COMPUTER UNIVERSITY(MANDALAY)

FINANL YEAR PROJECT REPORT

ON

DETERMINING THE OPTIMUM NUMBER OF PHONE REPAIRMEN

Bachelor of Computer Science

(B.C.Sc)

Presented By Group(5)

2014_2015

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Project Schedule

Project Proposal: :A System For Determining The Optimum Number Of Phone Repairman

First Seminar : :26.5.2015

Second Seminar : :3.7.2015

Third Seminar : :5.8.2015

Time Schedule	March 2015	May 2015	June 2015	July 2015	August 2015
Project Proposal					
First Seminar					
Second Seminar					
Third Seminar					
Book Submission					

Abstract

Queuing theory can be applied to a wide variety of operational situation where this imperfect matching between the customers and service facilities. The M/M/1 Model is Poisson Exponential Service Time Distribution , Single Server , Infinite Number of waiting positions. The system evaluates the performance of an existing queuing system. Results may be evaluated over a short period of time. The system will be implemented by VB.Net language. Queuing theory can be used to determine the level of service that balances the following two conflicting costs..(i)cost of offering the service and (ii)cost incurred due to delay in offering service.The first cost is associated with the service facilities and their operation and the second represents the cost of customer's waiting time.

List of Figures

List of Tables

CONTENTS

CHAPTER 1

INTRODUCTION

1.1 Introduction

A common situation occurring in everyday life is that the queuing or waiting in a line. Understanding waiting lines or queues and learning how to manage them is one of the most important areas in operations management. In general , a queue is formed when either units requiring services-commonly referred to as customers , wait for service or the service facilities , stand idle and wait for customers. It would reduce the customer's waiting time in an increase in the existing service facilities and resultantly reduce queuing up. Queuing decisions can frequently be based on past experience or on the facts of the current situations. The queuing system consists primarily of the queuing and the available number of servers. Queuing theory can be used to determine the level of service (either the service rate or the number of service facilities).[1].

1.2 Objectives of The Project

The objectives of this project are

- To measure the expected number of people in line , the expected waiting line of the arrivals and the expected percentage utilization of the service facilities.
- To evaluate the performance(characteristics of M/M/1 model) of an existing queuing system.
- To establish the optimum number of services.
- To determine the probability of customers in the queuing system and service being busy.
- To balance the cost of offering the service and the cost incurred due to delay in offering service.

1.3 Project Requirements

1.3.1Hardware Requirements

Processor -Pentium P4 1.8GHz

Memory -4GB DDR3

HDD -500GB

1.3.2 Software Requirements

Application Software -Visual Studio 2010

Database Software-Microsoft Office Access 2007

Programming Language -Visual Basic.Net

CHAPTER 2

Queuing Theory

2.1 Queuing Theory

Queuing theory can be used to determine the level of service.Queuing theory can be applied a wide variety of operational situation. It is extremely useful in predicting and evaluating system performanceQueuing theory has been used for operations research.Traditional queuing theory problems refer to customers visiting a store, analogous to requests arriving at device.Queues are also found in industry , in shops where the machines wait to be repaired at a tool crib where the mechanics wait to receive tools , in a warehouse where parts wait to be used.In general a queue is formed when either units requiring services commonly referred to as customers , wait for service or the service facilities , stand idle , and wait for customers.Queuing theory can be applied to a wide variety of operational situation where this imperfect matching between the customers and service facilities.Queuing theory can be used to determine the level of service that balances the following two conflicting costs..(i)cost of offering the service and (ii)cost incurred due to delay in offering service.The first cost is associated with the service facilities and their operation and the second represents the cost of customer's waiting time.The essential features of queuing system are (1) Input source (or calling population) (2) Queue configuration (3)Queue discipline (4)Service mechanism (or pattern).

2.1.1 Input Source

An input source is characterized by (i)Its size (ii)The attitude of the customers.(iii)The Distribution of arrival times (arrival process)

2.1.2 Queuing Configuration

The queue configuration refers to the number of queues,and their rese pective lengths.The number of queues depend upon the layout of a service system.Thus there may be a single queue or multiple queues.

2.1.3 Queue Discipline

Queue discipline may be " first_ come , first_served(FCFS)" service discipline or last_come ,first_served(LCFS) service discipline.

2.1.4 Service Mechanism (or Pattern)

The service mechanism is characterized by

(i)The arrangement (or capacity) of service facility

.(ii) The distribution of service times.

(iii) Server's behavior

(iv) Management policies.

2.2 Operating Characteristics of Queuing System

The operational characteristics of queuing system for the evaluation of the performance of an existing queuing system and to design a new system are:

1. Expected waiting time in queue.

2. Expected waiting time in system.

3. Expected number of customer in the queue.

4. Expected number of customer in the system(queue length).

5. The server utilization factor (or queuing busy period).

2.3 Probability Distribution in Queuing Systems

It is assumed that customer joining a system arrive in random manner and follow a poisson distribution or equivalently the inter_arrival times obey exponential distribution.

Service times are also assumed to be exponentially distributed.

2.3.1 Distribution of Inter_Arrival Times (Exponential Process)

$P_n=(\lambda t)^n/n!e^{-\lambda t}$,n=0,1,2,…

2.3.2 Distribution of Service Times

$s(t)=\mu e^{-\mu t}$,$0<t<\alpha$

6

2.4 MATHEMATICAL MODEL OF M/M/1 SYSTEM

Model I :{(M/M/1) : (α / FCFS)}Single server ,Unlimited Queue Model

Arrivals are random , and come from the Poisson probability distribution(Markov impute). Each service time is also assumed to be a random variable following the exponential distribution(Markov service).There is one single server in the queue. The queue discipline is First Come First Served , FCFS , and there is no limit on the size of the line.The average arrival and service rates do not change over time .

The process has been operating long enough to remove effects of the initial conditions. M/M/1 - Poisson Arrivals , Exponential Service Time Distribution ,Single Server , Infinite Number of waiting positions. Service times are assumed to be independent of each other and independent of the arrival process.

2.4.1 M/M/1 Model Formulation

L_s = average number of units (customers) in the system (waiting and being served)

= $\lambda/\mu-\lambda$

W_s = average time a unit spends in the system (waiting time plus service time)

= $1/\mu-\lambda$

L_q = average number of units waiting in the queue

= $\lambda^2/\mu(\mu-\lambda)$

W_q = average time a unit spends waiting in the queue

$= \lambda/\mu(\mu-\lambda)$

P_b= utilization factor for the system (i.e.busy period).

$= \lambda/\mu$

P_0= probability of 0 units in the system (that is , the service unit is idle).

$= 1-\lambda/\mu$

2.4.2 M/M/1 queuing systems

Distribution of Arrival Process

$E(N_2) = e^0 + \Sigma\, n.(\lambda\, t)^n/n!e^{-\lambda t}$

General formula,

$E(N_2) = e^0 + 1^1/0!\, e^{-1} + 2^2/1! + \ldots + n^n/(n-1)!\, e^{-n}$

Arrival Rate formula,

$\lambda = e^0 + \Sigma\, n^n/(n-1)!\, e^{-n}$

Distribution of Service Time

$P_n(f)=(\mu t)^n e^{-\mu t}/n!$, n=0,1,2,…

Service Rate Formula ,

$\mu=[e^0 + \Sigma n^n/(n-1)!\, e^{-n}]$.[2].

CHAPTER 3

DESIGN AND IMPLEMENTATION

3.1 System Flow Diagram

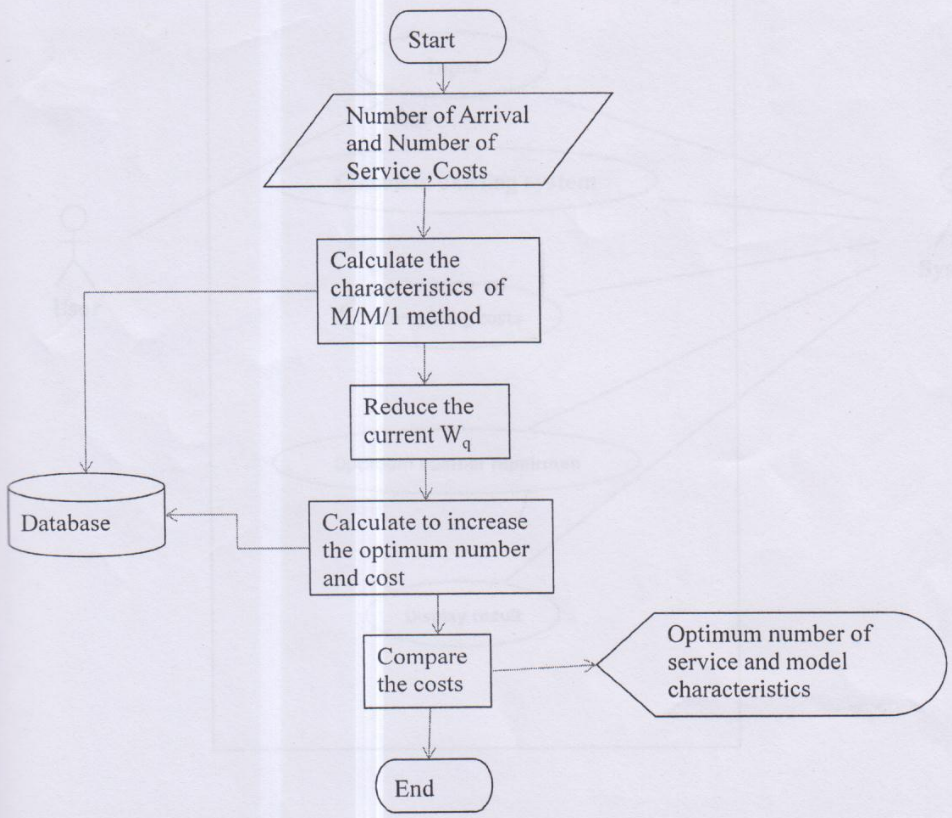

Figure 3.1 : System Flow Digram

3.2 Use Case Diagram

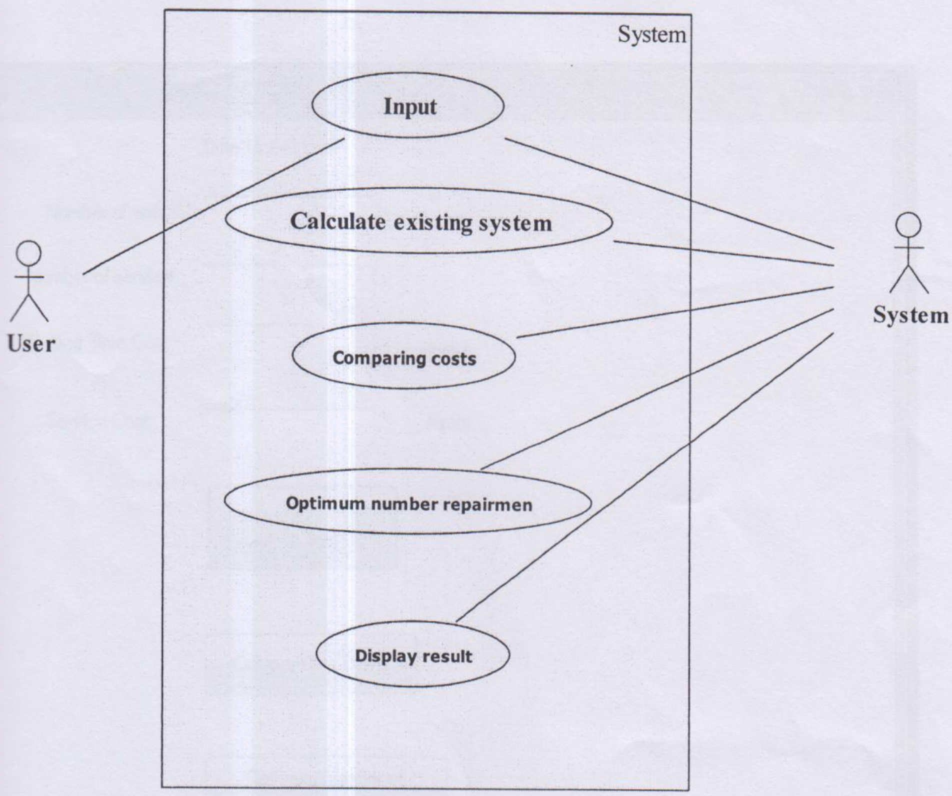

Figure 3.2: Use Case Diagram

3.3 Implementation of The Project

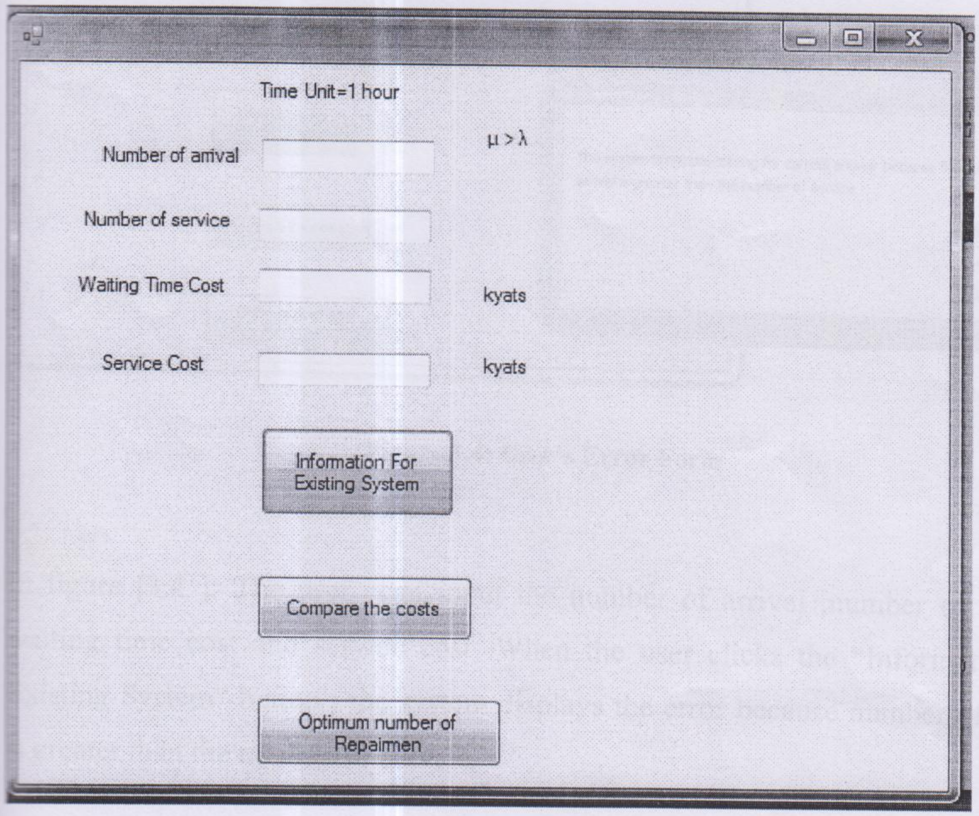

Figure 3.3: Main Form

Figure [3.3] shows the main form for this system.

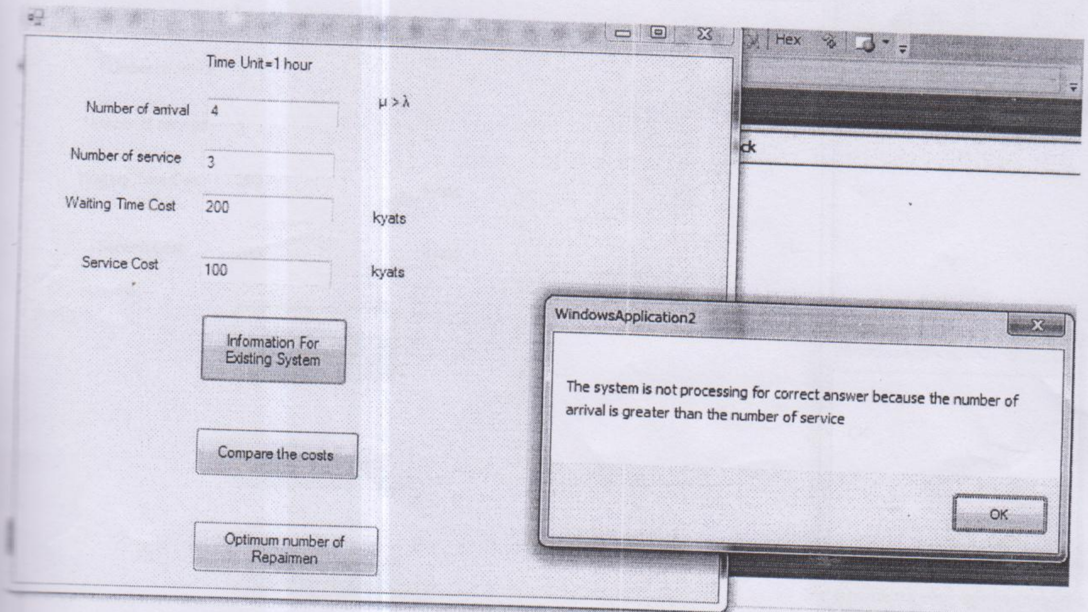

Figure 3.4: User's Error Form

In figure [3.4]: The user can input the number of arrival ,number of service, waiting time cost and service cost .When the user clicks the “Information For Existing System” button , the system displays the error because number of arrival is greater than the number of service.

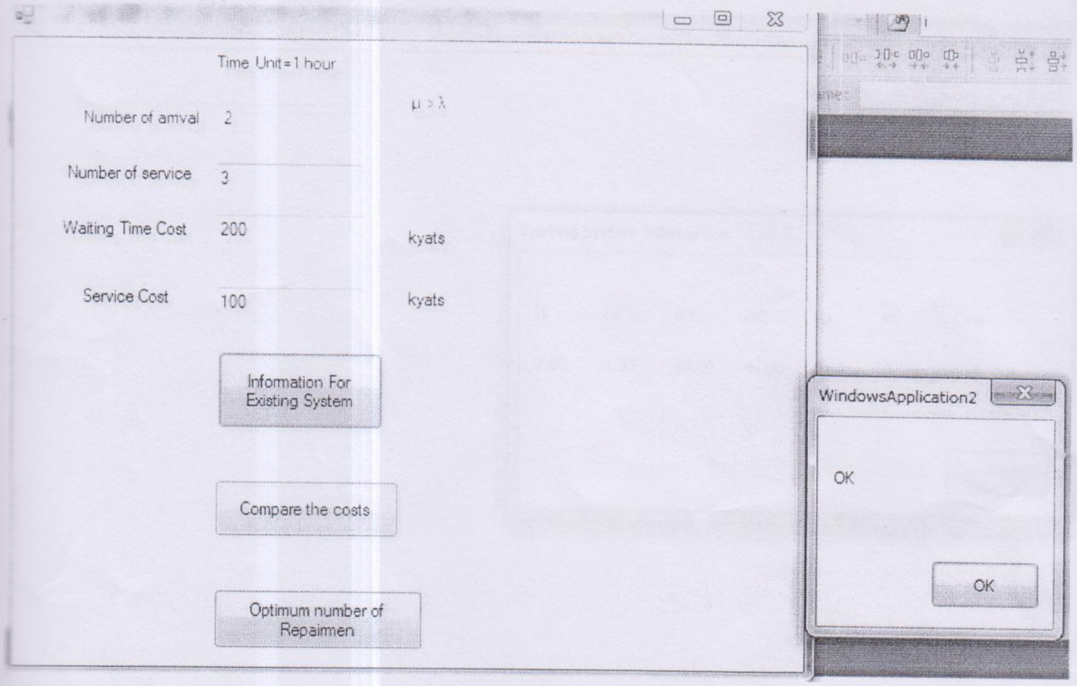

Figure 3.5: Display For User's Correct Input Form

In Figure [3.5]: When the user changes the inputs that the "number of arrival" is lower than the "number of service" and clicks the "Information For Existing System" button , the system displays the "OK".

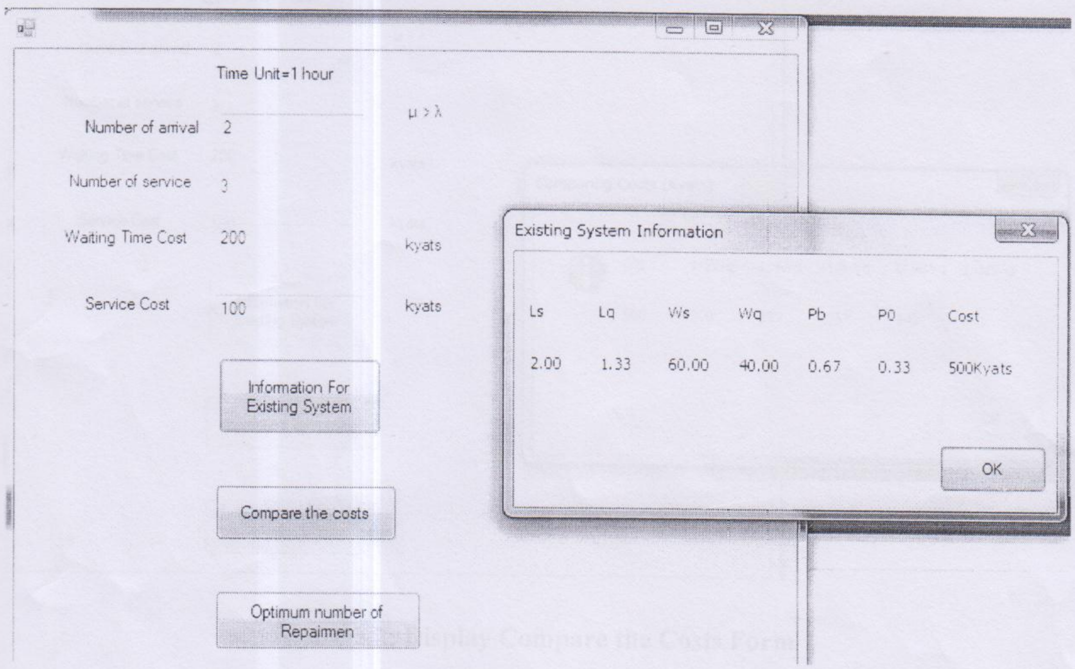

Figure 3.6: Display Information For Existing System Form

In Figure [3.6] :When the user clicks the "Information For Existing System" button, if the user inputs are correct ,the system shows the calculation of characteristics of M/M/1 model (correct results).

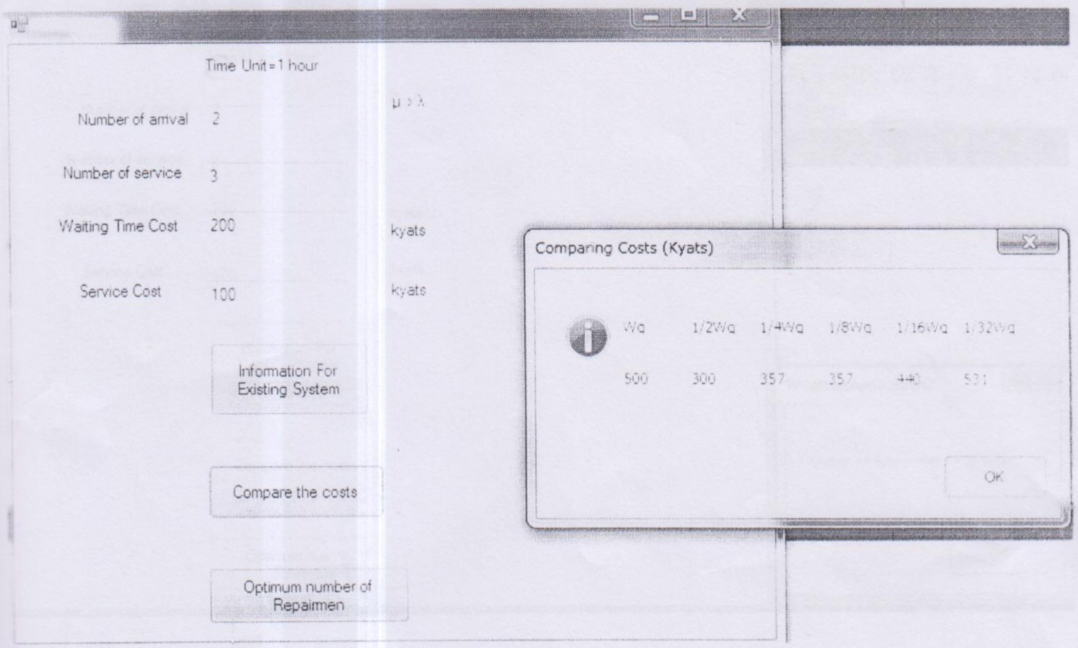

Figure 3.7: Display Compare the Costs Form

In Figure [3.7]: When the user clicks the "Compare the costs" button and the system shows the costs of comparing in reducing the current waiting times (Comparing Costs (Kyats)) .

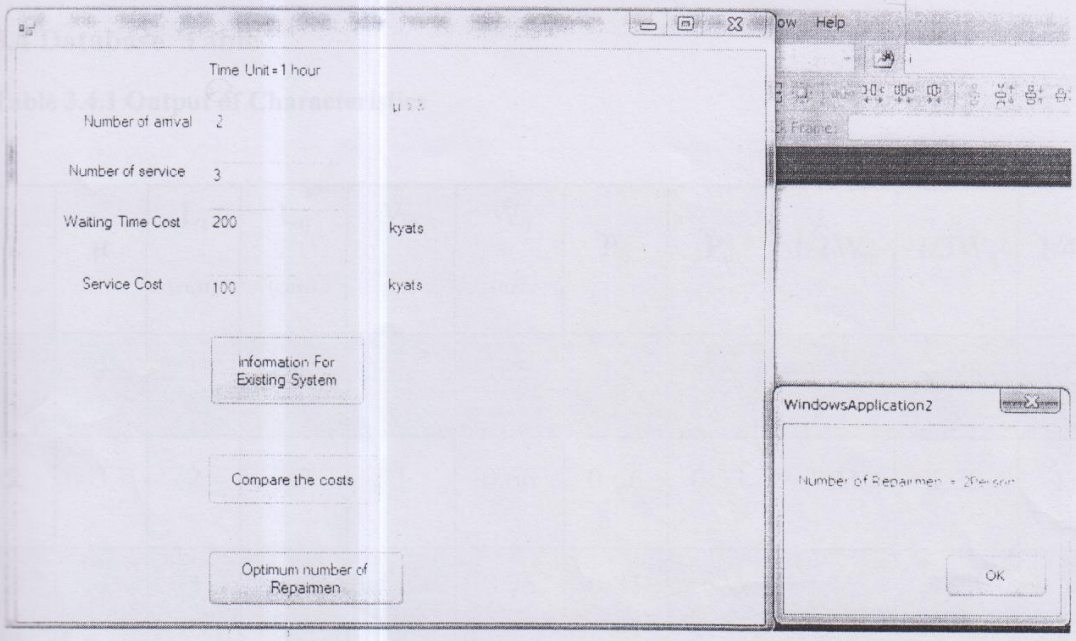

Figure 3.8: Display Optimum Number Repairmen Form

In Figure [3.8]: When the user clicks the "Optimum number of Repairmen" button, the system displays the result that is the optimum number of repairmen.

3.4 Database Table

Table 3.4.1 Output of Characteristics

λ	μ	L_s (cust)	L_q (cust)	W_s (hr)	W_q (hr)	P_b	P_0	$1/2W_q$	$1/3W_q$	$1/4W_q$
1	2	1	0.5	1	0.5	0.5	0.5	1.15	1.28	1.5
2	3	2	1.3	1	0.66	0.66	0.33	1.21	1.33	1.53
3	4	3	2.5	1	0.75	0.75	0.25	1.17	1.31	1.5
4	5	4	3.2	1	0.8	0.8	0.2	1.15	1.27	1.37
5	6	5	4.16	1	0.83	0.83	0.16	1.13	1.27	2.01
6	7	6	5.14	1	0.85	0.85	0.14	1.11	1.24	1.38

Table 3.4.2 Costs for Existing & New System

N0. of service			**Optimum No. of server**
1	2	3	
30Kyats	34Kyats	43Kyats	2
50Kyats	30Kyats	36Kyats	2
70Kyats	32Kyats	37Kyats	2
90Kyats	34Kyats	33Kyats	2
110Kyats	34Kyats	38Kyats	2
130Kyats	35Kyats	38Kyats	2

CHAPTER 4

CONCLUSION

4.1 Conclusion

This project can retrieve the customer in waiting time , service waiting time , cost and number of repairmen. This project determines the optimum number of repairmen. As this system uses Markov Model1(M/M/1) , to minimize the sum of the costs of waiting and the cost of providing service facilities. By using queuing process to save the customer waiting time. The owner is known to increase the number of repairmen by comparing the cost(existing system cost and new system cost).The customer is satisfied this service because the waiting time is reduced.

4.2 Advantages of the project

This system can reduce waiting time and determine the optimum number for repairmen. By using this system , the importance of queuing process can be known. By comparing the costs according to service facilities , whether the repairmen is increased or not ,can be decided. The customer is satisfied for reducing the waiting time.

4.3 Limitation and Further Extension

4.3.1 Limitation

This system should have the number of arrival rate is less than the number of service rate. This system has one repairman and can be increased the number of repairmen. Only one server can be used in Model Formulation. Any more service facilities can be used for further calculation.

4.3.2 Further Extension

The system can select the suitable employee for the specified post the bank. It can extend to select the suitable employee for the specified .Moreover , the system can implement the extension of the rules add to the identifying rules.