Csc 446 Assignment 1

1.

Simulation Table:

Custom	INTER ARRIVAL	Arrival time	BEGIN to serve	duration time	Ends Time	WAITING IN Q	TIME IN SYSTEM	Idle Time
T	0	2	2	4	6	0	4	2
H	6	8	8	2	10	0	2	2
T	2	10	10	4	14	0	4	0
T	2	12	14	4	18	2	6	0
T	2	14	18	4	22	4	8	0
H	6	20	22	2	24	2	4	0
T	2	22	24	4	28	2	6	0
H	6	28	28	2	30	0	2	0
H	6	34	34	2	36	0	2	4
T	2	36	36	4	40	0	4	0
H	6	42	42	2	44	0	2	2
H	6	48	48	2	50	0	2	4
H	6	54	54	2	56	0	2	4
T	2	56	56	4	60	0	4	0
H	6	62	62	2	64	0	2	2
T	2	64	64	4	68	0	4	0
T	2	66	68	4	72	2	6	0
T	2	68	72	4	76	4	8	0
H	6	74	76	2	78	2	4	0
T	2	76	78	4	82	2	6	0
Total	74	796	816	62	878	20	82	714

Event lists:

Events No.	Events Type	Custom No.	Clock
1	Arrival	1	2
2	Departure	1	6
3	Arrival	2	8
4	Departure	2	10
5	Arrival	3	10
6	Arrival	4	12
7	Departure	3	14

8	Arrival	5	14
9	Departure	4	18
10	Arrival	6	20
11	Departure	5	22
12	Arrival	7	22
13	Departure	6	24
14	Departure	7	28
15	Arrival	8	28
16	Departure	8	30
17	Arrival	9	34
18	Departure	9	36
19	Arrival	10	36
20	Departure	10	40
21	Arrival	11	42
22	Departure	11	44
23	Arrival	12	48
24	Departure	12	50
25	Arrival	13	54
26	Departure	13	56
27	Arrival	14	56
28	Departure	14	60
29	Arrival	15	62
30	Departure	15	64
31	Arrival	16	64
32	Arrival	17	66
33	Departure	16	68
34	Arrival	18	68
35	Departure	17	72
36	Arrival	19	74
37	Departure	18	76
38	Arrival	20	76
39	Departure	19	78
40	Departure	20	82

2.

a. Average service time=62/20=3.1mins

b. Average inter-arrival time=74/19=3.9min

c. Server utilization= Average inter-arrival time/ Average service time=31/39=0.79

d. Theoretical Server utilization= 60/80=3/4=0.75

e. Average time customer spends in the system= 82/20=4.1mins

f. 1. 4-2p

2. (p>=1/3 and 4-2p>=0)

We get 1/3<= p <=2

3.

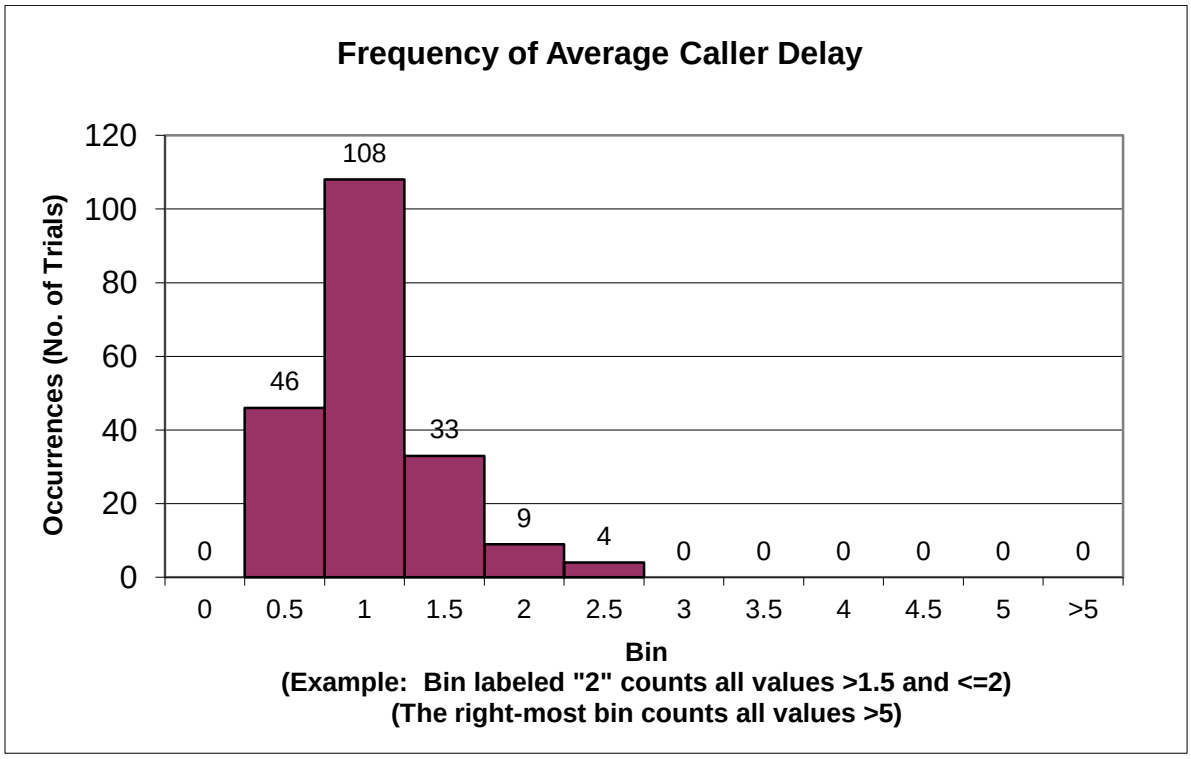
a. In the excel document

b. In the excel document

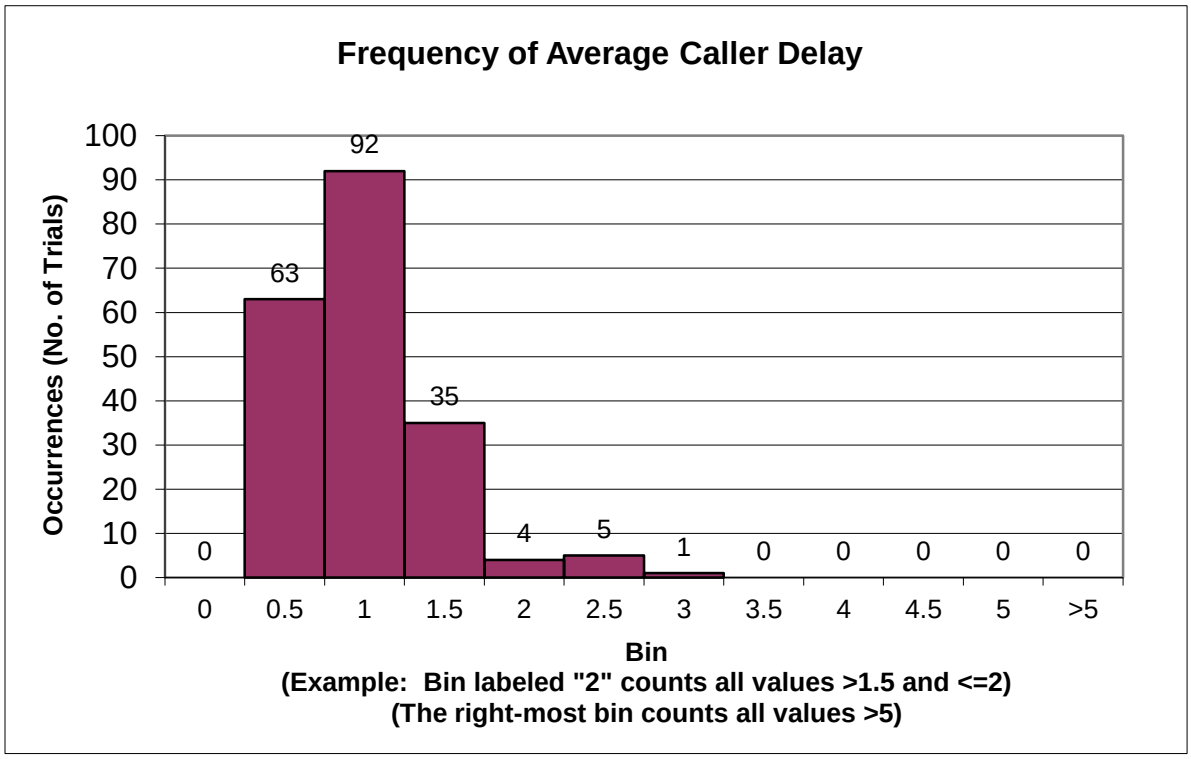
c.

Average waiting time	0.37
Probability	0.26
Probability of Idle Server for Able	0.265217391
Probability of Idle Server for Baker	0.226086957
Average Service Time	3.47
Average Time between arrivals	2.333333333
Average waiting time of those who wait	1.423076923
Average time customer spending the system	3.84

d. New policy:



Old policy:



Since in the new policy, there are more occurrences in 1-5mins and less occurrences in the column less than 1min, it means old policy saves more time, thus the old policy is better.

4.

a. 4.5

b. 3.2

c. u=3.2/4.5=32/45=0.71

d.

	(100seeds)	(1000seeds)
mean inter-arrival time:	4.41	4.53
mean service time:	3.17	3.22
server utilization:	0.719	0.711
mean response time:	6.74	8.66

e.

	(100seeds)	(1000seeds)
mean inter-arrival time:	4.45	4.50
mean service time:	3.19	3.21
server utilization:	0.716	0.713
mean response time:	6.60	7.54

f.

Less seeds, less utilization , inter-arrival time, service time and response time.

Less Customers, more response time.

g.

h.

	10	100	1000	5000	10000
mean inter-arrival time	4.38	4.45	4.5	4.56	4.44
mean service time	3.2	3.19	3.21	3.2	3.2
server utilization	0.7305936	0.716853933	0.713333	0.701754	0.720721
mean response time	6.97	6.6	7.54	6.78	6.94

5.

a. 1 trail:

Frequency of Heads and Tails			
Bins	**Frequency**		
3	7		21
6	11		66
10	7		70
		Total	157
		Average	6.28

b. 5 trails:

1total	157
2total	163
3total	158
4total	134
5total	149
Average	6.088

c. 10 trails:

1total	157
2total	163
3total	158
4total	134
5total	149
6total	156
7total	153
8total	158
9total	152
10total	149
Average	6.116

Conclusion: Intended distribution is 6.1 , and the more trails we try, the more close result we get .

6.

a. Set σx = 600 meters and σy =300 meters in the spread sheet, the average number of hits is 4.29 when 200 trials.

Multi-Trial Summary	
Bins	**Frequency**
0	2
1	2

2	24
3	38
4	48
5	38
6	28
7	17
8	2
9	1
10	0
Average	4.29
Median	4
Mode	4
Minimum	0
Maximum	9

b. Set σx = 600 meters and σy =300 meters in the spread sheet, the average number of hits is 4.33 when 400 trials.

Multi-Trial Summary	
Bins	**Frequency**
0	0
1	18
2	33
3	72
4	97
5	89
6	52
7	28
8	10
9	1
10	0
Average	4.33
Median	4
Mode	4
Minimum	1
Maximum	9

c. Set σx = 50 meters and σy =300 meters in the spread sheet, the average number of hits is 8.77 when 200 trials.

Multi-Trial Summary	
Bins	**Frequency**
0	0
1	0
2	0
3	0

4	0
5	0
6	7
7	19
8	48
9	65
10	61
Average	8.77
Median	9
Mode	9
Minimum	6
Maximum	10

d. Set σx = 50 meters and σy =500 meters in the spread sheet, the average number of hits is 8.77 when 200 trials.

Multi-Trial Summary	
Bins	**Frequency**
0	0
1	0
2	0
3	2
4	9
5	31
6	49
7	49
8	44
9	13
10	3
Average	6.67
Median	7
Mode	6
Minimum	3
Maximum	10

e. Set σx = 1900 meters and σy =950 meters in the spread sheet.

Multi-Trial Summary	
Bins	**Frequency**
0	217
1	134
2	41
3	8
4	0

5	0
6	0
7	0
8	0
9	0
10	0
Average	0.60
Median	0
Mode	0
Minimum	0
Maximum	3

f. When σx and σy increase, the average number of hits decreases.

When σx and σy decrease, the average number of hits increases.

7.

a. When p = 0.3,

Frequency of Heads and Tails				
			P'=	0.2974
Bins	**Frequency**		Error=	0.01
H	2974			
T	7027			

b. When p = 0.1,

Frequency of Heads and Tails				
			P'=	0.0995
Bins	**Frequency**		Error=	0.01
H	995			
T	9006			

c. When p = 0.001,

Frequency of Heads and Tails				
			P'=	0.0011
Bins	**Frequency**		Error=	0.10
H	11			
T	9990			

d. When p = 0.0001,

Frequency of Heads and Tails			P'=	0.0001
Bins	**Frequency**		Error=	0.00
H	1			
T	10000			

f. P’ is around p and when p decreases ,the p’ decreases and the error is always lower than or equal to 0.1 (very small). To reduce error, it is better to try more trials.