____

   B. How would the results be affected if two or three voters had cast strategic ballots (instead of sincere ballots), in an effort to "not waste their votes"?

_____

_____

   C. Which of the four voting methods do you believe is the right voting method for this decision in your unit? Why?

_____

_____

   D. Consider how we elect the president of the United States of America.
      1. What voting method do we use?

_____

      2. What are its advantages and disadvantages?

_____

_____

      3. Do you believe each voting citizen in the United States has an equal say in the vote tabulation?

_____

_____

      4. Is it possible for citizens to cast strategic votes and influence the outcome of a presidential election?

_____

_____

2. Create a report that summarizes the results from the various voting methods, outlines your analysis, and comments on voting methods for the U.S. presidency. Share your report with your mentor.

Resources

Donald G. Saari. *Chaotic Elections! A Mathematician Looks at Voting* (for youth with stronger mathematics backgrounds). American Mathematical Society, 2001.

William Poundstone. *Gaming the Vote: Why Elections Aren't Fair (and What We Can Do About It)*. Hill and Wang, 2008.