Covid-19 Transmission: Explanation with the Help of Graph (Tree)

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ABSRACT:

The end of the year 2019 witnessed the sudden attack of a new strain of coronavirus in Wuhan, China. On 31st of December 2019, China informed the World Health Organization (WHO) about the outbreak of pneumonia of unknown aetiology in Wuhan city, Hubei province of China. This disease was formerly referred to as '2019 novel coronavirus' or '2019-nCoV.' The COVID -19 virus is a new virus belongs to the same family of virus as the Severe acute respiratory-syndrome (SARS) and some types of common cold. The COVID -19 virus is transmitted rapidly through direct contact with an infected person. The rate at which this disease is transmitted can be easily understood by the special type of a graph called a Tree.

Keywords: COVID-19, tree, transmit, disease

TRANSMISSION OF CORONAVIRUS:

The WORLD HEALTH ORGANIZATION (WHO) declared COVID-19 as a global pandemic on March 11, 2020. COVID-19 infection causes fever, dry cough and fatigue and an infected person experiences mild to moderate respiratory issues without requiring any special treatment. The virus is transmitted from one person to another through direct contact with the respiratory droplets of an infected person and touching the surfaces contaminated with the COVID-19 virus. The best way to prevent the spread of the disease is to be aware about the disease and the way it is transmitted from one to another. The virus spreads from an infected person's mouth or nose in the form of droplets or aerosols when they cough, sneeze, speak or breathe. It is therefore important to follow certain basic etiquettes like covering your nose and mouth with a mask whenever you go out, do not cough or sneeze directly in the air, stay at home, avoid moving in groups, maintain proper hygiene, follow proper sanitization rules and the most important of all is to isolate yourself once infected by coronavirus until you recover from the infection. Proper hygiene and social distancing can prevent the spread of the COVID-19 to a great extent.

A graph is a data structure consisting of a finite set of points called vertices and a set of directed or undirected edges connecting any two vertices. Graphs can be used to develop mathematical models for logical reasoning for certain complicated large-scale relationships that can be represented using vertices and edges. In graph theory, a tree is an undirected graph in which any two vertices are

connected by exactly one path, or alternatively, a connected acyclic and undirected graph is called a tree. Trees are generally used to represent hierarchical structures in graphical forms.

We can easily understand how corona gets transmitted in community with the help of a tree (Graph). To understand this let us take a person who is corona positive as a root of a tree. If we assume that this positive person comes in contact with two persons in one day and makes them positive. Then the above 2 persons come in contact with two persons each in the next 1 day and infects them and the same cycle continues then we will notice that within 5 days, the total no. of persons infected by the disease will rise from 1 to 63, the graph for which will be as under:

$$\therefore \text{No. of infected persons in 5 days} = 2^0 + 2^1 + 2^2 + 2^3 + 2^4 + 2^5 = 63$$
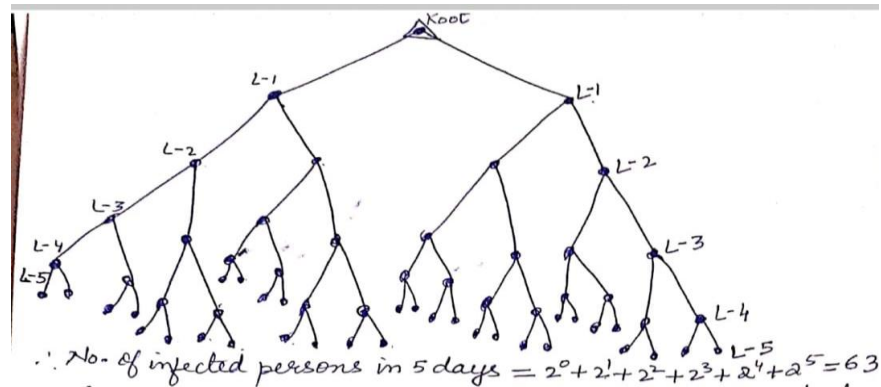
Similarly, we will notice that if one infected person on an average comes in contact with 3 persons in 1 day and the above cycle is repeated then we will find that the total no. of infected persons in 5 days will be 364. The graph will be as under:

$$\therefore \text{No. of infected persons in 5 days} = 3^0 + 3^1 + 3^2 + 3^3 + 3^4 + 3^5 = \frac{1 \cdot (3^6 - 1)}{(3-1)} = 364$$
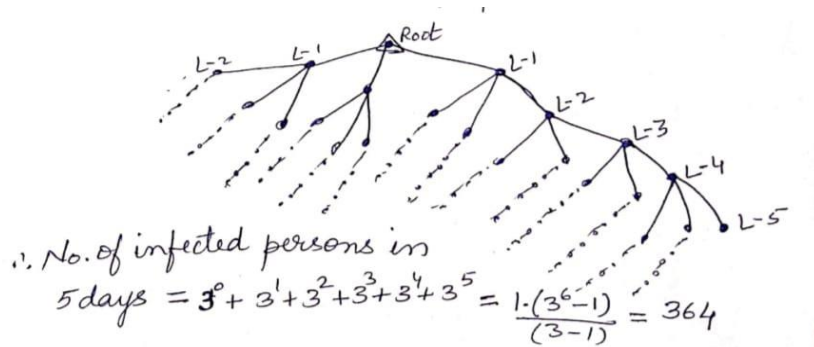
Now imagine if this cycle of 1 person infecting 2 persons on 1st day and those two infecting 2 persons each on 2nd day continues then in only 10 days the total number of infected persons will rise from 1 to 2047.

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Similarly, if this cycle of 1 person infecting 3 persons on 1st day and so on continues the no. of infected persons will rise from 1 to 88573.

But if we assume that 1 corona positive transmits the disease in 2 persons on 1st day and out of the 2 infected persons one person isolates himself then only one person will transmit the disease to two persons out of which one person again isolates himself and the 2nd transmits the disease to another two on the 2nd day and the cycle is repeated. Similarly, then we will notice that only 11 people will get infected in 5 days. The above situation can be easily understood by the following graph.
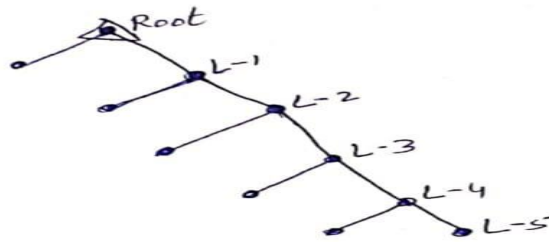
CONCLUSION:

Social distancing is the demand of the day because it is the most effective method to fight with COVID-19 pandemic which we have proved mathematically using tree (graph). It is evident from the graphical analysis that if we do not follow the required safety measures then the pandemic will take not much time to convert into an epidemic.

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