Sample Adventures in Recreational Mathematics

The year starts with the expedition described on this page. Additional adventures, like the ones outlined on the second page, will be organized as time permits and interest dictates, or perhaps become the foundation of future seminars on this topic.

A fun sub-genre of Recreational Mathematics is to pass the time when you don't have a pencil and paper, or someone to interact with. My favorite puzzle is called "Four 4's". The challenge is to use exactly four 4's and the four basic arithmetic operations: $+$, $-$, $\times$, $\div$. Your job is to find the sequence of operations that compute each number, starting at 1. Here is an incomplete list of valid answers for 1:

$$\big((4 \div 4) + 4\big) - 4$$
$$(4 \div 4) \times (4 \div 4)$$
$$\big((4 \div 4) \times 4\big) \div 4$$

Claim: It is possible to compute every number up to and including sixteen, except for (you guessed it) four numbers.

Write down your answers (and be careful about order of operations so you can remember exactly what you did later), and you will find that some of these are quite difficult. Remember:

Mathematicians do not like math because it is easy.
They enjoy how hard it is. - Anon.

As an ice breaker in the first meeting, we will compare notes about which ones we found difficult and different strategies we used to get the answers.

Note: If you search for this online, you will undoubtedly be flooded with many variations of the puzzle. Nearly all of them allow concatenation, which means you can use two fours to create 44 (we did not allow this!). Others allow all sorts of other operations we do not, like square roots, factorials, decimal points, powers, reciprocals, etc. etc. etc. Enjoy!
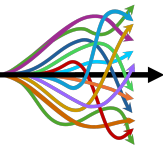
The following groups of recreational mathematics will be used to organize the year. Each semester we will restrict ourselves to one division of recreational mathematics.

Mathematical Puzzles Mathematical Puzzles are one-player games where the entire configuration is known at the start (there are no surprises!). I have included two Probabilistic Puzzles, marked with a star ($\star$).

- Water Pouring Puzzles
- Area Puzzles
- 24-Puzzle
- 15-Puzzle
- Tower of Hanoi
- 2048*
- Tetris*

Mathematical Games Mathematical Games are two-player games where they alternate turns and follow the same set of rules.

- Tic-Tac-Toe
- Nim
- Mancala
- Chopsticks
- Dots and Boxes
- Go
- Sprouts

Fair Division Is it possible to divide up the remaining dessert between two people? Yes - one divides it, the other chooses; both will be happy. What if there are 3 or more people? Breakthroughs in this question were inspired by the conflict in the Middle East, but unfortunately humans are not as rational as one would hope.

Origami The mathematics of paper-folding is beautiful and incredibly practical. In addition to the foundations of decorative origami, we will also learn about practical engineering challenges, like how the James Webb Space Telescope was folded during its trip to space.