

VisaRuPay Credit Card Company

(Case Study)

Course: Stochastic Modelling of Business

Submitted By:

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ANSWER 1

STATE DESCRIPTIONS

Customer's State (or stage) k : if he or she has missed making the minimum payment for the last k consecutive months.

Total number of states: 8

Transition Probability Matrix

```
[0.967 0.033 0 0 0 0 0 0 ]
[0.952 0 0.048 0 0 0 0 0 ]
[0.910 0 0 0.090, 0 0 0 0 ]
[0.835 0 0 0 0.165 0 0 0 ]
[0.788 0 0 0 0 0.212 0 0 ]
[0.713 0 0 0 0 0 0.287 0 ]
[0.671 0 0 0 0 0 0 0.329]
[1.000 0 0 0 0 0 0 0 ]
```

Other properties of the above Discrete Time Markov Chain:

- Number of CLASSES: 1
 - 1) RECURRENT: 1
 - 2) TRANSIENT: 0
- ABSORBING: NO
- APERIODIC: YES
- IRREDUCIBLE: YES
- ERGODIC: YES

Since, the DTMC is Ergodic, Stationary distributions are defined. Hence, Following is the Stationary Distribution:

States(i)	0	1	2	3	4	5	6	7
π_i	0.966	0.032	1.53×10^{-3}	1.37×10^{-4}	2.27×10^{-5}	4.81×10^{-6}	1.38×10^{-6}	4.55×10^{-7}

It is clear that the system stays most of the time in state 0, i.e most customers doesn't miss their payments, which is a good sign for their businesss.

ANSWER 2

ASSESSMENT OF CURRENT POLICY

Analyze the current policy (P_c), in which the company terminates the customer's account once the customer misses it's seventh consecutive minimum payment. Considering that loss in this case is of full outstanding amount left by then.

Formula for Expected Annual Loss per Customer:

$$E = \sum_0^{c-1} \pi(i) \times q(i) \times b(i) + \pi(c) * b(c-1) \quad - (1)$$

Where,

$\pi(i)$ is the proportion of time system remains in state i.

$q(i)$ is the probability of bankruptcy, being in state i.

$b(i)$ is the outstanding balance of that amount.

The first part of the equation takes the expected loss due to bankruptcy, while the second part consist of the loss due to termination of account, by the company. Considering the hypothesis, that at the starting of month c only, the account is terminated and hence all the outstanding balance of month c-1 will be lost.

On putting the values, i.e $c = 7$, we get an expected annual loss per customer of \$ 526.98 million.

ANSWER 3

SPI: A DEBT COLLECTION AGENCY

VisaRuPay has to pay SPI an annual retainer fee of \$ 50k for this service. SPI pay VisaRuPay 75% of the current outstanding balance on that account.

To decide whether to hire SPI or not, we should calculate the expected annual losses in case of hiring SPI and compare it with the current annual expected loss. So, consider P_m be the policy, that we handover the account to SPI when the customer misses it's m consecutive transactions. Then, expected annual loss for the company can be calculated as:

$$E_m = \sum_0^{m-1} \pi(i) \times q(i) \times b(i) + (1-k) \times \pi(m) \times b(c-1) \quad - (2)$$

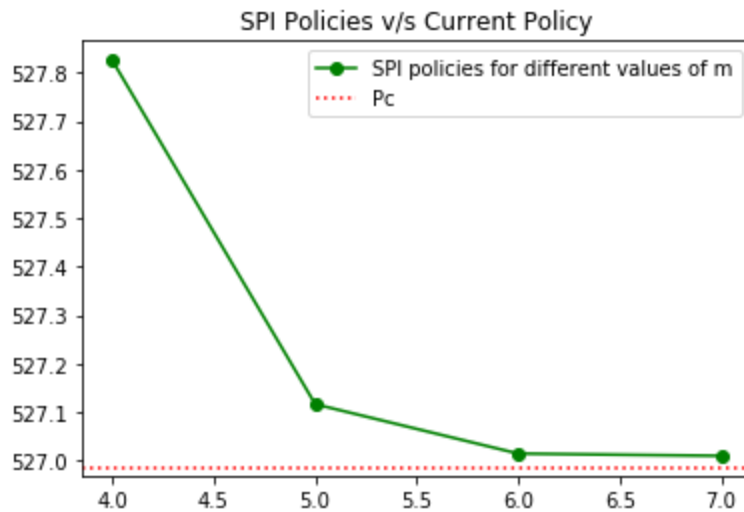
$\pi(i)$ is the proportion of time system remains in state i.

$q(i)$ is the probability of bankruptcy, being in state i.

$b(i)$ is the outstanding balance of that amount.

k is the proportion of money debt collection unit returns.

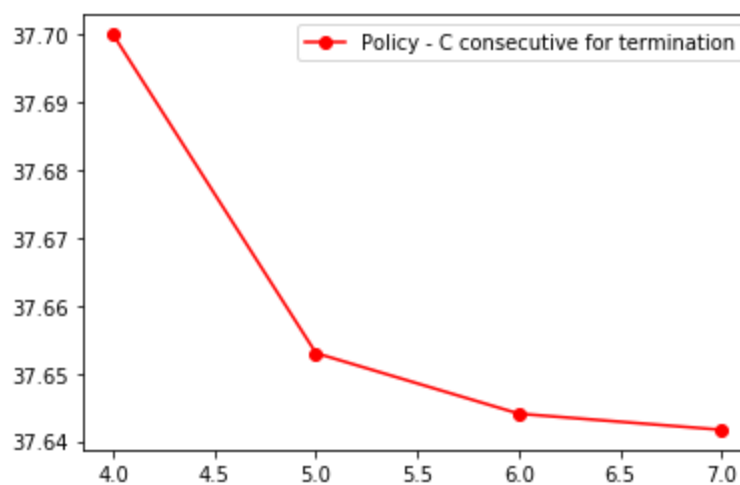
So the expected annual losses are plotted in the graph.



It is evident from the graph, the policy should not be accepted, as in the best case the expected annual loss for the 527.01 million dollars, but the current policy has a expected annual loss of 526.88 million dollar.

ANSWER 4

EVALUATION OF CURRENT POLICY FOR DIFFERENT C VALUES.



The above graph is constructed by changing the value of c in equation 1.

So, according to the above graph, the current policy with an annual expected loss of \$ 526.98 million. So, it is optimum to terminate the customer

ANSWER 5

ASSESTMENT OF CALLING POLICY

The cost per call = \$1

The new probability of transition from state 6 to 7 is 0.250.

To access the policy, I calculated the decrement in expected loss due to decrement in the transition probability and the expected cost to be incurred.

The expected annual loss for the new transition probability was calculated same as calculated in question 2.

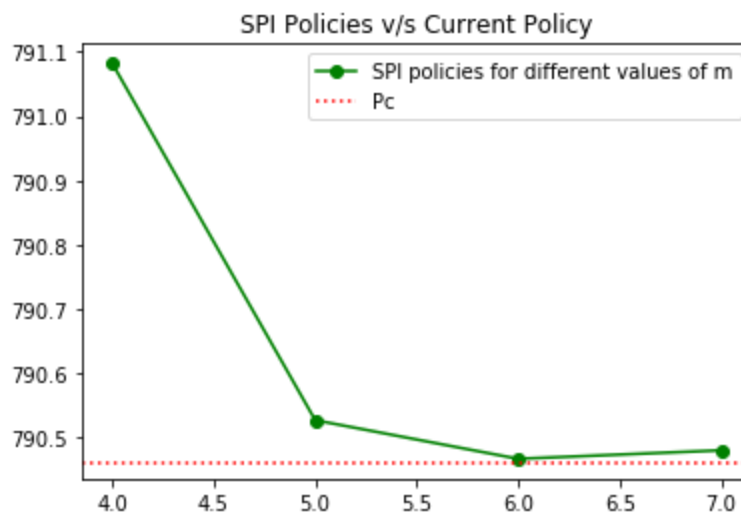
The expected total cost can be calculated using formula below:

$$E_{cost} = C_{pc} \times \pi(6) \times 14000000$$

Ratio of expected decrement in loss by E_{cost} came out to be 19, i.e calling policy can be adopted, to decrease the expected annual loss.

ANSWER 6

As the bankruptcy rate has been increased by 50%, so the new bankruptcy probabilities will be 1.5 times the current policies.



Here, also the values are calculated by changing the value of q in equation 1.

The least possible annual loss through the SPI = \$ 790.467 million

Loss if current policy is continued = \$ 790.461 million

The services of the SPI should not be taken, as still the expected annual loss in the case of current policy is lesser than that of SPI.

ANSWER 7

New debt collection agency:

Annual payment = 0

SPI pay VisaRuPay 60% of the current outstanding balance on that account.

so , the values are calculated using formula 2.

The Least expected annual loss in new option = 526.9713968549514

The Least expected annual loss in SPI option = 527.0100523124198

The current expected annual loss = 526.9834973451876

The least expected annual loss in new option is less than that in current policy, hence it should be considered as an option.