

Homework #10

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The example from [1] was recreated in Octave.

Two transition matrices are considered: T_1 for the original example and T_2 to simulate the redesigned web interface case.

$$T_1 = \begin{bmatrix} 0.89 & 0.75 & 0.49 \\ 0.10 & 0.22 & 0.44 \\ 0.01 & 0.03 & 0.07 \end{bmatrix} \quad (1)$$

$$T_2 = \begin{bmatrix} 0.65 & 0.45 & 0.29 \\ 0.34 & 0.42 & 0.44 \\ 0.01 & 0.13 & 0.27 \end{bmatrix} \quad (2)$$

For both simulations, the initial state \mathbf{i} is set to have 188969 inactive users, 81356 active users, and 14210 very active users.

1 Changes in userbase

A simulation for the changes seen in the usebase within a period of 10 months is presented. We note that the final state is calculated with

$$\mathbf{f} = \mathbf{T}_1^n \mathbf{i}$$

where \mathbf{f} is the final state of the system, and \mathbf{i} is the initial state. The results of the simulation are presented in Figure 1.

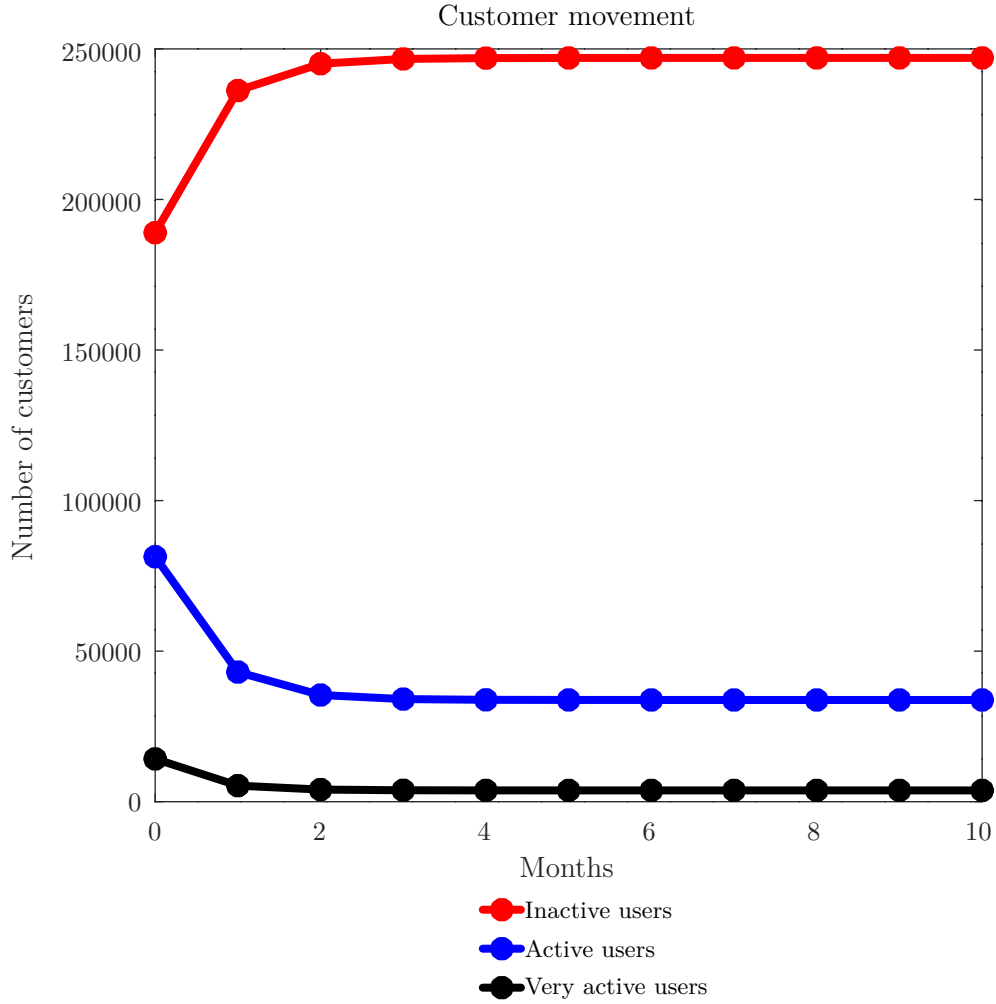


Figure 1: Userbase in 10 months.

2 Website redesign

A simulation was realized to observe the impact a website redesign could have in the changes within the userbase. Given the probabilities presented in (2) a simulation for 10 months was performed. The results are presented in Figure 2.

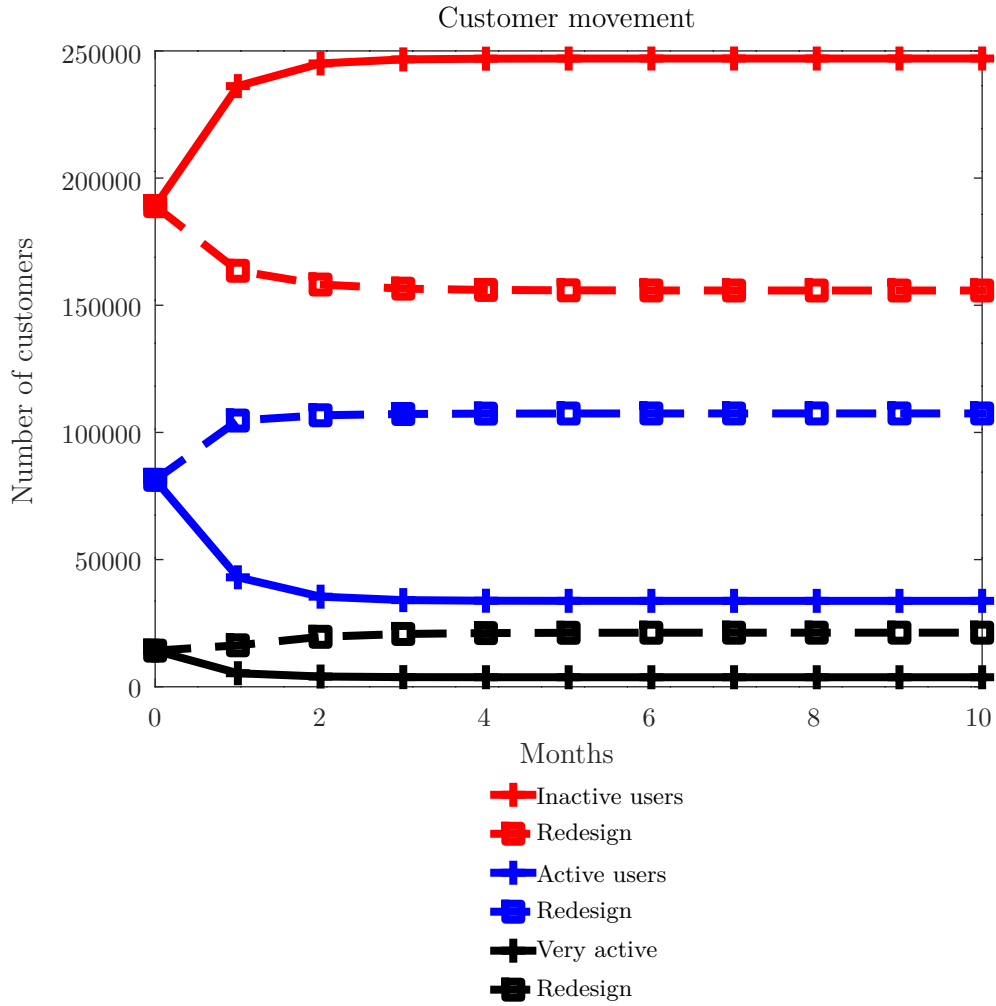


Figure 2: Website redesign.

References

- [1] Bassim Eledath. *How to Build a Market Simulator Using Markov Chains and Python*. 2018. URL: <https://towardsdatascience.com/how-to-build-a-market-simulator-using-markov-chains-and-python-7923256f8d29> (visited on 03/21/2020).

A Octave Code

```
1 % Based on code from https://towardsdatascience.com/how-to-build-a-market-simulator-using-markov-chains-and-python-7923256f8d29
2
3 close all
4 clear all
5 clc
6
7 transitionMatrix = [0.89,0.75,0.49;0.10, 0.22, 0.44;
    0.01, 0.03, 0.07];
8 redesignMatrix = [0.65,0.45,0.29;0.34, 0.42, 0.44;
    0.01, 0.13, 0.27];
9
10 initialState = [188969, 81356, 14210];
11
12 months = 10;
13
14 a = zeros(months+1, 1);
15 b = zeros(months+1, 1);
16 c = zeros(months+1, 1);
17
18 a(1) = initialState(1);
19 b(1) = initialState(2);
20 c(1) = initialState(3);
21
22 na = zeros(months+1, 1);
23 nb = zeros(months+1, 1);
24 nc = zeros(months+1, 1);
25
26 na(1) = initialState(1);
27 nb(1) = initialState(2);
28 nc(1) = initialState(3);
29 for i = 1:months
30     temp = (transitionMatrix^i) * initialState';
31     a(i+1) = temp(1);
32     b(i+1) = temp(2);
33     c(i+1) = temp(3);
34
```

```

35     ntemp = (redesignMatrix^i) * initialState';
36     na(i+1) = ntemp(1);
37     nb(i+1) = ntemp(2);
38     nc(i+1) = ntemp(3);
39 endfor
40
41 t = 0:months;
42
43 figure(1)
44 plot(t, a, 'r-o', 'linewidth', 3, t, b, 'b-o', '
    linewidth', 3, t, c, 'k-o', 'linewidth', 3)
45 xlabel('Months', 'Interpreter', 'latex')
46 ylabel('Number of customers', 'Interpreter', 'latex')
47 title('Customer movement', 'Interpreter', 'latex')
48 legend({'Inactive users', 'Active users', 'Very active
    users'})
49 legend("boxoff")
50 legend("location", "southoutside")
51 legend('orientation', 'vertical')
52
53 %%print('-dpdflatex', './img/hw10_markov.tex', '-S400
    ,400');
54
55 figure(2)
56 plot(t, a, 'r+', 'linewidth', 3, t, na, 'r-s', '
    linewidth', 3, t, b, 'b+', 'linewidth', 3, t, nb, '
    b-s', 'linewidth', 3, t, c, 'k+', 'linewidth', 3,
    t, nc, 'k-s', 'linewidth', 3)
57 xlabel('Months', 'Interpreter', 'latex')
58 ylabel('Number of customers', 'Interpreter', 'latex')
59 title('Customer movement', 'Interpreter', 'latex')
60 legend({'Inactive users', "Redesign", "Active users",
    "Redesign", "Very active", "Redesign"})
61 legend("boxoff")
62 legend("location", "southoutside")
63 legend('orientation', 'vertical')
64
65
66 %%print('-dpdflatex', './img/hw10_redesign.tex', '-
    S400,400');

```