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Covid-19 and the Fibonacci Numbers

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Abstract

The World has been shaken by the appearance of a new type corona virus in December 2019 in the city of Wuhan, China. The virus has then spread around the Globe causing many infections and fatalities. In this paper we have given a simple model for the spread of virus in terms of Fibonacci numbers.

1 Introduction

Fibonacci numbers (F_i) consitute a number sequence (for a review see [5] and for generalizations see [1].) This sequence first introduced by Italian mathematician Leonardo Fibonacci in his book "Liber Abaci" [4] in 1202. The first two values in the sequence are given as $F_1 = F_2 = 1$ and higher terms are the sum of previous two terms, that is $F_i = F_{i-1} + F_{i-2}$ for $i \geq 3$.

Since December 2019 the World has been hit by a new type of corona virus, named as Covid-19 by the World Health Organization [2]. This has raised a lot of panic around the World. As we are not medical professionals, we do not comment on the virus and the illness it causes. Our aim in this paper, is to give a simple model for the spread virus. In the end, we see that Fibonacci numbers play a central role.

2 A Simple Spread Model for Covid-19 and the Appearance of Fibonacci Numbers

The incubation period of the novel corona virus is two weeks [3]. We suppose each infected individual infects one other individual in each week and at the end of week-two recovers fully or dies (we are interested in the number of people who are actively infected and alive). So the time stamps are the beginning of week-one, at the end of week-one and at the end of week-two. According to our simple model, an infected individual can infect one other person at the end of week-one

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and at the end of week-two. Table 1 shows the number of infected people at each week.

						13
					8	8
				5	5	5
			3	3	3	
		2	2	2		
	1	1	1			
1	1	1				

Table 1: The number of infected people at each week. Horizontal axis is time (in weeks). The number of infected people at a particular week is the sum over that particular column.

The pattern in Table 1 calls for the use of Fibonacci numbers. We can re-write this table as in Table 2. As it is clear $f_1 = 1$ and $f_i = F_i + F_{i-1} + F_{i-2} = 2F_i$ for $i \geq 2$.

						F_7
					F_6	F_6
				F_5	F_5	F_5
			F_4	F_4	F_4	
		F_3	F_3	F_3		
	F_2	F_2	F_2			
F_1	F_1	F_1				
f_1	f_2	f_3	f_4	f_5	f_6	f_7

Table 2: The number of infected people at each week. Horizontal axis is time (in weeks). The number of infected people at a particular week is the sum over that particular column. F_i is the i^{th} Fibonacci number, and f_i is the total number of infected people at week i.

3 Conclusion

In this short paper, we developed a simple spread model for the novel corona virus, that is each person infect one other person at the end of week-one and week-two. At the beginning of week-one, no infections occur. At the end of week-two, person may die or recover from illness which is irrelevant to our analysis. Our aim is to give the number of infected people (f_i) at each week. We have found out that $f_1 = 1$ and for $i > 1$, $f_i = 2F_i$ where F_i is the i^{th} Fibonacci number. As expected, this gives an exponential growth.

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