

Six Degrees of Separation: Math Quest

by Gonit Sora - Tuesday, October 29, 2013

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We have so far seen many different mathematical things from prime numbers to simple calculation tricks. In this issue I would like to say about something entirely different. I am going to speak about a social experiment that has many mathematical connections and is an interesting game that you can play in your leisure. This game or theory is called 'six degrees of separation' and is now a worldwide phenomenon.

Six degrees of separation is the theory that everyone and everything is six or fewer steps away, by way of introduction, from any other person in the world, so that a chain of "a friend of a friend" statements can be made to connect any two people in a maximum of six steps. It was originally set out by Frigyes Karinthy and popularized by a play written by John Guare.

Now what do we mean by six steps away. Lets take an example, I have a friend, Ankush Goswami who is from Nagaon and is doing his graduate studies at the University of Florida in the USA under the supervision of Prof. Krishnaswami Alladi. Again, Prof. Alladi did his graduate studies under the supervision of Prof. Ernst Strauss who was Albert Einstein's assistant at the Institute of Advanced Study in Princeton University, USA. So this gives me the following chain that connects me and Einstein:

Manjil P. Saikia ----- Ankush Goswami ----- Krishnaswami Alladi ----- Ernst Strauss ----- Albert Einstein

Notice that I am just three steps away from Einstein and anyone who knows me is four steps away from Einstein. This game can be played with arbitrary people, but sometimes it becomes difficult to find a link. But in most of the cases with some trial and error we can get a link.

What does this game have to do with mathematics? Well this is just an example of a mathematical concept called graph. This graph is not the graph of a function or equation that you plot in a graph paper, but something entirely different. I leave the description of what are graphs to a later date where I shall give you the necessary motivation and a few very interesting mathematical oddities.

This game of six degrees was recently tried on Facebook by a developer where he wanted to see how far apart were two random people apart on the social networking website, Facebook. He found experimentally that the average distances of friends between two people on Facebook was just 5.7 still validating the six degrees theory.

Mathematicians are normally known to be a dry species, but they still have their own games. One such game is what they call the Erdos number. This concept is similar to the six degrees concept. Paul Erdos was a very prolific Hungarian born mathematician who wrote more than 1500 research papers with more than 500 co-authors. This is by far the largest number of mathematical papers written by a single

mathematician. A few decades away someone jokingly formed the idea of an Erdos number. The idea is quite simple, Paul Erdos himself has an Erdos number of 0, anyone who has written a paper with Erdos gets an Erdos number of 1, and someone who has written a paper with someone whose Erdos number is 1 has an Erdos number of 2. And this goes on and on. It is believed that almost all mathematicians have a finite Erdos number, and in fact people from very diverse fields also have Erdos numbers. The highest known Erdos number is 12. For someone who has never written a joint paper, his Erdos number is considered to be infinity.

Lets give an example of Erdos number. My Erdos number is 5 via the following link:

Paul Erdos had collaborated with the famous probabilist Marc Kac, and Kac had collaborated with the physicist Powell Oskar, who in turn had collaborated with the Greek theoretical physicist I. Antoniadis. Recently I wrote a joint mathematical paper with Alexandre Laugier who had collaborated with Antoniadis in CERN. So the following link gives me an Erdos number of 5:

Erdos --- Kac --- Powell ---- Antoniadis --- Laugier ---- Saikia

In fact, I share my Erdos number with the famous Hollywood actress, Natalie Portman. :)

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