CHAPTER 1
INTRODUCTION

1.1 Introduction

Nobody likes to be kept waiting. It's boring, wastes time, and is sometimes physically uncomfortable. Waiting for a service process is an almost universal phenomenon like the bank. Every organization faces the problem of waiting lines somewhere in its operation. Actually, waiting in lines is part of everyday life. Whether it is waiting in line at a grocery store to buy deli items , waiting in line at the bank for a teller, or waiting at an amusement park to go on the newest ride, we spend a lot of time waiting. Your wait is a result of the number of people served before you, the number of servers working, and the amount of time it takes to serve each individual customer. Waiting time is affected by the design of the waiting line system. A waiting line system (or queuing system) is defined by two elements: the population source of its customers and the process or service system itself. In this project we studied the current position in (Jumhouria Bank). We determined the waiting time from the customer inside this service sector by using the Arena software and suggested the solution to reduce it [1].

1.2 Statement of the Problem

The case study was carried out at a Jumhouria Bank that services people who are working for Benghazi University. Some work is done manually by the operators such as checking the customer's check. Appendix 3 shows some pictures that show the services inside the bank. Workers in this bank are working from 9 am to 2 pm 5 days a week. In this research we used the Arena Software to simulate the current system to determine the waiting time and suggest solutions to reduce it.

1.3 Objectives

1. To determine the time that customer spends inside the bank.
2. To suggest good solutions for reducing waiting time.

1.4 Research Questions

This study will answer the following research questions:

i) What are the sources of problems that faced by customers?
ii) What are the main problems in the bank?
iii) How can this bank be improved to meet customer needs?

1.5 Scope of the Study

The case study was carried out at a Jumhouria Bank. This study will only determine the waiting time for customer.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

The Jumhouria bank and service sectors have been facing frequent service delays to their customers a bad experience for its clients. One of the reasons behind this is the queuing system prevailing in this sector. Waiting is inevitable in any service organization. Hence queues are formed. A long queue makes customer dissatisfied whereas increasing servers to decrease the length of a queue increases costs.

2.2 Elements Of Waiting Lines

Any time there is more customer demand for a service than can be provided, a waiting line occurs. Customers can be either humans or inanimate objects. In a waiting line system, managers must decide what level of service to offer. Allow level of service may be inexpensive, at least in the short run, but may incur high costs of customer dissatisfaction, such as lost future business and actual processing costs of complaints. A high level of service will cost more to provide and will result in lower dissatisfaction costs. Because of this trade-off, management must consider what is the optimal level of service to provide [2].

2.3 The Customer Population

The customer population can be considered to be finite or infinite. When potential new customers for the waiting line system are affected by the number of customers already in the system, the customer population is finite. When the number of customers waiting in

line does not significantly affect the rate at which the population generates new customers, the customer population is considered infinite [2].

2.4 The Service System

The service system is characterized by the number of waiting lines, the number of servers, the arrangement of the servers, the arrival and service patterns, and the service priority rules.

The Number of Waiting Lines: Waiting line systems can have single or multiple lines. Banks often have a single line for customers. Customers wait in line until a teller is free and then proceed to that teller's position.

The Number of Servers System: serving capacity is a function of the number of Service facilities and server proficiency. In waiting line systems, the terms server and Channel are used interchangeably. It is assumed that a server or channel can serve one customer at a time [2].

2.5 Arrival and Service Patterns

Waiting line models require an arrival rate and a service rate. The arrival rate specifies the average number of customers per time period. The service rate specifies the average number of customers that can be serviced during a time period. The service rate is the capacity of the service system. If the number of customers you can serve per time periods less than the average number of customers arriving, the waiting line grows infinitely. You never catch up with the demand! It is the variability in arrival and service patterns that causes waiting lines. Lines form when several customers request service at approximately the same time. This surge of customers temporarily overloads the service system and a line develops. Waiting line models that assess the performance of service systems usually

assume that customers arrive according to a Poisson probability distribution, and service times are described by an exponential distribution.[2]

2.6 Waiting line performance Measures

Performance measures are used to gain useful information about waiting line systems. These measures include:

1. The average number of customers waiting in line and in the system. The number of customers waiting in line can be interpreted in several ways. Short waiting lines can result from relatively constant customer arrivals (no major surges in demand) or from the organization's having excess capacity (many cashiers open). On the other hand, long waiting lines can result from poor server efficiency, inadequate system capacity, and/or significant surges in demand.

2. The average time customers spend waiting, and the average time a customer spends in the system. Customers often link long waits to poor-quality service. When long waiting times occur, one option may be to change the demand pattern. That is, the company can offer discounts or better service at less busy times of the day or week. For example, a restaurant offers early-bird diners a discount so that demand is more level. The discount moves some demand from prime-time dining hours to the less desired dining hours.

3. The system utilization rate. Measuring capacity utilization shows the percentage of time the servers are busy. Management's goal is to have enough servers to assure that waiting is within allowable limits but not so many servers as to be cost-inefficient [2].

2.7 Introduction to Simulation

2.7.1 Simulation defined

Simulation is one of the most powerful analysis tools available to those responsible for the design, analysis, and operation of complex processes or systems. In an increasingly competitive world, simulation has become a very powerful tool for the planning, design, and control of systems. It is viewed today as an indispensable problem-solving methodology for engineers, designers, and managers [3].We will define simulation as the process of designing a model of a real system and conducting experiments with this model for the purpose of understanding the behavior of the system and/or evaluating various strategies for the operation of the system. We consider simulation to include both the construction of the model and the experimental use of the model for studying a problem. Thus, you can think of simulation modeling as an experimental and applied methodology that seeks to accomplish the following: describe the behavior of systems, construct theories or hypotheses that account for the observed behavior, and use the model to predict future behavior; i.e., the effects produced by changes in the system or aim its method of operation. The terms "model" and "system" are key components of our definition of simulation. By model, we mean a representation of a group of objects or ideas in some form other than that of the entity itself. By system, we mean a group or collection of interrelated elements that cooperate to accomplish some stated objective. We can simulate systems that already exist and those that can be brought into existence; i.e., those in the preliminary or planning stage of development.

2.7.2 Advantages of simulation

Because its basic concept is easy to comprehend, a simulation model is often easier to justify to management or customers than some of the analytical models. In addition, simulation might have more credibility because its behavior has been compared to that of the real system or because it has required fewer simplifying assumptions and thereby has captured more of the true characteristics of the real system [3].

2.7.3 Arena Software

Arena software enables you to bring the power of modeling and simulation to your business. It is designed for analyzing the impact of changes involving significant and complex redesigns associated with supply chain, manufacturing processes, logistics, distribution and warehousing, and service systems. Arena software provides the maximum flexibility and breadth of application coverage to model any desired level of detail and complexity.

Typical scenarios include: [4]

a) Detailed analysis of any type of manufacturing system, including material-handling components
b) Analysis of complex customer service and customer management systems
c) Analysis of global supply chains that include warehousing, transportation, and logistics systems
d) Predicting system performance based on key metrics such as costs, throughput, cycle times, and utilizations
e) Identifying process bottlenecks such as queue build ups and over-utilization of resources
f) Planning staff, equipment, or material requirements.

In addition to the Arena Professional Edition, Rockwell Software offers a full suite of products to provide enterprise-wide simulation, optimization, and 3D model animation. Arena software is designed for manufacturing or business process consultants and analysts and industrial or systems engineers. It is typically deployed as an enterprise business analysis and productivity tool [4].

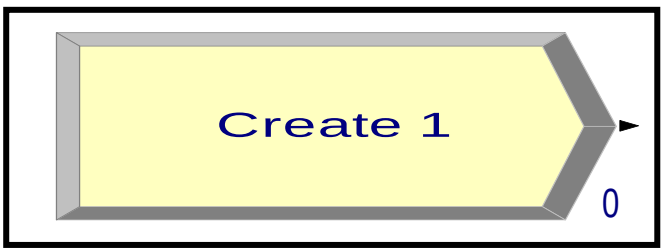
2.7.4 Statistical Distributions

Arena contains a set of built-in functions for generating random numbers from the commonly used probability distributions. These distributions appear on pull-down menus in many Arena modules where they're likely to be used. They also match the distributions in the Arena Input Analyzer.. Each of the distributions in Arena has one or more parameter values associated with it. You must specify these parameter values to define the distribution fully. The number, meaning, and order of the parameter values depend on the distribution. To enter a distribution in an Arena field, you type the name of the distribution (or its four-letter abbreviation) followed by its parameters enclosed in parentheses. [4].

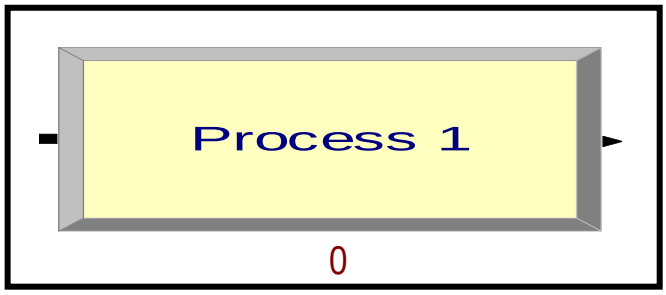
2.8 Some modules that are used for building the models.[4].

In Arena, modules are the flowchart and data objects that define the process to be simulated. All information required to simulate a process is stored in modules.

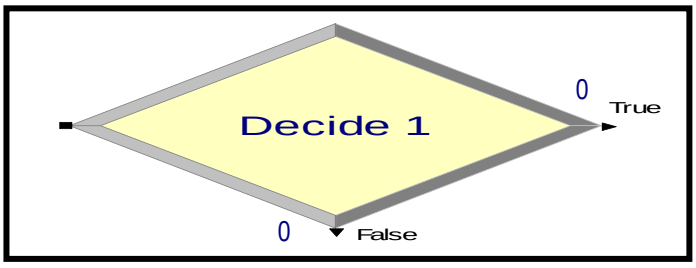
Create: The start of process flow. Entities enter the simulation her



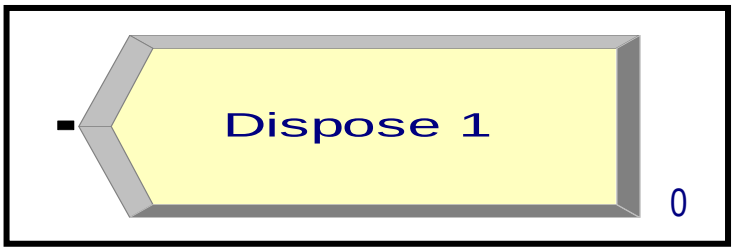
Process: An activity, usually performed by one or more resources and requiring some time to complete.



Decide: A branch in process flow. Only one branch is taken.



Dispose: The end of process flow. Entities are removed from the simulation here.



CHAPTER 3:
RESEARCH METHODOLGY

3.1 Introduction

This chapter gives an overview on the design of the study. It discusses the project design, the setting of the study, the instrument, the data collection and analysis.

3.2 Overall Methodology

The goal of the project is to reduce waiting time inside service sector which is Jumhouria Bank "Benghazi University branch". So that the Customers can finish their needs in good work conditions with less problems.

Firstly, we visited the Jumhouria Bank three times which were in the first and the middle and the end of the month. We collected the suitable data for constructing our models. We used Arena software package for analyzing the data.

Secondly, we constructed the models that helped us for calculating the waiting time for customers.

Thirdly, we gave our solutions to reduce the waiting times and provide customers with good services.

The next chart shows the main steps that we did in our project.

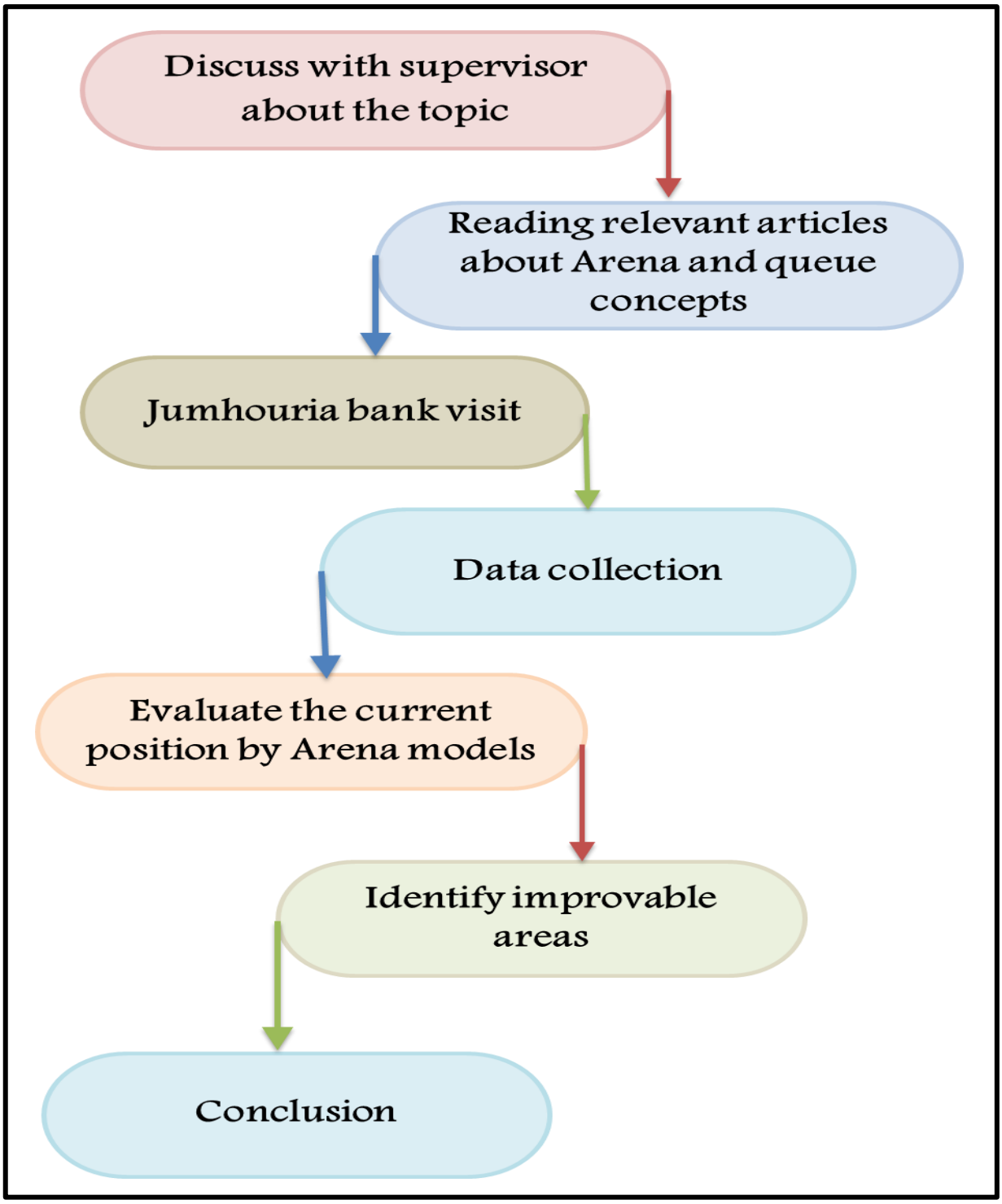


Fig 3.1 Methodology flow chart

3.3 Selection of Respondents

This study will focus on customers who are visiting Jumhouria Bank Benghazi university branch only.

3.4 study tools

The instruments used for this research are Arena software package version 12.

3.5 Jumhouria Bank information

In the framework of implementing the strategy adopted by Central Bank of Libya to restructure, develop and update the Libyan banking sector in order to improve the banking services at the local and international level, and according to the conclusions of the general meetings of both Uma & Jumhouria Banks concerning the amalgamation in a combined banking unit, based on the decision of the board of directors of Central Bank of Libya No.74 -2007 to approve this, and the Central Bank of Libya decision No. 8-2008 to consider that as cases mentioned in the article 62 of the law of the banks, the decision of amalgamation has been issued in a combined bank under the name of Jumhouria bank. Its works as a huge banking entity started at the beginning of the second quarter of 2008 with a budget of 11 billion dinars and 146 branches & Agencies, (5,807) employees, which contributed directly to provide funding to the small & medium projects for both public and privet sectors and to widen the funding of the international trade to encourage the Import & Export. It is one of the biggest Libyan banks, since make a huge contribution in the banking activity and will rank among the top ten bank in the middle East & North Africa region, all its activities will be in compliance with the Libyan commercial law and the approved regulations of its articles of association and the laws governing the works of the Libyan banks, supervised by the Central Bank of Libya.

The shares of the bank had been put for the public subscription to widen the ownership base and to encourage the individuals to get the normal shares in the Capital of the bank which had contributed to deal in the shares of the bank at the Libyan stock market, whereby the capital has raised to 1 billion Libyan Dinars. The bank uses its Articles of association as a framework in all its operations for attracting and making fund available, in addition to the Central Bank of Libya directives to present the necessary funding for the development projects, shared by the bank, the headquarters of the General Administration of the bank is located in Tripoli, its branches are widespread in the country and present the best & modern banking services to all dealer in different areas of Libya. Jumhouria bank seeks to provide services to all the shareholders, especially the existing and the prospective customers enabling them to get the developed products & services with quality thus increasing their satisfaction through the facilitation of the procedures and the dealing of a wide network of branches locally, from another hand, the administration of the bank acts on the training of the manpower to improve the performance level, to cope with the latest development in the banking industry, to ensure the attainment of good levels of scientific & practical awareness, being capable to match the technological requirements era, through the continuous training locally & abroad.

The bank offers a set of banking services, among them are:

1. Opening of current accounts, deposit & saving accounts and the acceptance of all the available funding.
2. Opening of the documentary credits, accept foreign documents for collection to encourage the international trade operations.
3. Issuance of the local & foreign letters of Guarantees.
4. Foreign Transfer operations for nationals & non-residents.
5. Issuance of the ATM cards.
6. Offering of real estate, commercial and social loans and granting credit facilities to all categories of customers
7. Contribution in funding the real estate & investment projects.

8. Hiring of safe boxes.
9. Selling & purchasing foreign currency.
10. Providing technical & financial studies & consultancies.

The bank endeavor to develop same of the traditional services to become electronic, since a number of banking services have to be provided in an electronic form, whereby, a large number of ATMs had been operated, and a launch of the service of the points of sale, SMS service through mobile sets and the money transfer through the Western Union network [5].

Jumhouria Bank have the largest network of branches distributed in Libya exceeding 140 branches in addition to a network of Automatic Teller Machines available in the most of our bank branches [5].

CHAPTER 4
DATA COLLECION AND ANALYSIS

4.1 Introduction

The Jumhouria bank was selected as a real case study to conduct the simulation study. The purpose of this study to determine the waiting time and simulate the system by using arena software.

4.2 Current Branch Service Delivery Process

The Jumhouria bank "Benghazi university' branch" is working five days during the week which are from Sunday to Thursday. The working hours from 9 am till 2pm. In this bank the customers deal with three servers who check the instrument or ask for any help first then the customers will go to one of three windows to get their money

4.3 Data Collection

The data was collected from 8:30 am until 2:00 pm,.the Appendix 1 shows the data that we collected and used in arena software.

4.4 Fitting the data that need it to construct the models

After we collected the data now we should know the distribution for each data that we need to construct our model. First we will start with arrival time data.

4.4.1 Fitted distribution for arrival time

The data of arrival time follows the lognormal distribution with parameters (mean = 7.82,variance = 9.94). The next figure shows the distribution that we got.

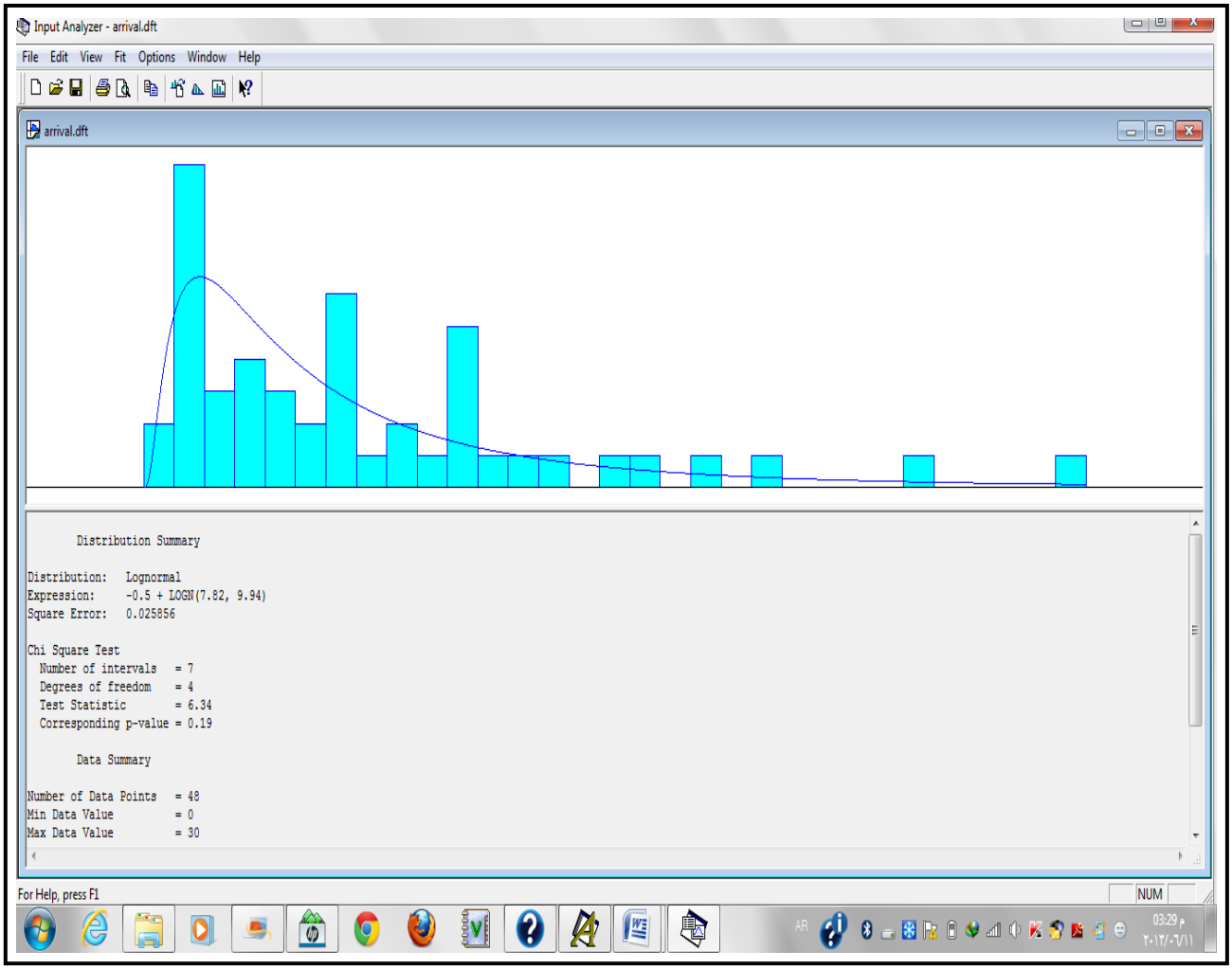


Fig.4.1 Arrival time distribution

4.4.2 Fitting distribution for Service1

The data for service1 follows lognormal distribution with parameters (mean = 3.21, variance = 4.13). The next figure shows the distribution for servic1 which is (customers check their account)

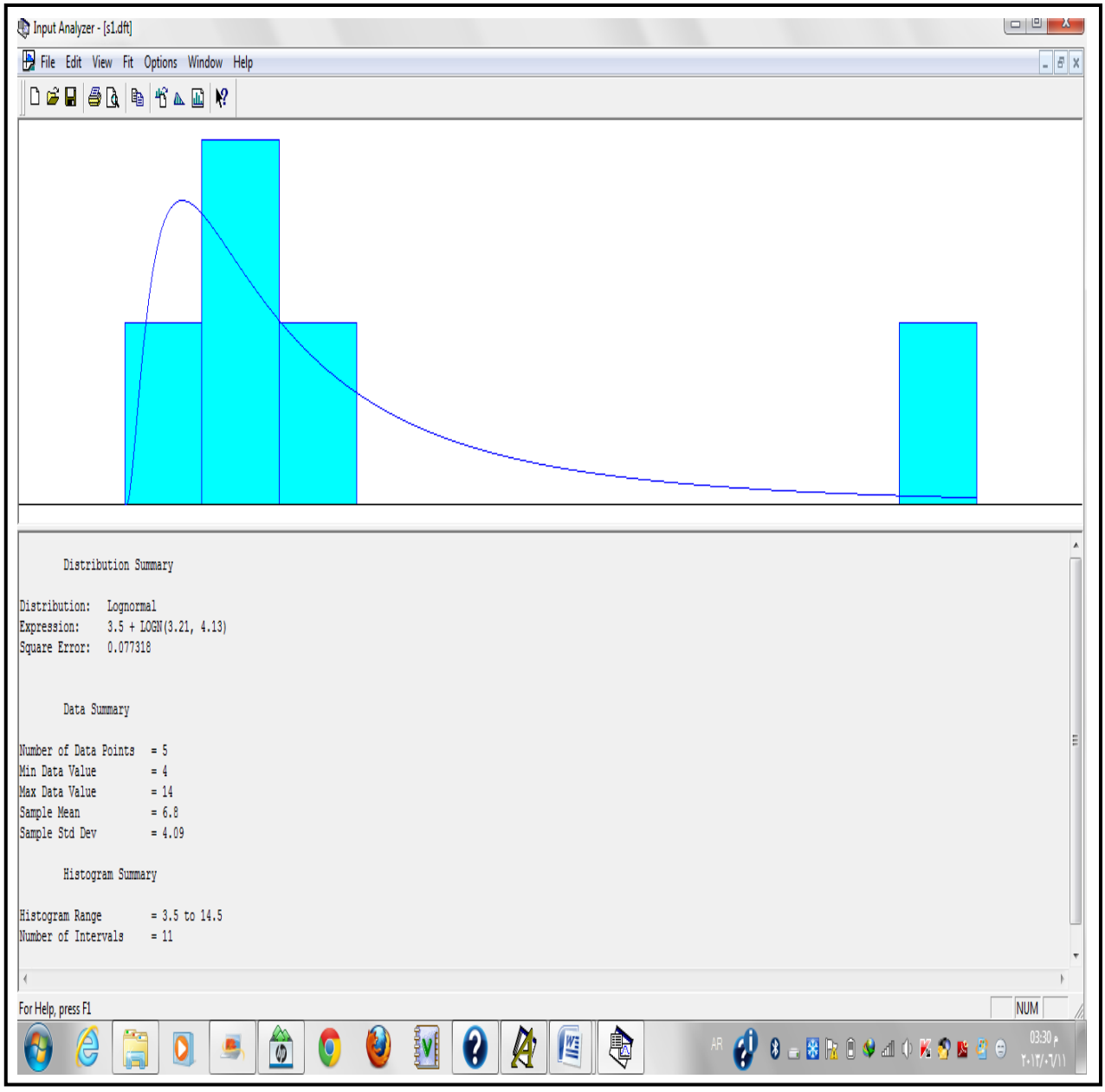


Fig.4.2 The service2 distribution

4.4.3 Fitted distribution for Service2

The data for service2 follows Beta distribution with parameters (Beta = 0.234,0. Alpha = 226) ,the next figure shows the dist for servic2 which is same as service1 customers check their account.

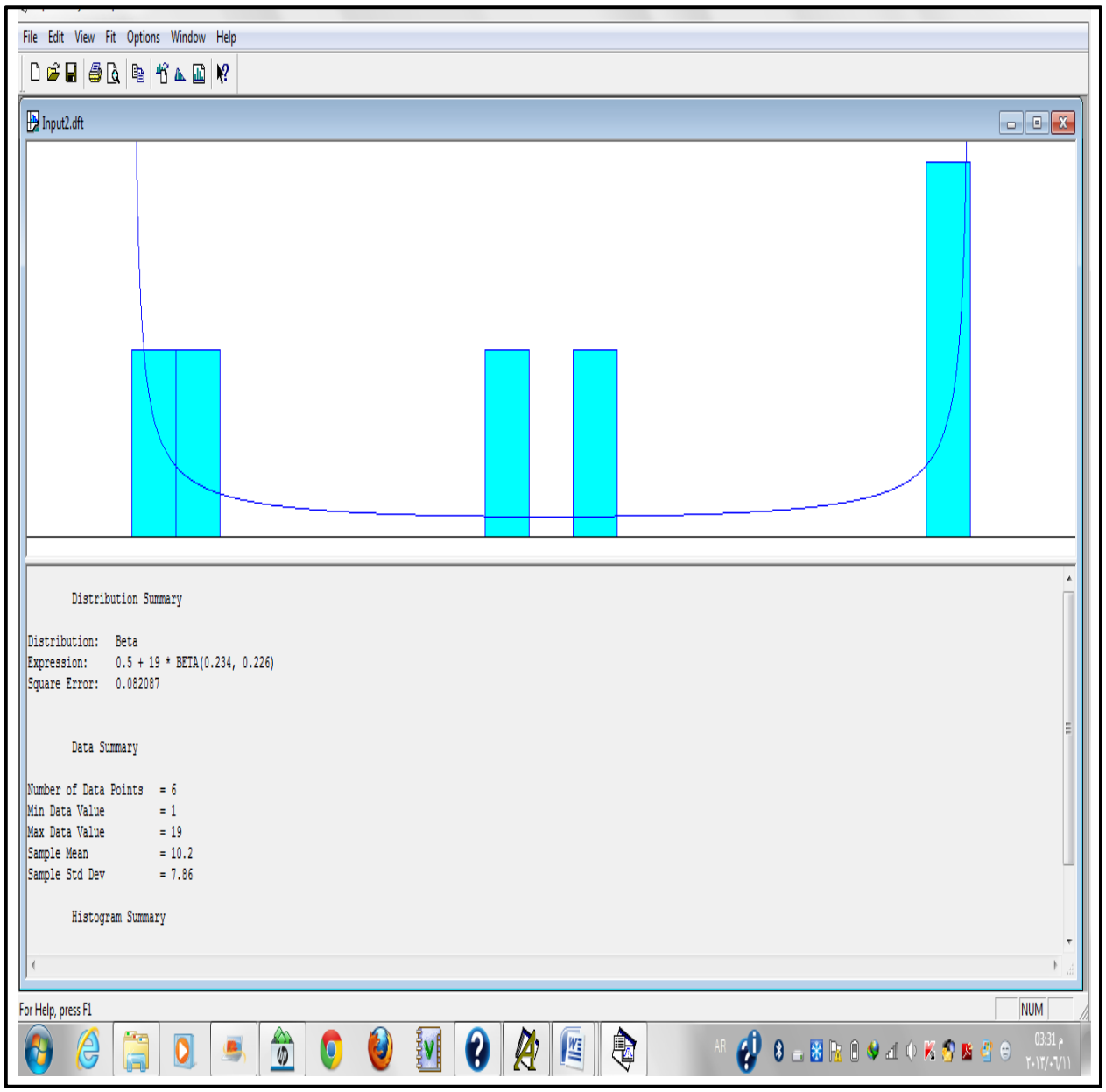


Fig.4.3 The service2 distribution

4.4.4 Fitted distribution for Service3

The data for service3 follows Lognormal distribution with parameters (mean = 11.5,varince = 33.8). The next figure shows the distribution for servic3 which is same as service1and 2 customers check their account.

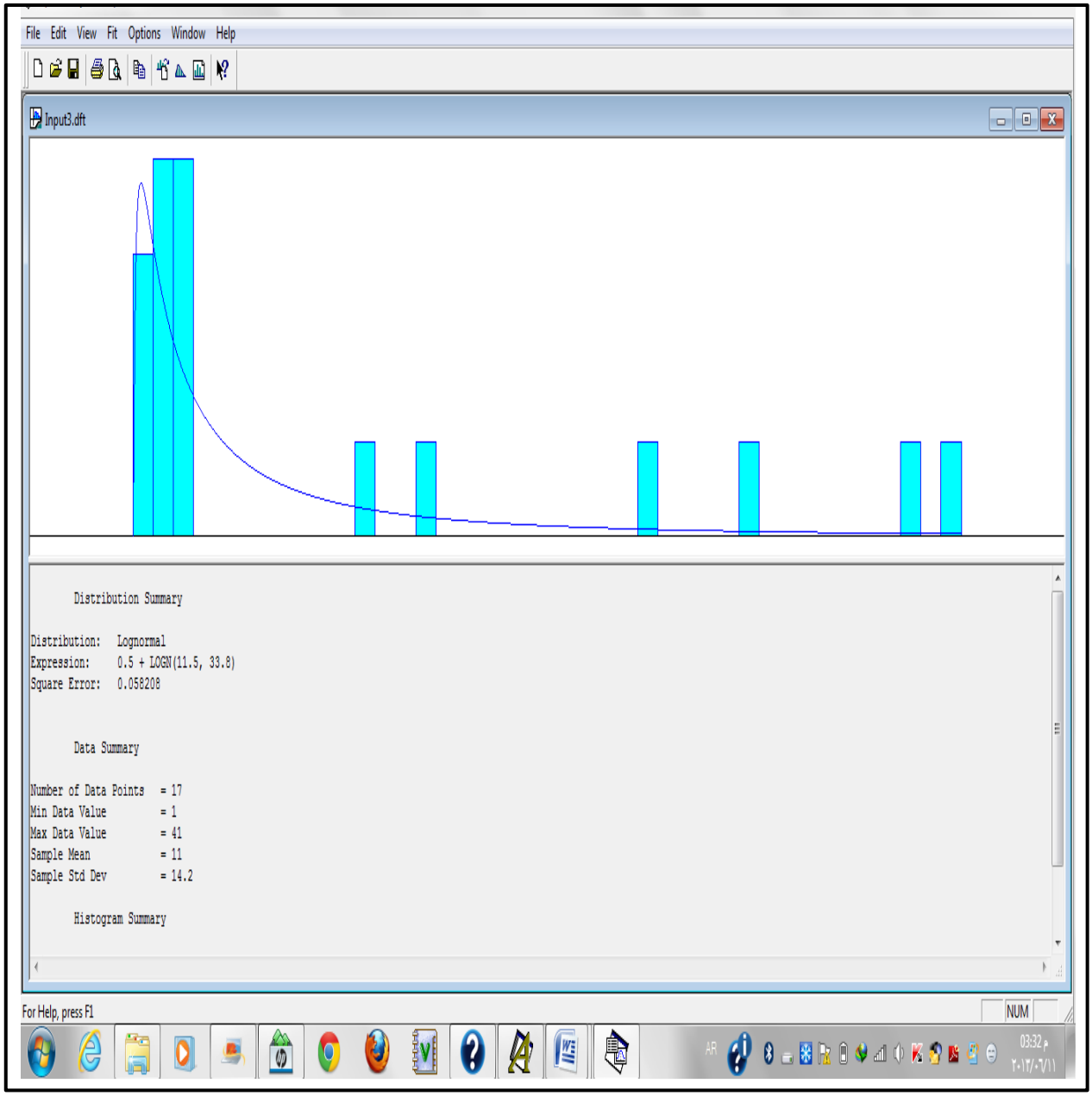


Fig.4.4 The service3 distribution

4.4.5 Fitted distribution for Service4

The data for service4 follows Beta distribution with parameters (Beta= 0.357,Alpha = 0.378). The next figure shows the distribution for servic4 which is customers draw their money

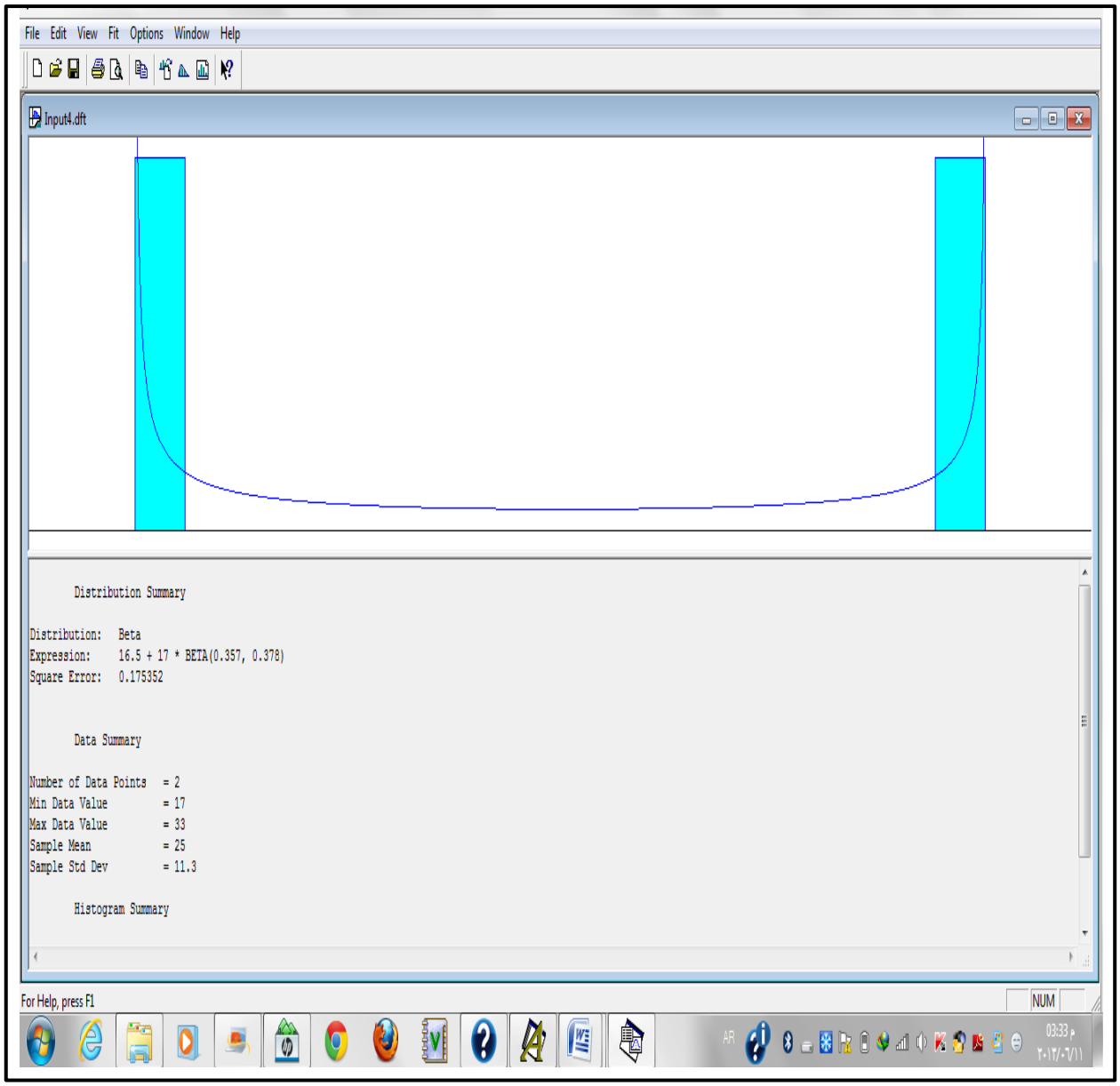


Fig.4.5 The service4 distribution

4.4.6 Fitted distribution for Service5

The data for service5 follows Beta distribution with parameters (Beta = 0.074,Alpha = 0.074), the next figure shows the distribution for servic5 which is as service4 customer draw their money

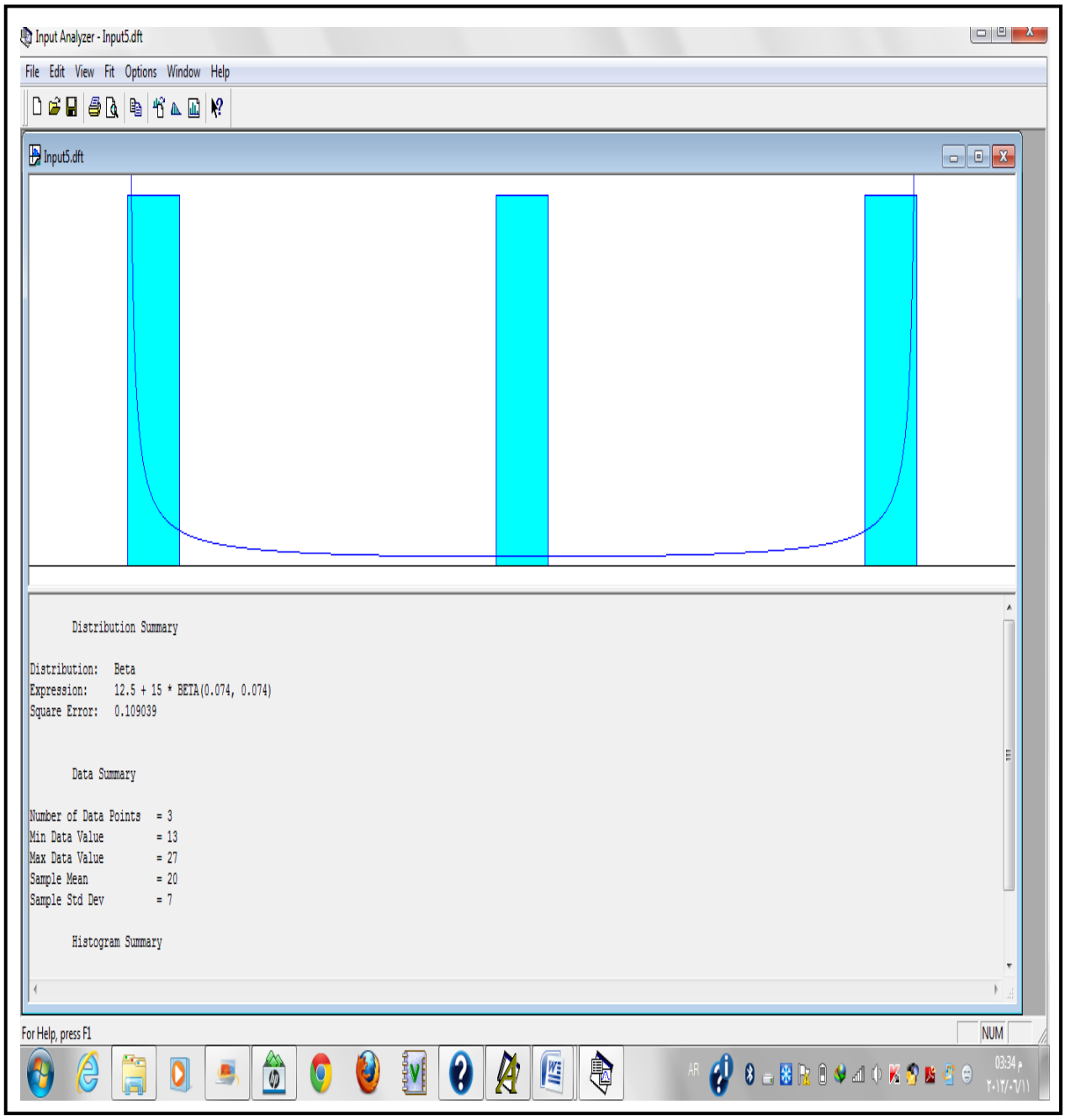


Fig.4.6 The service5 distribution

4.4.7 Fitted distribution for Service 6

The data for service6 follows Gamma distribution with parameters (Beta = 4.39, Alpha = 1.79) ,the next figure shows the distribution for servic6 which is as service 4 and 5 customer draw their money

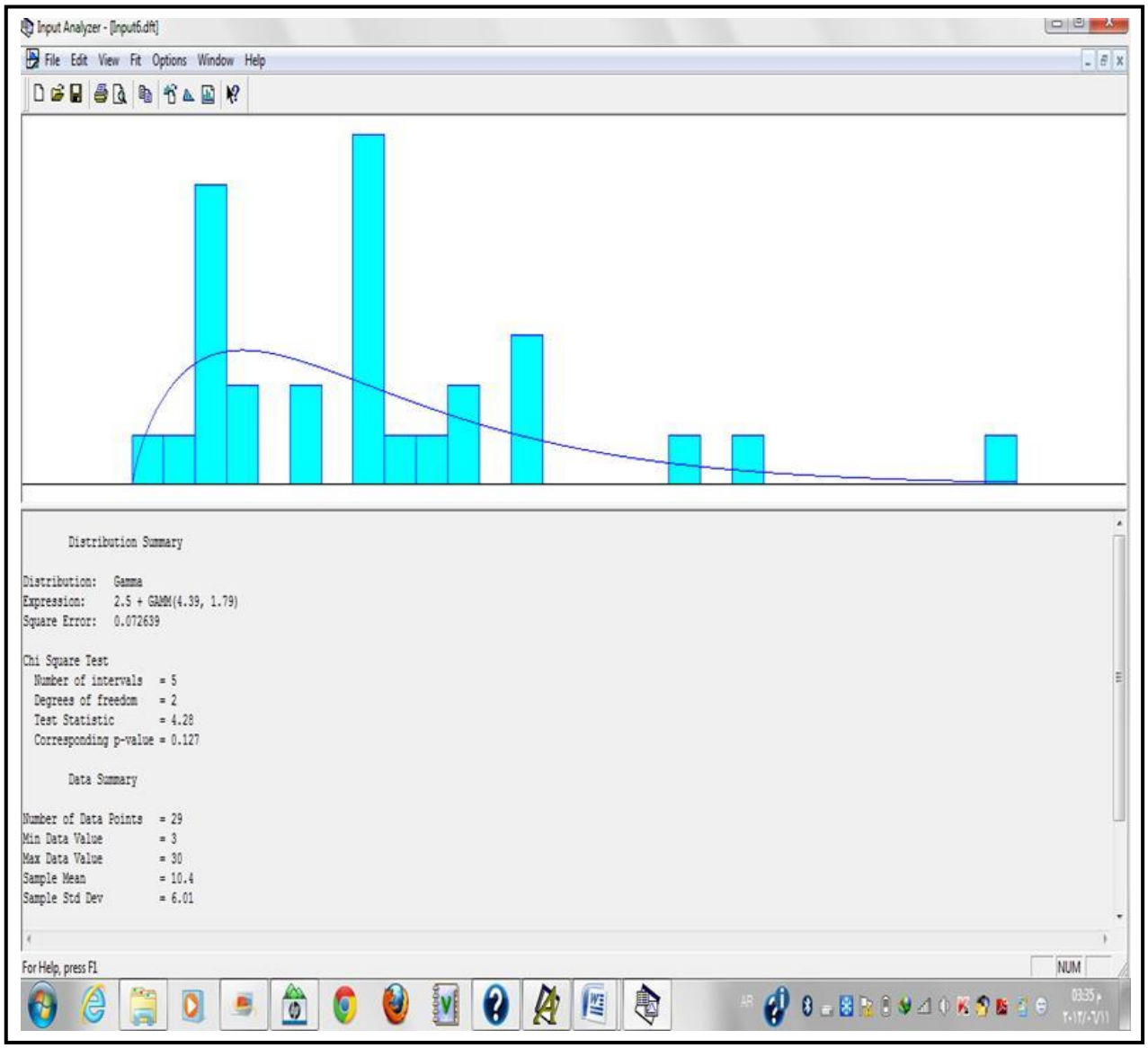


Fig.4.7 The service6 distribution

4.5 constructing the model

As can be seen from the figure 4.8 the customer arrive then he or she will decide where will go to services1,2,3 or services 4,5,6. Some of them go directly to get their money without checking their instruments. Some of them go to services1,2,3 first to cheek their instruments and go to services 4,5,6 to get their money. the next model shows the current position inside the bank.

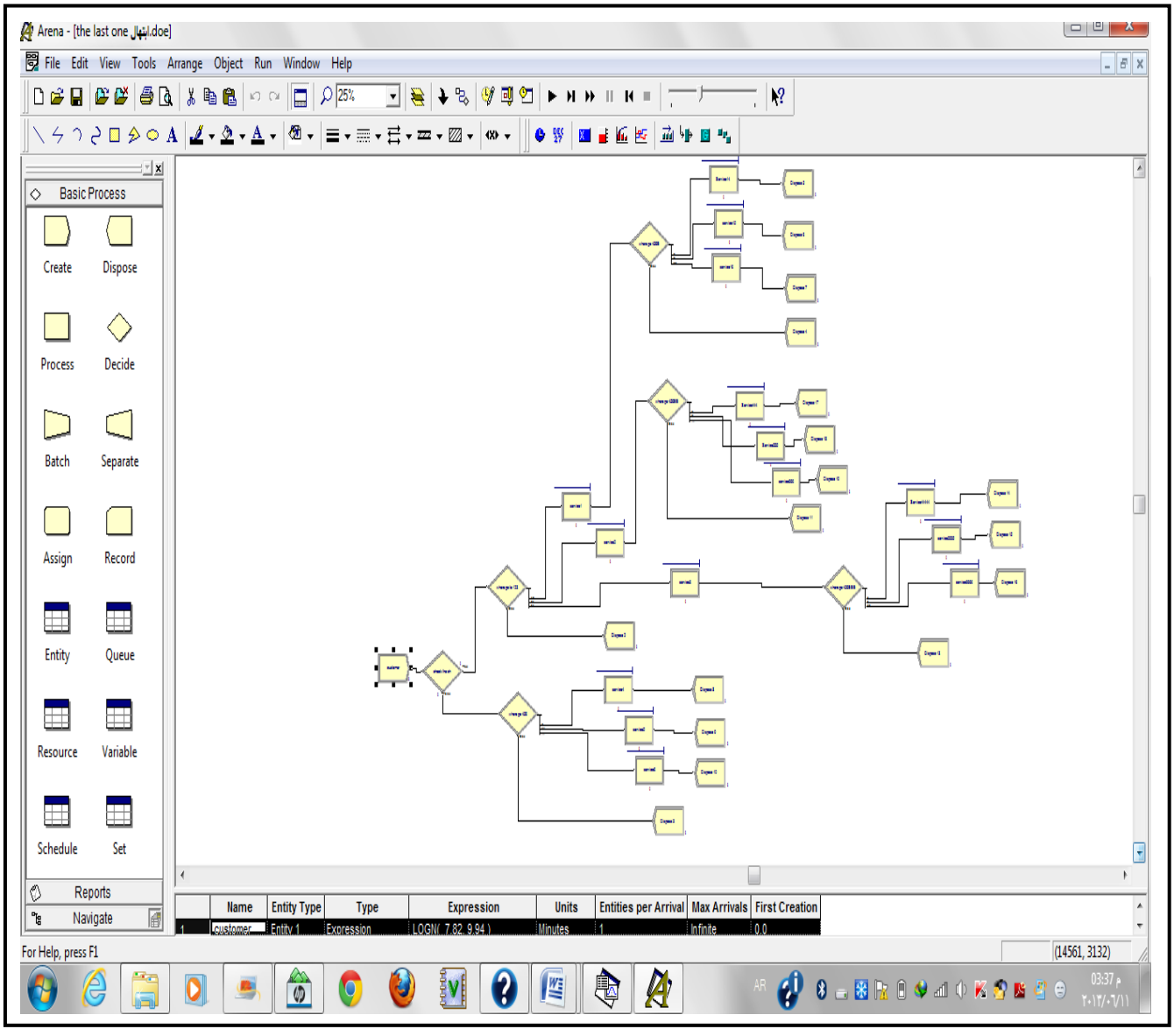


Fig.4.8 Construct model

4.6 Results and discussion

In models that are constructed the length of each simulation replication was setup to be one day for each model, five hours a day[300 minutes], number of replication is 100 replications. In Arena we got a lot of information but we selected the information that we need only. The next table shows the results that are selected.

Table 4.1 the Results

Number of customers IN	**28**
Number of customers OUT	**20**
Waiting time for Service2	**34 minutes**
Waiting time for Service3	**50 minutes**
Waiting time for Service5	**114 minutes**
Waiting time for Service6	**35 minutes**

As can be seen from table above, customers spent more than 30 minutes inside the bank just to get their service or money.

Actually, in this system customers spent a long time to get their services. This will lead to many problems such as customers will be nervous and fight each other just to get their need early. In the next chapter we will suggest our solutions to make this system better.

CHAPTER 5
CONCLUSIONS ADN RECOMMENDATIONS

Actually, after we collecting data and analyzing the current position in the Jumhouria bank we noted that the main problem is that the customers check their instruments first then they go to take their money. This process takes long time and causes long queues. To solve this problem we decided to change the current the system, so customers check and take their money from same place. The next figure show the suggested model for the Jumhouria bank.

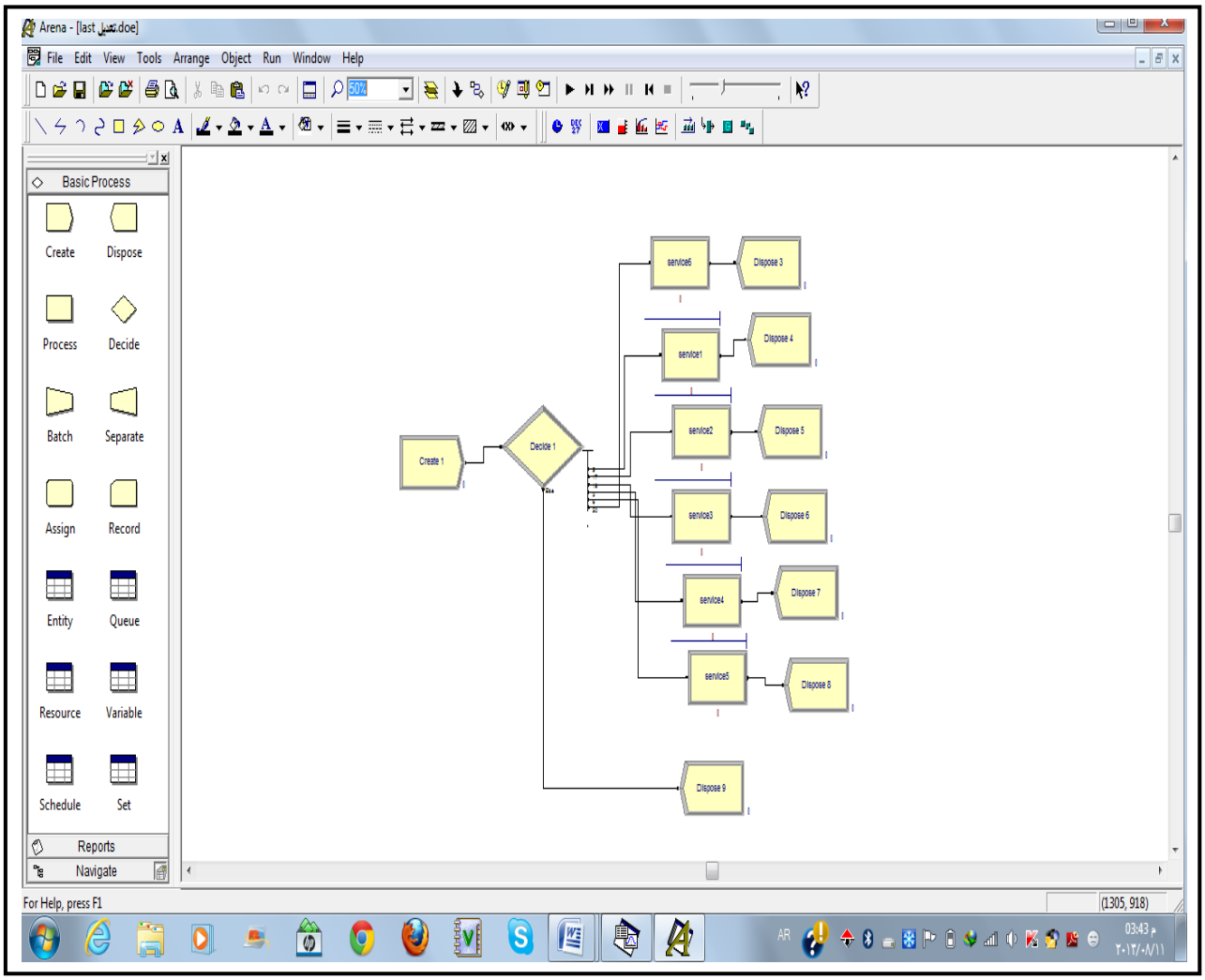


Fig.5.1 The suggested model

From the figure above customers will go for example to service, he or she will check her or his account then draw his or her money after that leave the bank.

After we simulate the new model we got the next results

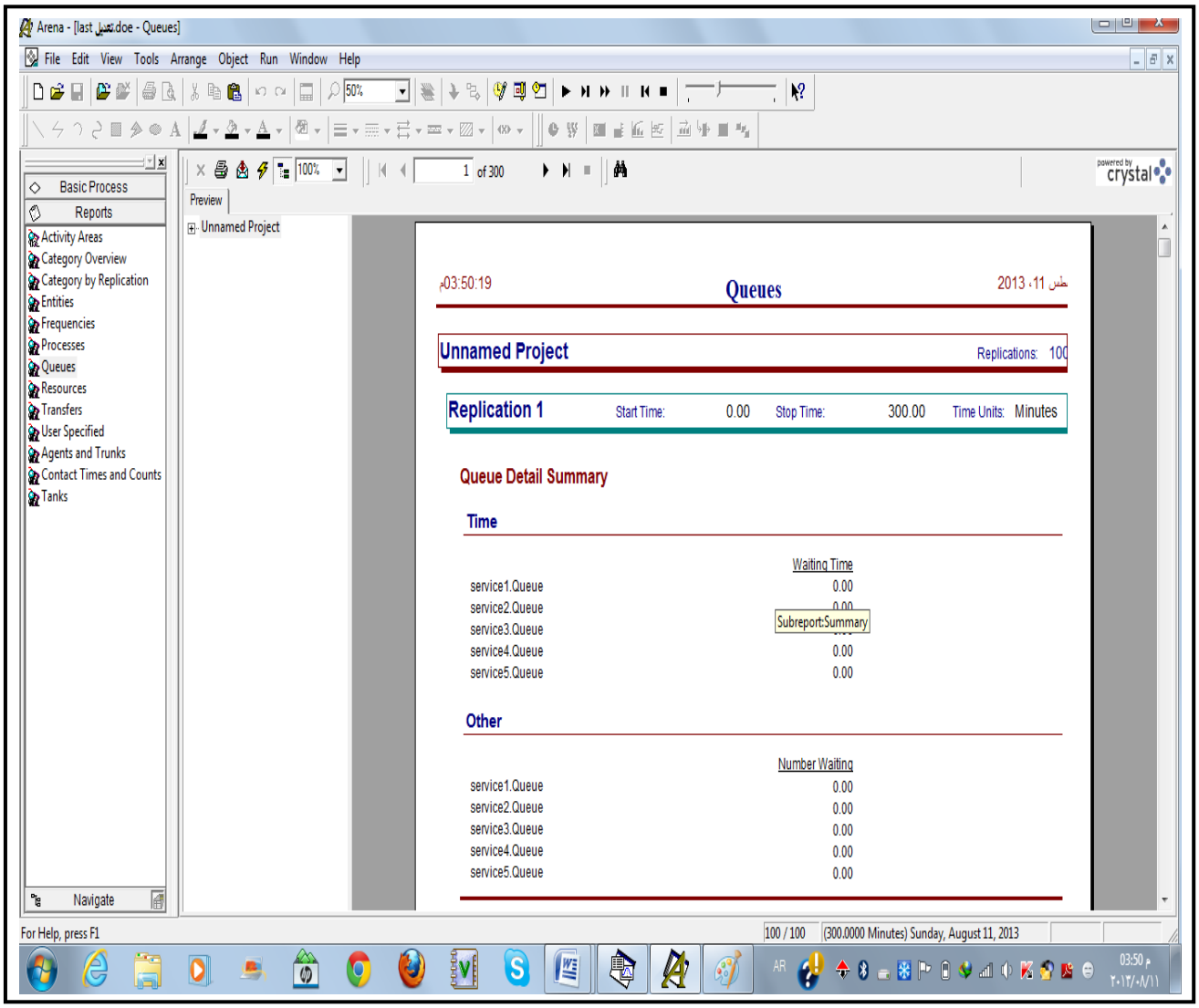


Fig.5.2 results of suggested model

As can be seen from the figure 5.2 above the new system is so good and can help to reduce the waiting time.

The machine money is a good decision but the Jumhouria bank put certain value that can be draw which is 200 LD. For that people who want more than this value must go to inside the bank that leads to increase number of customers. So if the value is increased or made it free what customers need can draw this will reduce the number of customers and decrease the waiting time.

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[3] Dennis Peg den, Randall P. Sadowski, and Robert E. Shannon Introduction to Simulation Using SIMAN, Second Edition (McGraw-Hill, 1995).

[4] User's Guide Publication ARENA-UM001B-EN-P - October 2005 Supersedes Publication ARENA-UM001A-EN-P

[5] http://www.jbank.ly/AboutUs-e.asp

APPENDICES

Appendix 1: the data that we need to construct the models

Cu	*Arrival T*	*Service1*	*Service2*	*Service3*	*Service4*	*Service5*	*Service6*
1	8:48	-	-	8:48-8:49	-	-	8:49-9:00
2	8:49	-	-	8:49-8:52	-	-	9:00-9:15
3	8:55	-	-	-	-	-	9:16-9:26
4	8:56	8:56-9:00	-	-	-	-	9:26-9:36
5	8:50	9:00-9:05	-	-	-	-	9:37-9:50
6	8:53	9:05-9:10	-	-	-	-	9:50-9:56
7	9:01	-	-	9:15-9:17	-	-	9:56-10:18
8	9:06	-	-	-	-	-	10:18-10:23
9	9:06	-	-	-	-	-	10:23-10:38
10	9:17	-	-	-	-	9:17-9:37	-
11	9:20	-	-	-	-	-	10:38-10:48
12	9:33	-	-	9:36-10:15	-	-	-
13	9:39	-	-	10:15-10:56	-	-	-
14	9:49	-	-	-	9:52-10:25	-	-
15	10:19	-	-	-	-	-	10:48-11:00
16	10:20	-	-	-	-	-	11:00-11:10
17	10:08	-	-	10:22-10:24	-	-	11:11-11:19
18	10:24	-	-	10:25-10:27	-	-	11:20-11:28
19	10:27	-	-	10:28-10:40	-	-	11:29-11:39
20	10:28	10:28-10:42	-	-	-	-	-
21	10:30	-	-	10:46-10:49	-	-	11:40-11:50
22	10:40	-	-	10:50-10:52	-	-	-
23	11:05	-	-	-	-	-	12:02-12:15

24	11:06	-	-	-	-	-	12:16-12:19
25	11:00	-	11:00-11:01	-	-	-	-
26	11:03	11:09-11:15	-	-	-	-	-
27	11:07	-	-	-	-	-	12:20-12:50
28	11:14	-	-	11:23-11:54	-	-	-
29	11:20	-	11:29-11:31	-	-	-	-
30	11:31	-	11:32-11:41	-	-	-	-
31	11:49	-	-	-	-	11:49:12:16	-
32	12:09	-	-	12:09-12:12	-	12:17-12:30	-
33	12:13	-	-	-	-	-	12:50-1:00
34	12:22	-	-	12:22-12:23	12:24-12:41	-	-
35	12:23	-	-	-	-	-	-
36	12:27	-	-	12:27-12:30	-	-	-
37	12:29	-	-	-	-	-	12:51-12:56
38	12:39	-	-	-	-	-	12:57-1:07
39	12:45	-	-	-	-	-	1:08-1:28
40	12:55	-	12:55-1:14	-	-	-	-
41	12:55	-	-	12:55-12:56	-	-	-
42	1:02	-	-	-	-	-	1:29-1:34
43	1:03	-	-	-	-	-	1:35-1:50
44	1:04	-	-	-	-	-	1:51-1:56
45	1:05	-	-	1:05-1:20	-	-	-
46	1:20	-	-	1:20-1:46	-	-	1:57-1:02
47	1:28	-	-	-	-	-	1:02-2:07
48	1:30	-	-	-	-	-	2:07-2:11
49	1:35	-	1:35-1:46	-	-	-	-
50	1:36	-	1:36-1:55	-	-	-	-

Appendix 2: the data that we entered to construct the models

Arrival time	S1	S2	S3	S4	S5	S6
0	4	1	1	33	20	11
1	5	2	3	17	27	15
6	5	9	2		13	10
1	14	19	39			10
6	6	11	41			13
3		19	2			6
8			2			22
5			12			5
10			3			15
1			2			10
3			31			12
13			3			10
6			1			8
10			3			8
30			1			10
12			15			10
16			26			13
3						3
1						30
2						10
10						5
25						10
1						20
6						5

3						15
4						5
7						5
6						5
1						4
18						6
20						5
4						
9						
1						
4						
2						
10						
6						
10						
0						
7						
1						
1						
1						
15						
8						
2						
5						
1						