*Note: Due to sensitivity and confidentiality of information, the company's name has been masked and sensitive data have been removed

Study and Improvement of the High Counter Queue System

IE3100R Systems Design Project – AY 10/11
Department of Industrial and Systems Engineering

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1. Introduction

A local retail bank wanted to study and better their queue system for high counter operations at their branches so as to enhance customer service experience. A branch of interest was selected for this study.

The bank judge their queue system performance on a weekly basis base on the following 3 KPIs:

1. 80% of the transactions are done within 15 min
2. An average queue time less than or equals to 10 min
3. The maximum queue time of 30 min.

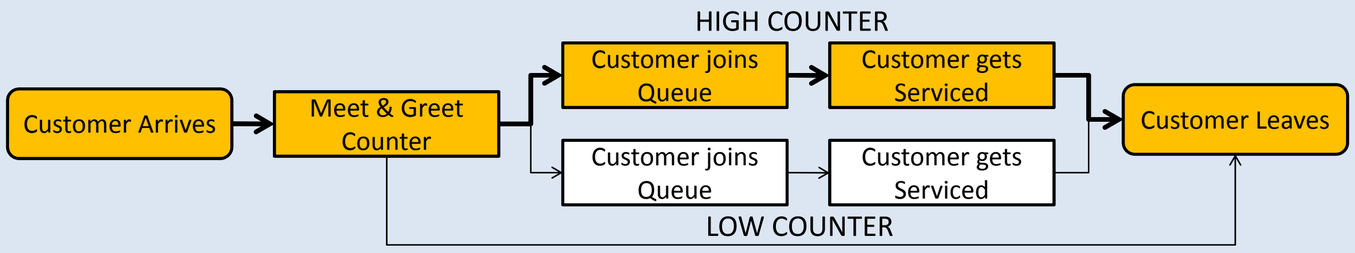
2. Problem Statement & Objectives

The bank's studies showed that, relative to the other KPIs, maximum queue time is a problem. Lengthy queue time has been a constant source of customer dissatisfaction. The branch of interest did not satisfy the 3 KPIS.

3. Objectives

1. Determine how queuing time are influenced with respect to the number of manned high tellers at different times of the day.
2. Determine an optimal manning policy which will work towards reducing queueing time.

4. Queue System Process



Manning Policy

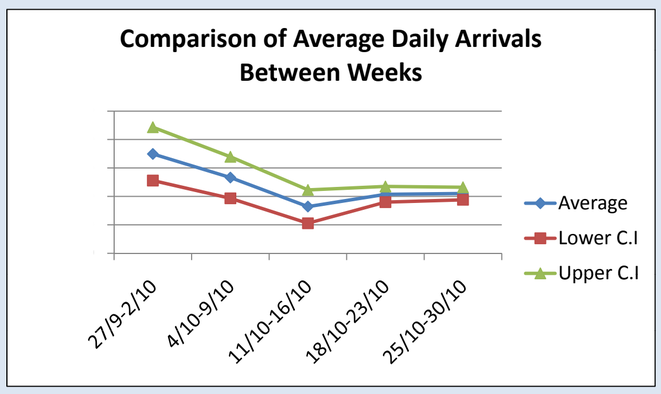
1. No. of counters manned: There are a total of 7 available high counters at the branch of interest. On average a total of 5 high counters are being utilized throughout the day.
2. Lunch policy: High counter staffs at the branch each takes half an hour staggered lunch breaks, one at a time, starting from 11am; lunch period thus ends by 1.30pm.

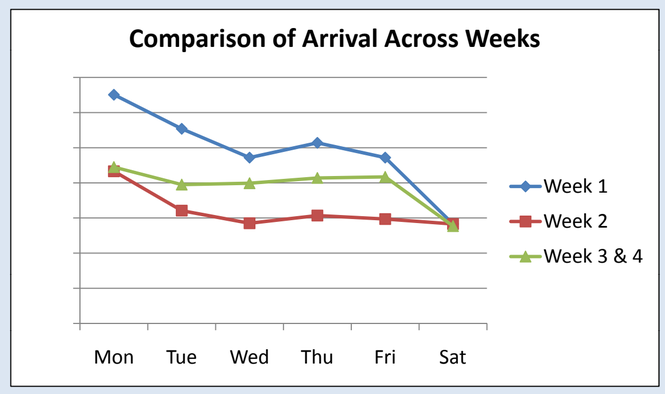
5. Data Analysis

Arrival Time Analysis

Based on ANOVA analysis of arrival distribution, the table on the right shows the weeks and days of the weeks which have arrival distributions that are not significantly different; a total of 12 distributions.

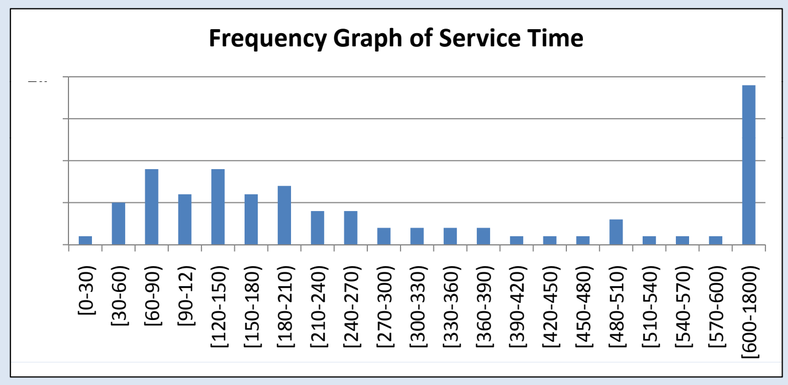
	Week 1	Week 2	Week 3	Week 4
Monday	Distribution 1	Distribution 5	Distribution 9	
Tuesday				
Wednesday			Distribution 10	
Thursday	Distribution 2	Distribution 6		
Friday	Distribution 3	Distribution 7	Distribution 11	
Saturday	Distribution 4	Distribution 8	Distribution 12	





Service Time Analysis

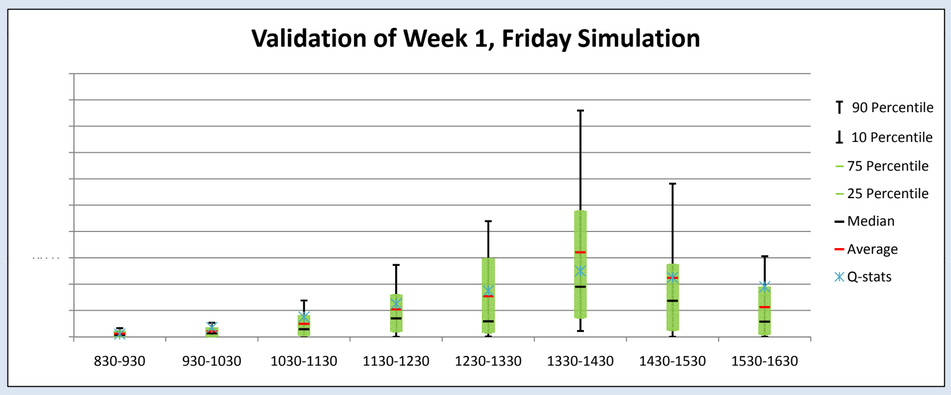
Service time distribution is assumed to be same throughout the month. The following service time frequency graph is based on the collection of 3 days worth of service time data at the branch of interest.



6. Modelling and Validation of Model

Model was built using MATLAB and Simulink. Via ART method, using a general distribution for service time and exponential distribution per half an hour for arrival time, input data was generated for the model. A total of 25 runs were made, each run running for the full operational hours of the bank (8.30am t0 4.30pm).

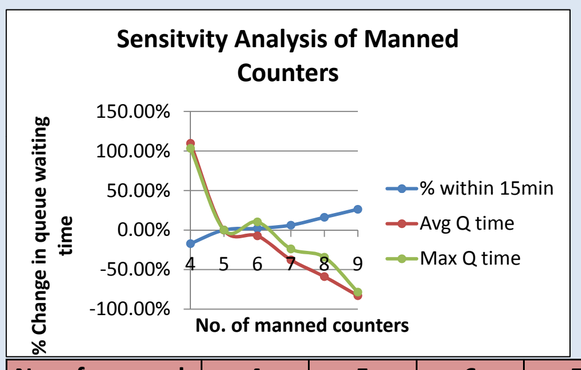
The queue time distribution generated, was compared against the queue time statistics from the bank so as to validate the model. These queue statistics are queueing times of one individual collected on an hourly basis. The model is considered validated if 50% and 75% of the queue statistics is captured within 25-75 and 0-75 percentile of the queue time distribution respectively. The model was validated against 30 days of collected service and arrival data and queue statistics.



7. Sensitivity Analysis

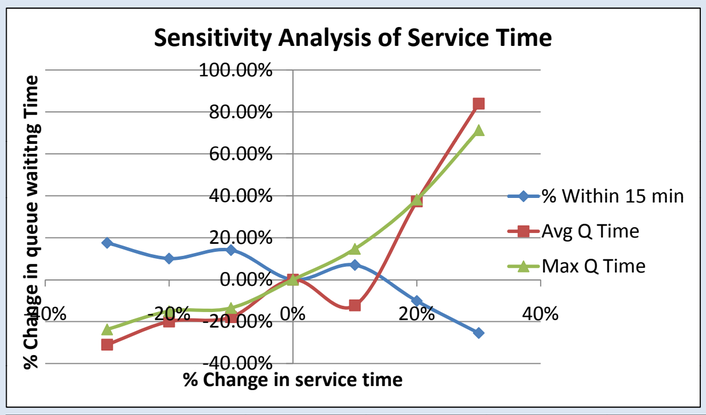
Sensitivity analysis was done using the current worst case scenario as the base case and only factors which are within the control of Company were tested, namely no. of manned counters, service rate and lunch schedule.

Lunch Hours	1100-1330	1000-1230	1300-1530	1000-1100 1300-1430	1000-1130
No. of staff going for lunch each time	1	1	1	1	2
% Within 15min					
% Change	0.00%	13.49%	10.70%	1.22%	-7.92%
Avg queue time(min)					
% Change	0.00%	-35.44%	-32.04%	-2.91%	24.76%
Avg max queue time(min)					
% Change	0.00%	-35.29%	-36.57%	-10.74%	39.64%



If Company wish to satisfy the 3 KPIs, the minimum number to open is approximately 7 (with lunchtime fixed at 11am – 1.30pm).

No. of manned counters	4	5 (Base)	6	7	8	9
% within 15min						
Avg Q Time (min)						
Max Q Time (min)						



10% or 20% decrease in service time results in similar level of improvement in the performance of second and third KPIs. Only when the decrease approaches 30%, the improvements start to become quite noticeable.

% Change in service time	-30%	-20%	-10%	base	+10%	+20%	+30%
% within 15min							
Avg Q Time (min)							
Max Q Time (min)							

8. Recommendations

Variable factors	Ease of implementing change (H/M/L)	Remarks
No. of manned counters	M	Limited by space and availability of manpower
Lunch hours	H	No change to manpower level and not constraint my facility space
Lunch period	L	May not be an appropriate HR policy to reduce lunch break. Increasing lunch break decrease the branch capacity to serve its customer
Service rate	L	Requires training which comes at a cost and productivity gains may only be seen in the long term
Arrival rate	N.A.	Company is not able selectively accept its customers

Based on the sensitivity analysis and ease of implementing change, the following heuristic solution is crafted

- Short-term: Change lunch period from 10am-12.30pm to increase available capacity during the peak period
- Mid-term: In addition to short term changes, increase manning level by 1
- Long-term: In addition to mid-term changes, improve productivity to decrease service time by 10%