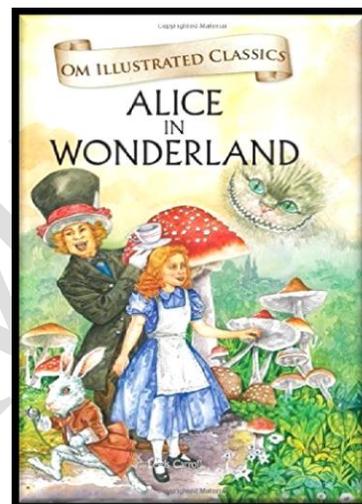


MATH'S LOGIC BEHIND ALICE'S ADVENTURES IN WONDERLAND

By Sonal Bhamare

Abstract

Alice's Adventures in Wonderland is an 1865 novel written by Charles Lutwidge Dodgson under the pseudonym Lewis Carroll. He was lecturer in the subject of Mathematics at Christ Church College (1855-1881). Basically this novel is for children's containing 12 chapters. Yes, in the Victorian era mathematician decided to write a children's book. That explains a lot about Lewis. It is a fantasy story told to the Liddell sisters. Henry Liddell was Dean at Christ Church College had four children's.

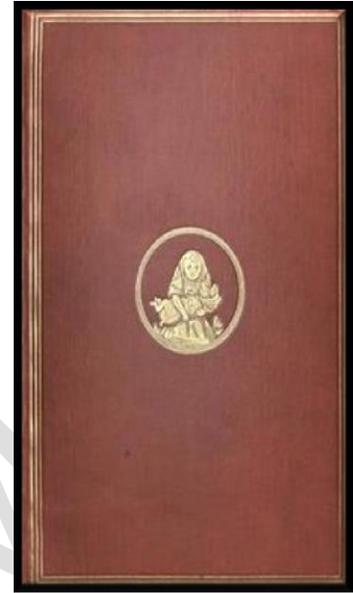


We all know the importance of mathematics in our lives. This article explains how one can apply mathematics in literature. In most of the Profession like Engineering, Pharmacy, Medical, etc. we can apply mathematics knowledge but only few people are aware about Mathematics can also apply in literature. This article also highlights the mathematics logic behind the different parts of the story like Euclid's geometry, property of circle, Linear equation etc. in the Caterpillar chapter, the concept of real line in the Cheshire cat chapter, the concept of quaternion in the Mad tea party chapter etc. Lewis Carroll applies his mathematics knowledge in his story very beautifully.

Keywords Euclidean geometry, quaternion, lines of symmetry

Introduction

Lewis Carroll was a very conservative man; he was conservative religiously, politically and even mathematically. The mid-19th century was a revolutionary time for math. More and more abstract mathematical concepts started to emerge. Lewis Carroll didn't like this new abstract math very much, so he used hidden meanings within his literature to attack abstract math and other mathematicians, as well as to promote traditional Euclidian math. Story starts with Alice fall down in a rabbit hole & enters in the imaginary world where creatures like cat, rabbit, caterpillar, frog etc. can talk, they can dance, they can sing etc. In the decade 1865 (The Victorian era) these things are very new & surprising to people that's why this book became a bestseller and made Lewis Carroll famous worldwide. The overwhelming commercial success of the first Alice book changed his life in many ways.



**Cover of the original edition
(1865)**

Lewis Carroll suffered from a rare neurological disorder that causes strange hallucinations and affects the size of visual objects, which can make the sufferer feel bigger or smaller than they are. This disease was named Alice in Wonderland Syndrome. From this we can get idea how famous this novel was.

I. The Caterpillar

In this part Alice comes upon a mushroom while she is frustrated with to her current identity crisis. She finds blue caterpillar smoking a hookah is sitting on it & gets supersized how caterpillar can smoke & even talk also. The Caterpillar questions Alice and she admits to her current identity crisis.



Before crawling away, the caterpillar helps Alice by telling that she can get into her original size using mushroom. Caterpillar also tells that one side of the mushroom will make her taller and the other side will make her shorter. But Alice gets confused with sides of circular mushroom i.e. which one is left side & which one is right side. She realized this very difficult question.

She breaks off two pieces from the mushroom. One side makes her shrink smaller than ever, while another causes her neck to grow high into the trees. This is the **property of circle** i.e. Alice remained looking thoughtfully at the mushroom for a minute, trying to make out which were the two sides of it.



Since a circle has infinitely many lines of symmetry, there are also infinitely many lefts and right. But, the two endpoints of a diameter are always on different sides of a circle, so one side is left and the other would be right.

Alice brings herself back to her normal height after successful efforts by using mushroom. We saw many variations in Alice's height. This also shows reflection of **Euclidean geometry**, where absolute magnitude doesn't matter. In the Euclid's geometry important fact is the ratio of one length to another. In this scenario Alice act like a Euclidean geometer, keeping her ratios constant, even if her size changes.

This also shows reflection of **Linear equation**. i.e. $L.H.S=R.H.S$ for example in linear equation $x + y = 4$, if we add an integer in L.H.S then we have to add it in R.H.S also to balance the equation.

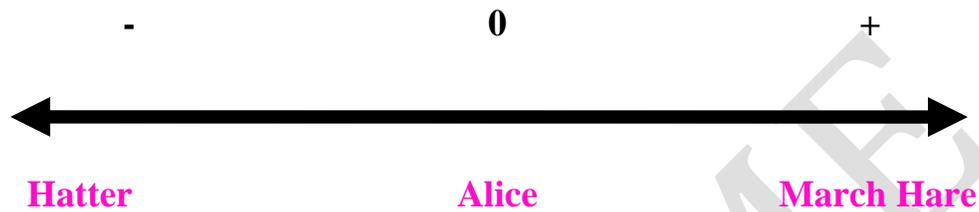
In this case door is acting like equals to sign. In first part before entering the door Alice have to eat a cake & drink the liquid to get into smaller size so that she can enters through the small door. Similarly in second part after entering the door she has to eat piece of mushroom so she can get into her proper size.

II. The Cheshire cat

Alice meets Cheshire cat when she leaves the Duchess house, and finds it in a tree. It constantly grins and can disappear and reappear whenever it likes. Sometimes it disappears and leaves its grin behind.



At that point Alice confuses where to go because there are two roads in front of her. Then Alice request Cheshire cat to help her. Then the Cat told that at right side she can found Hatter & at the left side she can found March Hare. Cat also gave advice to visit either she like but they both mad.



This situation reflects the concept **of real line** of mathematics, where 0 lies at the center, Positive numbers are lies at right of zero & negative numbers are lies at the left of zero.

III. Mad Tea Party

Alice becomes a guest at a "mad" tea party along with the March Hare, the Hatter, and a very tired Dormouse who falls asleep frequently, only to be violently woken up moments later by the March Hare and the Hatter.



The characters give Alice many riddles and stories, including the famous. Why is a raven like a writing desk? The Hatter reveals that they have tea all day because Time has punished him by

eternally standing still at 6 pm (tea time). Alice becomes insulted and tired of being bombarded with riddles and she leaves claiming that it was the stupidest tea party that she had ever been to.

This mad tea party represents three terms (Hatter, March Hare & Dormouse) of a **quaternion** (geometry involving 4 dimensions), in which the all-important fourth term, time, is missing. Without time one can imagine, the characters are stuck at the tea table, constantly moving round to find clean cups and saucers.

Their movement around the table is reminiscent of Hamilton's early attempts to calculate motion, which was limited to rotations in a plane before he added time to the mix. Even when Alice joins the party, she can't stop the Hatter, the Hare and the Dormouse shuffling round the table, because she's not an extra-spatial unit like Time. Hatter & March Hare are continuously tried to put the Dormouse into the teapot to free from an endless rotation around the table.

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