

Problem statement

A bank would like to examine its operation for potential improvements. This bank consists of three main services (ATM – customer service –Tellers). It opens at 8 am and closes at 5 pm, but bank's staff stays to finish the remaining customers' procedures after 5 pm for additional hour, about 50% of the customers go to Tellers, 20% customer service and 30% ATMs. The below table shows us the Customers' arrival pattern over the day:

Hours	Arrival rate per hour	Hours	Arrival rate per hour
1	50	6	90
2	70	7	93
3	85	8	70
4	87	9	63
5	80	10	0

There are 3 identical ATM machines outside the bank, but the manager saves electricity by turning on only 1 ATM machine at the start of the day. If the queue at ATMs exceed 3 customers, the manger turn on additional ATM.

The ATM times are distributed EXPO (8). All ATMs after 30 customers have breakdown to be provided with money, breakdowns time distributed EXPO (15).

About 8% of customers at ATMS don't know about ATMs withdrawal limit and need to withdraw more money so they go to tellers inside bank.

Inside the bank customers pass through one of two booking officers to either go to tellers or customer service and take their number in queue, times in this process distributed UNIF(0.5,1.5).

This bank has only 20 waiting seats for both tellers and customer service. We noticed that any customer enters the bank while all seats are occupied leaves the bank before even booking a number.

Customers go to Teller to make deposit or withdraw money, tellers' times estimated to be TRIA (4, 7, 9), there are 6 identical tellers with schedules summarized as:

Hours	Number of tellers	Hours	Number of tellers
1	3	6	6
2	5	7	5
3	5	8	5
4	6	9	4
5	6	10	2

Customers go to customer service either to edit their accounts or create new one. About 70% of customers who go to customer service need to edit their accounts and 30% of customers need to create new accounts in this bank.

Estimated time needed to edit your account in customer service is TRIA (5, 8, 12) .

Creating new account is a little bit longer process, at first customer service advisor explain different types of accounts then finalize some paperwork this process estimated to be TRIA(10, 15,20) and then the advisor send customers to tellers to make deposit with higher priority - advisor wait customers to make a deposit and don't accept new customers- this process take time estimated to be TRIA(3,4,5) .The final process of creating new account when the customer returns to the advisor estimated to be TRIA(2,3,4) .

There are 7 account managers with different schedules these schedules summarized as:-

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
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ramy		✕	✕	✕	✕	✕	✕	✕	✕		✕	✕	✕	✕	✕	✕	✕	✕		
mohamed	✕	✕	✕	✕	✕	✕	✕		✕	✕	✕	✕	✕	✕	✕	✕	✕			
samy				✕	✕	✕	✕	✕	✕	✕	✕		✕	✕	✕	✕	✕	✕	✕	✕
kareem		✕	✕	✕	✕	✕	✕	✕		✕	✕	✕	✕	✕	✕	✕	✕	✕		
magdy			✕	✕	✕	✕	✕	✕	✕	✕		✕	✕	✕	✕	✕	✕	✕	✕	
farouq				✕	✕	✕	✕	✕	✕	✕	✕		✕	✕	✕	✕	✕	✕	✕	✕

run simulation for 5 days – using helpful plots , variables and animations – keeping statistics on number of customers in each service , Tellers, ATM and customer service advisors utilization , average total customers time in each service and number of angry customers who leave because limited seats in bank.