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12 October, 2018. Kobina Ocran

Research paper - Project 3

In this project we write a program that simulates the adoption of a new product in a market over time using a difference equation developed by marketing researcher Frank Bass in 1969. We define a function that represents model with a difference equation(represents the model more accurately) and then simulates it accordingly. The Bass diffusion model presumes that there's one product which is eventually adopted by the population N. In the first part of the project we display the first part of the bass diffusion model by using the equation:

A(t) = A(t-dt) + r.(1-A(t-dt)).dt + s.A(t-dt).(1-A(t-dt)).dt

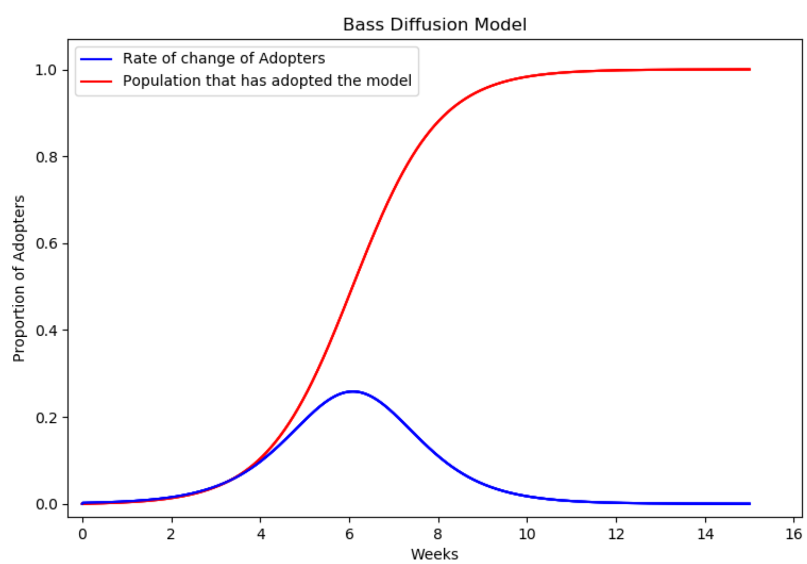
which in python is represented as:

A = A + r*(1-A)*dt+s*A*(1-A)*dt

When the model is implemented, we also add the rate of change of adopters over time by the equation:

rate_of_A = (AList[-1]-AList[-2])/dt

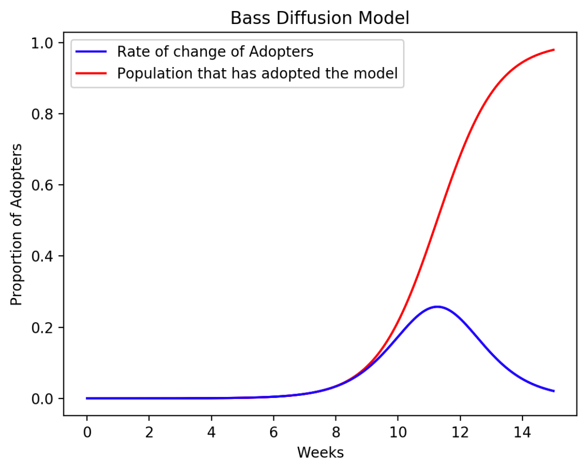
We also create lists in our program by first creating an empty list and to add values to the end of the list, we will use the `append` method of the list class.Also we call the matplotlib.pyplot function (that takes two inputs: x and y lists) and numpy function that plots the graphs representing different data easily.
We put all these things in a loop inside our function to keep it running smoothly. When we run the first part of our program, we get the following graph:



Question 4.3.1:
Describe the picture and explain the pattern of new adoptions and the resulting pattern of total adoptions over the 15-week launch.

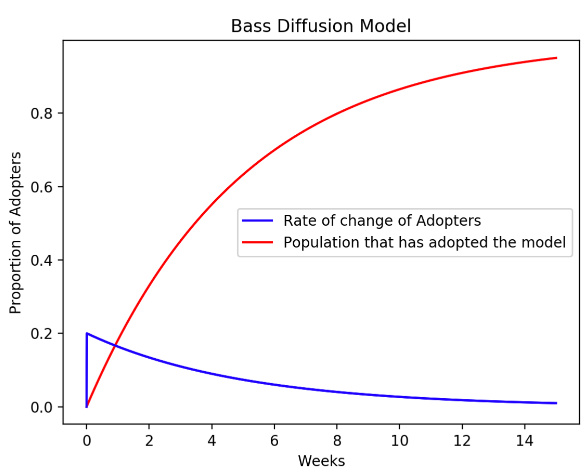
The red-line graph produced is a typical S-shaped. The critical mass here is about three weeks and then social contagion kicks in the steep increase in the product adoption takes place. This is when the market sells most. And the blue-line graph shows the rate of change of adopters and its a bell-shaped graph showing the variation in the adoption. The most change comes over at week 6.

Question 4.3.2
Now make r very small but leave s the same (r = 0.00001, s = 1.03), and answer the same question. What kind of market does this represent?



The rate of adoption is less is it selling in the market later. So the critical mass takes more time here as compared to the first graph. The social contagion then hits in and the graph goes up steeply.

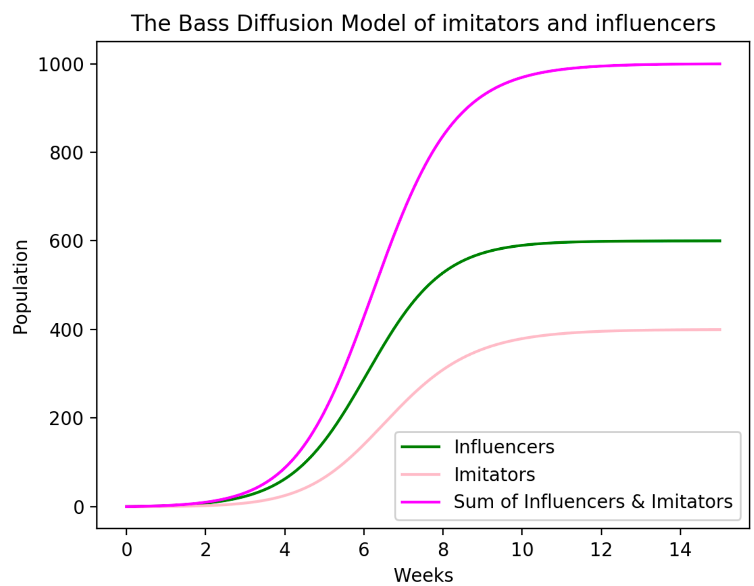
Question 4.3.3
Now set r to be 100 times its original value and s to be zero (r = 0.2, s = 0), and answer the first question again. What kind of market does this represent?



The population that is adopting the model, adopts the model continuously but is not exactly directly proportional. There is no critical mass and the social contagion is spread out as compared to the other graphs. The rate on the other hand is a sudden jump and then slowly goes down spread over the time of weeks.

Question 4.3.4

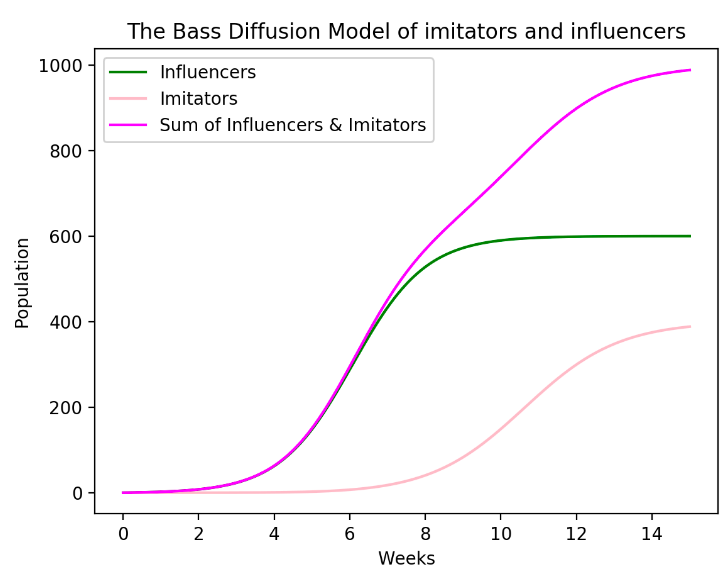
Describe the picture and explain the pattern of new adoptions and the resulting pattern of total adoptions. Point out any patterns that you find interesting.



These graphs are similar to our very first S-shaped graph where there is very less critical mass and then social contagion hits and the product hits the market majorly. The graph is different because it uses actual population sizes as compared to the first one. The influencers have more of an effect on the product being sold than imitators. It's a 6:4 ratio and together has a 100% effect in the market.

Question 4.3.5

Now set w = 0.01 and rerun the simulation. Describe the new picture and explain how and why this changes the results.



The graph here for the imitators gets more critical mass before in comparison to the previous one. And the product doesn't have a very strap social contagion. The graph for the imitators remain the same. The sum of both graph gets in a 'weird' shape where it doesn't have that much critical mass but that social contagion hits and then gets disrupted because of the imitators. This changes the results because the social contagion isn't that direct as in the other graph. It's less steeper.

In conclusion, this model summarizes how the product is adopted by the population. And how changing a value can affect the whole graph. And how the part A and part B models are actually similar except the scale. They have the same S-shape if you keep the values neutral. The function used to implement the model also shows that the slight change in the parameters of a function can have a major change in the results. The use of 'running' lists is very extended in this project explaining to us the different ways we can use and extract different lists.