October 6 2024

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RAM Math Circle - Chennai
Session 6

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Session format:

- 75 minutes: Counting problems

- 15 minutes: Geometry with paper folding

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1 Introduction to counting

We continued working on counting problems based on the addition and multiplication principles.


Addition principle: *If there are m different elements in set A and n different elements in set B, then the total number of ways of choosing 1 element from either set A or set B is m + n.*

Multiplication principle: *If there are m different elements in set A and n different elements in set B, then the total number of ways of choosing an element from set A and an element from set B is m × n.*

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1. How many different 5 digit numbers are there? (Leading zeroes are not allowed e.g. 01442 is not a 5 digit number.)

2. How many even 5 digit numbers are there?

3. How many 5 digit numbers contain exactly one 3?

4. How many times is the digit 0 written when listing all numbers form 1 to 3333?

2 Geometry with paper folding

We completed the construction of a *Skeletal Octahedron* using modular origami. We used 6 water-bomb modules for this model. [1]

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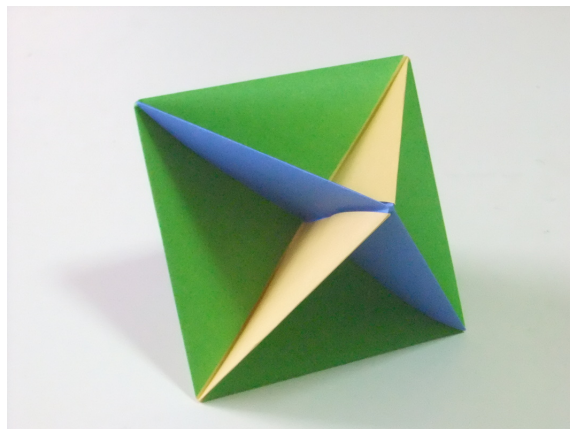
[1]The image is borrowed from https://www.herngyi.com/blog/colors-and-symmetry-in-skeletal-octahedra

Here are some things to know about the model we have constructed:

- A regular octahedron has eight congruent equilateral triangles as faces, twelve edges of equal lengths and six vertices.
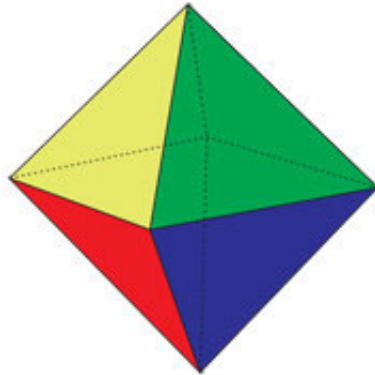
- Our construction gives the 'skeleton' of the regular octahedron, i.e. the three planes that lie within and pass through the edges and vertices of the regular octahedron. It shows us the equilateral triangles that form the faces and all the edges and vertices.

3   Food for thought

1. If the length of one edge of an octahedron is 1 unit, can you calculate the surface area of the octahedron?

2. Repeat the above exercise when the edge length is l.

3. How many times is the digit 5 written when listing all numbers from 1 to 100000?