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Appendices

Appendix A

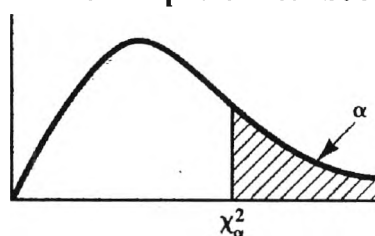
A) Kolmogorov – Smirnov Critical Value

<i>Degrees of Freedom</i> (N)	$D_{0.10}$	$D_{0.05}$	$D_{0.01}$
1	0.950	0.975	0.995
2	0.776	0.842	0.929
3	0.642	0.708	0.828
4	0.564	0.624	0.733
5	0.510	0.565	0.669
6	0.470	0.521	0.618
7	0.438	0.486	0.577
8	0.411	0.457	0.543
9	0.388	0.432	0.514
10	0.368	0.410	0.490
11	0.352	0.391	0.468
12	0.338	0.375	0.450
13	0.325	0.361	0.433
14	0.314	0.349	0.418
15	0.304	0.338	0.404
16	0.295	0.328	0.392
17	0.286	0.318	0.381
18	0.278	0.309	0.371
19	0.272	0.301	0.363
20	0.264	0.294	0.356
25	0.24	0.27	0.32
30	0.22	0.24	0.29
35	0.21	0.23	0.27
Over 35	$\frac{1.22}{\sqrt{N}}$	$\frac{1.36}{\sqrt{N}}$	$\frac{1.63}{\sqrt{N}}$

Source: F. J. Massey, "The Kolmogorov–Smirnov Test for Goodness of Fit," *The Journal of the American Statistical Association*, Vol. 46. ©1951, p. 70. Adapted with permission of the American Statistical Association

Appendix B

B) Percentage points of the Chi-Square Distribution with ν degree of freedom



ν	$\chi_{0.005}^2$	$\chi_{0.01}^2$	$\chi_{0.025}^2$	$\chi_{0.05}^2$	$t_{0.10}^2$
1	7.88	6.63	5.02	3.84	2.71
2	10.60	9.21	7.38	5.99	4.61
3	12.84	11.34	9.35	7.81	6.25
4	14.96	13.28	11.14	9.49	7.78
5	16.7	15.1	12.8	11.1	9.2
6	18.5	16.8	14.4	12.6	10.6
7	20.3	18.5	16.0	14.1	12.0
8	22.0	20.1	17.5	15.5	13.4
9	23.6	21.7	19.0	16.9	14.7
10	25.2	23.2	20.5	18.3	16.0
11	26.8	24.7	21.9	19.7	17.3
12	28.3	26.2	23.3	21.0	18.5
13	29.8	27.7	24.7	22.4	19.8
14	31.3	29.1	26.1	23.7	21.1
15	32.8	30.6	27.5	25.0	22.3
16	34.3	32.0	28.8	26.3	23.5
17	35.7	33.4	30.2	27.6	24.8
18	37.2	34.8	31.5	28.9	26.0
19	38.6	36.2	32.9	30.1	27.2
20	40.0	37.6	34.2	31.4	28.4
21	41.4	38.9	35.5	32.7	29.6
22	42.8	40.3	36.8	33.9	30.8
23	44.2	41.6	38.1	35.2	32.0
24	45.6	43.0	39.4	36.4	33.2
25	49.6	44.3	40.6	37.7	34.4
26	48.3	45.6	41.9	38.9	35.6
27	49.6	47.0	43.2	40.1	36.7
28	51.0	48.3	44.5	41.3	37.9
29	52.3	49.6	45.7	42.6	39.1
30	53.7	50.9	47.0	43.8	40.3
40	66.8	63.7	59.3	55.8	51.8
50	79.5	76.2	71.4	67.5	63.2
60	92.0	88.4	83.3	79.1	74.4
70	104.2	100.4	95.0	90.5	85.5
80	116.3	112.3	106.6	101.9	96.6
90	128.3	124.1	118.1	113.1	107.6
100	140.2	135.8	129.6	124.3	118.5

Source: Robert E. Shannon, *Systems Simulation: The Art and Science*, ©1975, p. 372.
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Appendix C

C) Simulation Results

Simulation Result (telephone lines = 70, IVR port = 60, and agent = 20)

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 1 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Transfer Time	234.05	13.813	15.128	1390.2	1057
Agent_Q Queue Time	23.186	(Corr)	.00000	303.72	1480
Agent Time	308.72	30.038	7.2479	8053.1	1469
IVR Time	153.67	(Corr)	9.6875	1625.8	10294
IVR_Q Queue Time	2.0701	.83250	.00000	36.456	11407

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final value
IVR Ports Available	60.000	(Insuf)	60.000	60.000	60.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	1.0591	(Corr)	.00000	15.000	.00000
Agent Number Busy	16.130	(Corr)	.00000	20.000	14.000
IVR Ports Busy	56.693	(Corr)	.00000	60.000	56.000
IVR Utilization	.94489	(Corr)	.00000	1.0000	.93333
Telephone Utilization	.97489	(Corr)	.00000	1.0000	.92857
Agent Utilization	.80654	(Corr)	.00000	1.0000	.70000
Telephone Lines Busy	68.242	(Corr)	.00000	70.000	65.000
# in IVR_Q	.72882	(Corr)	.00000	9.0000	.00000
Telephone Lines Availa	70.000	(Insuf)	70.000	70.000	70.000

COUNTERS

Identifier	Count	Limit
Lines Success	11407	Infinite
Lines Busy	6664	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	2.0701
Avg Agent Q Time	23.186
Busy Lines	6664.0
Success Lines	11407.
IVR Utilize	.93333
Telephone Utilize	.92857
Agent Utilize	.70000
Success Percent	63.123

Beginning replication 2 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 2 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
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Transfer Time	236.20	12.604	17.106	1226.4	1131
Agent_Q Queue Time	16.115	11.454	.00000	240.24	1570
Agent Time	284.69	19.504	8.2433	2463.5	1560
IVR Time	152.28	(Corr)	4.9646	2052.4	10383
IVR_Q Queue Time	2.0444	(Corr)	.00000	37.578	11574

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Final Value
IVR Ports Available	60.000	(Insuf)	60.000	60.000	60.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	.78088	.57044	.00000	18.000	.00000
Agent Number Busy	15.923	(Corr)	.00000	20.000	11.000
IVR Ports Busy	57.234	.61552	.00000	60.000	60.000
IVR Utilization	.95390	.01026	.00000	1.0000	1.0000
Telephone Utilization	.97286	.00418	.00000	1.0000	.98571
Agent Utilization	.79618	(Corr)	.00000	1.0000	.55000
Telephone Lines Busy	68.100	.29252	.00000	70.000	69.000
# in IVR_Q	.73044	(Corr)	.00000	9.0000	1.0000
Telephone Lines Availa	70.000	(Insuf)	70.000	70.000	70.000

COUNTERS

Identifier	Count	Limit
Lines Success	11575	Infinite
Lines Busy	6426	Infinite

OUTPUTS

Identifier	value
Avg IVR Q Time	2.0444
Avg Agent Q Time	16.115
Busy Lines	6426.0
Success Lines	11575.
IVR Utilize	1.0000
Telephone Utilize	.98571
Agent Utilize	.55000
Success Percent	64.301

Beginning replication 3 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 3 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Observations
Transfer Time	239.90	(Corr)	15.256	2163.9	1128
Agent_Q Queue Time	15.735	9.0625	.00000	276.81	1589
Agent Time	281.86	20.395	6.4994	5584.2	1571
IVR Time	153.63	(Corr)	7.3084	4883.3	10207
IVR_Q Queue Time	1.9526	.95815	.00000	47.970	11391

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Final Value
IVR Ports Available	60.000	(Insuf)	60.000	60.000	60.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	.77241	.42139	.00000	11.000	1.0000
Agent Number Busy	15.981	1.1033	.00000	20.000	20.000
IVR Ports Busy	56.937	.69487	.00000	60.000	56.000
IVR Utilization	.94896	.01158	.00000	1.0000	.93333
Telephone Utilization	.97348	.00392	.00000	1.0000	.94286
Agent Utilization	.79908	.05517	.00000	1.0000	1.0000
Telephone Lines Busy	68.143	.27463	.00000	70.000	66.000
# in IVR_Q	.68652	.32105	.00000	9.0000	.00000
Telephone Lines Availa	70.000	(Insuf)	70.000	70.000	70.000

COUNTERS

Identifier	Count	Limit
Lines Success	11391	Infinite
Lines Busy	6553	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	1.9526
Avg Agent Q Time	15.735
Busy Lines	6553.0
Success Lines	11391.
IVR Utilize	.93333
Telephone Utilize	.94286
Agent Utilize	1.0000
Success Percent	63.480

Beginning replication 4 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 4 of 10

Project: Call Center Anal Run execution date : 4/21/2001
 Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Observations
Transfer Time	237.42	(Corr)	17.049	1138.1	1028
Agent_Q Queue Time	88.811	44.069	.00000	443.12	1502
Agent Time	312.57	24.883	7.7969	4738.2	1493
IVR Time	152.45	(Corr)	6.8004	2538.3	9909
IVR_Q Queue Time	1.1983	(Corr)	.00000	39.518	10997

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Final Value
IVR Ports Available	60.000	(Insuf)	60.000	60.000	60.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	4.1171	(Corr)	.00000	22.000	.00000
Agent Number Busy	17.446	(Corr)	.00000	20.000	12.000
IVR Ports Busy	54.345	(Corr)	.00000	60.000	60.000
IVR Utilization	.90576	(Corr)	.00000	1.0000	1.0000
Telephone Utilization	.97695	(Corr)	.00000	1.0000	.98571
Agent Utilization	.87233	(Corr)	.00000	1.0000	.60000
Telephone Lines Busy	68.386	(Corr)	.00000	70.000	69.000
# in IVR_Q	.40695	(Corr)	.00000	9.0000	2.0000
Telephone Lines Availa	70.000	(Insuf)	70.000	70.000	70.000

COUNTERS

Identifier	Count	Limit
Lines Success	10999	Infinite
Lines Busy	7083	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	1.1983
Avg Agent Q Time	88.811
Busy Lines	7083.0
Success Lines	10999.
IVR Utilize	1.0000
Telephone Utilize	.98571
Agent Utilize	.60000
Success Percent	60.828

Beginning replication 5 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 5 of 10

Project: Call Center Anal Run execution date : 4/21/2001
 Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Observations
Transfer Time	227.35	15.094	16.201	1766.7	1112
Agent_Q Queue Time	65.139	(Corr)	.00000	598.57	1591
Agent Time	310.67	31.561	6.3140	10245.	1573
IVR Time	153.92	(Corr)	9.4933	3622.7	9876
IVR_Q Queue Time	1.2883	.71670	.00000	50.826	11043

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Final Value
IVR Ports Available	60.000	(Insuf)	60.000	60.000	60.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	3.1986	(Corr)	.00000	26.000	.00000
Agent Number Busy	17.382	(Corr)	.00000	20.000	20.000
IVR Ports Busy	54.964	(Corr)	.00000	60.000	55.000
IVR Utilization	.91608	(Corr)	.00000	1.0000	.91667
Telephone Utilization	.97639	(Corr)	.00000	1.0000	1.0000
Agent Utilization	.86914	(Corr)	.00000	1.0000	1.0000
Telephone Lines Busy	68.346	(Corr)	.00000	70.000	70.000
# in IVR_Q	.43911	.24806	.00000	10.000	.00000
Telephone Lines Availa	70.000	(Insuf)	70.000	70.000	70.000

COUNTERS

Identifier	Count	Limit
Lines Success	11043	Infinite
Lines Busy	6907	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	1.2883
Avg Agent Q Time	65.139
Busy Lines	6907.0
Success Lines	11043.
IVR Utilize	.91667
Telephone Utilize	1.0000
Agent Utilize	1.0000
Success Percent	61.520

Beginning replication 6 of 10

ARENA Simulation Results
 Pa - License #9400000

Summary for Replication 6 of 10

Project: Call Center Anal Run execution date : 4/21/2001
 Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Observations
Transfer Time	238.39	13.004	15.977	1288.0	1092
Agent_Q Queue Time	24.824	17.936	.00000	316.11	1537
Agent Time	294.58	19.893	6.4179	4750.9	1528
IVR Time	153.24	(Corr)	7.5050	1305.7	10242
IVR_Q Queue Time	1.8672	.90546	.00000	43.713	11394

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Final Value
IVR Ports Available	60.000	(Insuf)	60.000	60.000	60.000

Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	1.1776	.83300	.00000	19.000	.00000
Agent Number Busy	16.082	(Corr)	.00000	20.000	11.000
IVR Ports Busy	56.706	(Corr)	.00000	60.000	60.000
IVR Utilization	.94511	(Corr)	.00000	1.0000	1.0000
Telephone Utilization	.97540	.00391	.00000	1.0000	1.0000
Agent Utilization	.80411	(Corr)	.00000	1.0000	.55000
Telephone Lines Busy	68.278	.27350	.00000	70.000	70.000
# in IVR_Q	.65709	.25495	.00000	9.0000	5.0000
Telephone Lines Availa	70.000	(Insuf)	70.000	70.000	70.000

COUNTERS

Identifier	Count	Limit
Lines Success	11399	Infinite
Lines Busy	6554	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	1.8672
Avg Agent Q Time	24.824
Busy Lines	6554.0
Success Lines	11399.
IVR Utilize	1.0000
Telephone Utilize	1.0000
Agent Utilize	.55000
Success Percent	63.493

Beginning replication 7 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 7 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001
Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Transfer Time	246.05	15.369	17.236	1463.7	1098
Agent_Q Queue Time	87.935	(Corr)	.00000	758.17	1580
Agent Time	307.86	(Corr)	7.1667	13588.	1565
IVR Time	152.16	(Corr)	7.1256	2595.1	9867
IVR_Q Queue Time	1.3405	(Corr)	.00000	40.444	11017

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final value
IVR Ports Available	60.000	(Insuf)	60.000	60.000	60.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	4.3119	(Corr)	.00000	34.000	7.0000
Agent Number Busy	17.289	(Corr)	.00000	20.000	20.000
IVR Ports Busy	54.861	(Corr)	.00000	60.000	52.000
IVR Utilization	.91436	(Corr)	.00000	1.0000	.86667
Telephone Utilization	.97649	(Corr)	.00000	1.0000	.95714
Agent Utilization	.86448	(Corr)	.00000	1.0000	1.0000
Telephone Lines Busy	68.354	(Corr)	.00000	70.000	67.000
# in IVR_Q	.45584	(Corr)	.00000	9.0000	.00000
Telephone Lines Availa	70.000	(Insuf)	70.000	70.000	70.000

COUNTERS

Identifier	Count	Limit
Lines Success	11017	Infinite
Lines Busy	7003	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	1.3405

Avg Agent Q Time	87.935
Busy Lines	7003.0
Success Lines	11017.
IVR Utilize	.86667
Telephone Utilize	.95714
Agent Utilize	1.0000
Success Percent	61.137

Beginning replication 8 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 8 of 10

Project: Call Center Anal	Run execution date :	4/21/2001
Analyst:	Model revision date:	4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Transfer Time	243.81	13.957	16.407	1523.0	1125
Agent_Q Queue Time	40.278	18.454	.00000	298.42	1589
Agent Time	304.67	(Corr)	6.8158	12031.	1573
IVR Time	153.67	(Corr)	4.0065	1455.4	9902
IVR_Q Queue Time	1.3863	(Corr)	.00000	39.591	11083

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final value
IVR Ports Available	60.000	(Insuf)	60.000	60.000	60.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	1.9753	.93715	.00000	14.000	.00000
Agent Number Busy	17.117	(Corr)	.00000	20.000	19.000
IVR Ports Busy	55.588	.97103	.00000	60.000	56.000
IVR Utilization	.92648	.01618	.00000	1.0000	.93333
Telephone Utilization	.97613	(Corr)	.00000	1.0000	.97143
Agent Utilization	.85588	(Corr)	.00000	1.0000	.95000
Telephone Lines Busy	68.328	(Corr)	.00000	70.000	68.000
# in IVR_Q	.47423	(Corr)	.00000	9.0000	.00000
Telephone Lines Availa	70.000	(Insuf)	70.000	70.000	70.000

COUNTERS

Identifier	Count	Limit
Lines Success	11083	Infinite
Lines Busy	6881	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	1.3863
Avg Agent Q Time	40.278
Busy Lines	6881.0
Success Lines	11083.
IVR Utilize	.93333
Telephone Utilize	.97143
Agent Utilize	.95000
Success Percent	61.695

Beginning replication 9 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 9 of 10

Project: Call Center Anal	Run execution date :	4/21/2001
Analyst:	Model revision date:	4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
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Transfer Time	233.35	13.804	17.174	1619.1	1144
Agent_Q Queue Time	68.042	(Corr)	.00000	473.96	1604
Agent Time	303.85	(Corr)	8.2856	6137.7	1592
IVR Time	153.08	(Corr)	9.1441	1272.0	9782
IVR_Q Queue Time	1.7818	1.2393	.00000	47.339	10986

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final value
IVR Ports Available	60.000	(Insuf)	60.000	60.000	60.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	3.3685	(Corr)	.00000	19.000	.00000
Agent Number Busy	17.252	(Corr)	.00000	20.000	13.000
IVR Ports Busy	54.659	(Corr)	.00000	60.000	60.000
IVR Utilization	.91100	(Corr)	.00000	1.0000	1.0000
Telephone Utilization	.97627	(Corr)	.00000	1.0000	1.0000
Agent Utilization	.86260	(Corr)	.00000	1.0000	.65000
Telephone Lines Busy	68.338	(Corr)	.00000	70.000	70.000
# in IVR_Q	.60443	(Corr)	.00000	10.000	3.0000
Telephone Lines Availa	70.000	(Insuf)	70.000	70.000	70.000

COUNTERS

Identifier	Count	Limit
Lines Success	10989	Infinite
Lines Busy	7106	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	1.7818
Avg Agent Q Time	68.042
Busy Lines	7106.0
Success Lines	10989.
IVR Utilize	1.0000
Telephone Utilize	1.0000
Agent Utilize	.65000
Success Percent	60.729

Beginning replication 10 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 10 of 10

Project: Call Center Anal	Run execution date :	4/21/2001
Analyst:	Model revision date:	4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Transfer Time	249.69	15.651	15.040	2467.0	1075
Agent_Q Queue Time	61.410	(Corr)	.00000	505.52	1472
Agent Time	341.90	42.610	9.5627	14765.	1459
IVR Time	152.88	(Corr)	5.4110	2878.8	9843
IVR_Q Queue Time	.92188	(Corr)	.00000	29.851	10976

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final value
IVR Ports Available	60.000	(Insuf)	60.000	60.000	60.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	2.7899	(Corr)	.00000	24.000	.00000
Agent Number Busy	17.469	(Corr)	.00000	20.000	13.000
IVR Ports Busy	54.938	(Corr)	.00000	60.000	58.000
IVR Utilization	.91563	(Corr)	.00000	1.0000	.96667
Telephone Utilization	.97752	(Corr)	.00000	1.0000	1.0000
Agent Utilization	.87349	(Corr)	.00000	1.0000	.65000
Telephone Lines Busy	68.426	(Corr)	.00000	70.000	70.000
# in IVR_Q	.31230	(Corr)	.00000	10.000	.00000
Telephone Lines Availa	70.000	(Insuf)	70.000	70.000	70.000

COUNTERS

Identifier	Count	Limit
Lines Success	10976	Infinite
Lines Busy	7050	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	.92188
Avg Agent Q Time	61.410
Busy Lines	7050.0
Success Lines	10976.
IVR Utilize	.96667
Telephone Utilize	1.0000
Agent Utilize	.65000
Success Percent	60.889

ARENA Simulation Results
Pa - License #9400000

Output Summary for 10 Replications

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

OUTPUTS

Identifier	Average	Half-width	Minimum	Maximum	# Replications
Avg IVR Q Time	1.5851	.27153	.92188	2.0701	10
Avg Agent Q Time	49.147	19.213	15.735	88.811	10
Busy Lines	6822.7	168.74	6426.0	7106.0	10
Success Lines	11187.	152.38	10976.	11575.	10
IVR Utilize	.95500	.03074	.86667	1.0000	10
Telephone Utilize	.97714	.01760	.92857	1.0000	10
Agent Utilize	.76500	.13225	.55000	1.0000	10
Success Percent	62.120	.89736	60.729	64.301	10

Simulation run time: 4.25 minutes.
Simulation run complete.

Simulation Result (telephone lines = 100, IVR port = 90, and agent = 20)

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 1 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Transfer Time	238.26	(Corr)	16.748	1598.9	1423
Agent_Q Queue Time	234.36	(Corr)	.00000	678.70	1820
Agent Time	298.47	(Corr)	6.5349	7166.9	1803
IVR Time	153.34	(Corr)	6.0097	2080.5	13025
IVR_Q Queue Time	.08693	(Corr)	.00000	13.227	14534

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final Value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	13.165	(Corr)	.00000	37.000	1.0000
Agent Number Busy	19.356	(Corr)	.00000	20.000	20.000
IVR Ports Busy	72.414	(Corr)	.00000	90.000	86.000
IVR Utilization	.80461	(Corr)	.00000	1.0000	.95556
Telephone utilization	.95689	(Corr)	.00000	1.0000	1.0000

Agent Utilization	.96783	(Corr)	.00000	1.0000	1.0000
Telephone Lines Busy	95.689	(Corr)	.00000	100.00	100.00
# in IVR_Q	.03899	(Corr)	.00000	6.0000	.00000
Telephone Lines Availa	100.00	(Insuf)	100.00	100.00	100.00

COUNTERS

Identifier	Count	Limit
Lines Success	14534	Infinite
Lines Busy	3278	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	.08693
Avg Agent Q Time	234.36
Busy Lines	3278.0
Success Lines	14534.
IVR Utilize	.95556
Telephone Utilize	1.0000
Agent Utilize	1.0000
Success Percent	81.596

Beginning replication 2 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 2 of 10

Project: Call Center Anal	Run execution date :	4/21/2001
Analyst:	Model revision date:	4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Transfer Time	224.89	(Corr)	15.879	1146.2	1435
Agent_Q Queue Time	235.32	(Corr)	.00000	820.95	1865
Agent Time	291.07	22.928	8.5087	5661.0	1850
IVR Time	152.13	(Corr)	3.1356	1896.2	13283
IVR_Q Queue Time	.01362	(Corr)	.00000	9.1253	14795

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final Value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	13.571	(Corr)	.00000	47.000	12.000
Agent Number Busy	19.337	(Corr)	.00000	20.000	20.000
IVR Ports Busy	72.602	(Corr)	.00000	90.000	77.000
IVR Utilization	.80670	(Corr)	.00000	1.0000	.85556
Telephone Utilization	.95309	(Corr)	.00000	1.0000	.98000
Agent Utilization	.96689	(Corr)	.00000	1.0000	1.0000
Telephone Lines Busy	95.308	(Corr)	.00000	100.00	98.000
# in IVR_Q	.00622	(Insuf)	.00000	3.0000	.00000
Telephone Lines Availa	100.00	(Insuf)	100.00	100.00	100.00

COUNTERS

Identifier	Count	Limit
Lines Success	14795	Infinite
Lines Busy	2994	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	.01362
Avg Agent Q Time	235.32
Busy Lines	2994.0
Success Lines	14795.
IVR Utilize	.85556
Telephone Utilize	.98000
Agent Utilize	1.0000

Success Percent 83.169

Beginning replication 3 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 3 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Observations
Transfer Time	237.55	15.612	17.014	1570.6	1414
Agent_Q Queue Time	338.23	(Corr)	.00000	902.94	1845
Agent Time	299.45	21.569	6.0300	5121.9	1828
IVR Time	152.96	(Corr)	7.0033	1224.5	12458
IVR_Q Queue Time	.05402	.10299	.00000	17.072	13942

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Final Value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	19.311	(Corr)	.00000	44.000	16.000
Agent Number Busy	19.564	(Corr)	.00000	20.000	20.000
IVR Ports Busy	69.431	(Corr)	.00000	90.000	70.000
IVR Utilization	.77146	(Corr)	.00000	1.0000	.77778
Telephone Utilization	.96567	(Corr)	.00000	1.0000	.95000
Agent Utilization	.97821	(Corr)	.00000	1.0000	1.0000
Telephone Lines Busy	96.566	(Corr)	.00000	100.00	95.000
# in IVR_Q	.02324	(Insuf)	.00000	6.0000	.00000
Telephone Lines Availa	100.00	(Insuf)	100.00	100.00	100.00

COUNTERS

Identifier	Count	Limit
Lines Success	13942	Infinite
Lines Busy	4151	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	.05402
Avg Agent Q Time	338.23
Busy Lines	4151.0
Success Lines	13942.
IVR Utilize	.77778
Telephone Utilize	.95000
Agent Utilize	1.0000
Success Percent	77.057

Beginning replication 4 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 4 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Transfer Time	241.15	17.850	16.158	2548.5	1325
Agent_Q Queue Time	361.01	(Corr)	.00000	965.83	1798
Agent Time	309.19	30.687	6.1525	14539.	1781
IVR Time	153.64	(Corr)	8.1164	1781.5	12474
IVR_Q Queue Time	.00260	(Corr)	.00000	8.4264	13874

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Final Value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	20.034	(Corr)	.00000	45.000	1.0000
Agent Number Busy	19.662	(Corr)	.00000	20.000	20.000
IVR Ports Busy	69.314	(Corr)	.00000	90.000	75.000
IVR Utilization	.77016	(Corr)	.00000	1.0000	.83333
Telephone Utilization	.96176	(Corr)	.00000	1.0000	.90000
Agent Utilization	.98311	(Insuf)	.00000	1.0000	1.0000
Telephone Lines Busy	96.175	(Corr)	.00000	100.00	90.000
# in IVR_Q	.00111	(Insuf)	.00000	4.0000	.00000
Telephone Lines Availa	100.00	(Insuf)	100.00	100.00	100.00

COUNTERS

Identifier	Count	Limit
Lines Success	13874	Infinite
Lines Busy	3783	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	.00260
Avg Agent Q Time	361.01
Busy Lines	3783.0
Success Lines	13874.
IVR Utilize	.83333
Telephone Utilize	.90000
Agent Utilize	1.0000
Success Percent	78.575

Beginning replication 5 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 5 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Transfer Time	235.30	14.338	16.245	1323.3	1371
Agent_Q Queue Time	382.97	(Corr)	.00000	1051.6	1843
Agent Time	290.93	(Corr)	6.3052	5564.2	1827
IVR Time	155.40	(Corr)	7.4518	3045.8	12194
IVR_Q Queue Time	.10932	(Corr)	.00000	16.390	13645

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final Value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	21.784	(Corr)	.00000	64.000	.00000
Agent Number Busy	19.059	(Corr)	.00000	20.000	17.000
IVR Ports Busy	68.799	(Corr)	.00000	90.000	80.000
IVR Utilization	.76443	(Corr)	.00000	1.0000	.88889
Telephone Utilization	.96799	(Corr)	.00000	1.0000	.91000
Agent Utilization	.95298	(Corr)	.00000	1.0000	.85000
Telephone Lines Busy	96.799	(Corr)	.00000	100.00	91.000
# in IVR_Q	.04604	(Corr)	.00000	7.0000	.00000
Telephone Lines Availa	100.00	(Insuf)	100.00	100.00	100.00

COUNTERS

Identifier	Count	Limit
Lines Success	13645	Infinite
Lines Busy	4418	Infinite

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Transfer Time	229.42	13.245	17.003	1409.0	1460
Agent_Q Queue Time	242.42	(Corr)	.00000	717.92	1915
Agent Time	276.67	22.828	6.1724	5535.9	1901
IVR Time	154.32	(Corr)	7.6324	2612.6	12927
IVR_Q Queue Time	.05583	.06262	.00000	17.260	14466

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final Value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	14.330	(Corr)	.00000	41.000	3.0000
Agent Number Busy	19.027	(Corr)	.00000	20.000	20.000
IVR Ports Busy	72.176	(Corr)	.00000	90.000	79.000
IVR Utilization	.80196	(Corr)	.00000	1.0000	.87778
Telephone Utilization	.95952	(Corr)	.00000	1.0000	.92000
Agent Utilization	.95139	(Corr)	.00000	1.0000	1.0000
Telephone Lines Busy	95.951	(Corr)	.00000	100.00	92.000
# in IVR_Q	.02493	.02799	.00000	5.0000	.00000
Telephone Lines Availa	100.00	(Insuf)	100.00	100.00	100.00

COUNTERS

Identifier	Count	Limit
Lines Success	14466	Infinite
Lines Busy	3504	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	.05583
Avg Agent Q Time	242.42
Busy Lines	3504.0
Success Lines	14466.
IVR Utilize	.87778
Telephone Utilize	.92000
Agent Utilize	1.0000
Success Percent	80.500

Beginning replication 8 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 8 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Transfer Time	240.55	15.341	15.099	1874.3	1389
Agent_Q Queue Time	291.67	(Corr)	.00000	696.04	1817
Agent Time	306.59	18.736	6.0848	2807.2	1802
IVR Time	152.76	(Corr)	3.9004	2546.7	12806
IVR_Q Queue Time	.03160	(Corr)	.00000	14.996	14282

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	16.357	(Corr)	.00000	40.000	.00000
Agent Number Busy	19.682	(Corr)	.00000	20.000	17.000
IVR Ports Busy	70.980	(Corr)	.00000	90.000	87.000
IVR Utilization	.78867	(Corr)	.00000	1.0000	.96667
Telephone Utilization	.96316	(Corr)	.00000	1.0000	1.0000
Agent Utilization	.98415	(Insuf)	.00000	1.0000	.85000

Telephone Lines Busy	96.316	(Corr)	.00000	100.00	100.00
# in IVR_Q	.01393	(Insuf)	.00000	8.0000	.00000
Telephone Lines Availa	100.00	(Insuf)	100.00	100.00	100.00

COUNTERS

Identifier	Count	Limit
Lines Success	14282	Infinite
Lines Busy	3720	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	.03160
Avg Agent Q Time	291.67
Busy Lines	3720.0
Success Lines	14282.
IVR Utilize	.96667
Telephone Utilize	1.0000
Agent Utilize	.85000
Success Percent	79.335

Beginning replication 9 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 9 of 10

Project: Call Center Anal	Run execution date :	4/21/2001
Analyst:	Model revision date:	4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Transfer Time	227.46	(Corr)	15.704	1376.3	1373
Agent_Q Queue Time	364.30	(Corr)	.00000	911.18	1843
Agent Time	299.28	21.676	8.2493	4802.3	1830
IVR Time	154.84	(Corr)	5.2100	1960.9	12229
IVR_Q Queue Time	.01034	(Corr)	.00000	9.3206	13685

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final Value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	20.722	(Corr)	.00000	54.000	.00000
Agent Number Busy	19.551	(Corr)	.00000	20.000	16.000
IVR Ports Busy	68.376	(Corr)	.00000	90.000	83.000
IVR Utilization	.75974	(Corr)	.00000	1.0000	.92222
Telephone Utilization	.96447	(Corr)	.00000	1.0000	.94000
Agent Utilization	.97757	(Corr)	.00000	1.0000	.80000
Telephone Lines Busy	96.447	(Corr)	.00000	100.00	94.000
# in IVR_Q	.00437	(Insuf)	.00000	4.0000	.00000
Telephone Lines Availa	100.00	(Insuf)	100.00	100.00	100.00

COUNTERS

Identifier	Count	Limit
Lines Success	13685	Infinite
Lines Busy	4272	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	.01034
Avg Agent Q Time	364.30
Busy Lines	4272.0
Success Lines	13685.
IVR Utilize	.92222
Telephone Utilize	.94000
Agent Utilize	.80000
Success Percent	76.209

Beginning replication 10 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 10 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Observations
Transfer Time	233.30	(Corr)	16.449	1628.4	1401
Agent_Q Queue Time	304.82	(Corr)	.00000	1030.5	1844
Agent Time	298.41	(Corr)	10.037	4491.3	1829
IVR Time	153.65	(Corr)	5.7551	1569.5	12617
IVR_Q Queue Time	.03252	(Corr)	.00000	10.918	14105

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final Value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	17.348	(Corr)	.00000	50.000	.00000
Agent Number Busy	19.469	(Corr)	.00000	20.000	20.000
IVR Ports Busy	70.222	(Corr)	.00000	90.000	87.000
IVR Utilization	.78025	(Corr)	.00000	1.0000	.96667
Telephone Utilization	.96137	(Corr)	.00000	1.0000	1.0000
Agent Utilization	.97346	(Corr)	.00000	1.0000	1.0000
Telephone Lines Busy	96.137	(Corr)	.00000	100.00	100.00
# in IVR_Q	.01416	(Insuf)	.00000	5.0000	.00000
Telephone Lines Availa	100.00	(Insuf)	100.00	100.00	100.00

COUNTERS

Identifier	Count	Limit
Lines Success	14105	Infinite
Lines Busy	3806	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	.03252
Avg Agent Q Time	304.82
Busy Lines	3806.0
Success Lines	14105.
IVR Utilize	.96667
Telephone Utilize	1.0000
Agent Utilize	1.0000
Success Percent	78.750

ARENA Simulation Results
Pa - License #9400000

Output Summary for 10 Replications

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

OUTPUTS

Identifier	Average	Half-width	Minimum	Maximum	# Replications
Avg IVR Q Time	.04895	.02502	.00260	.10932	10
Avg Agent Q Time	309.96	38.115	234.36	382.97	10
Busy Lines	3783.9	296.00	2994.0	4418.0	10
Success Lines	14146.	252.18	13645.	14795.	10
IVR Utilize	.89667	.04170	.77778	.96667	10
Telephone Utilize	.96000	.02737	.90000	1.0000	10
Agent Utilize	.95000	.05474	.80000	1.0000	10
Success Percent	78.905	1.5900	75.541	83.169	10

Simulation run time: 4.27 minutes.
Simulation run complete.

Simulation Result (telephone line = 100, IVR ports = 90, and agent = 27)

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 1 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Observations
Transfer Time	233.43	11.522	17.051	1340.9	1566
Agent_Q Queue Time	11.553	(Corr)	.00000	330.30	1988
Agent Time	295.10	19.540	6.0930	4709.7	1972
IVR Time	152.81	(Corr)	7.7037	1987.2	14276
IVR_Q Queue Time	.10961	(Corr)	.00000	13.087	15922

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final Value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000
Agent Number Available	27.000	(Insuf)	27.000	27.000	27.000
# in Agent_Q	.70890	.77501	.00000	19.000	.00000
Agent Number Busy	20.824	1.2942	.00000	27.000	18.000
IVR Ports Busy	78.981	1.2888	.00000	90.000	80.000
IVR Utilization	.87758	.01432	.00000	1.0000	.88889
Telephone Utilization	.94050	(Corr)	.00000	1.0000	.91000
Agent Utilization	.77129	.04794	.00000	1.0000	.66667
Telephone Lines Busy	94.050	(Corr)	.00000	100.00	91.000
# in IVR_Q	.05387	(Corr)	.00000	6.0000	.00000
Telephone Lines Availa	100.00	(Insuf)	100.00	100.00	100.00

COUNTERS

Identifier	Count	Limit
Lines Success	15922	Infinite
Lines Busy	2040	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	.10961
Avg Agent Q Time	11.553
Busy Lines	2040.0
Success Lines	15922.
IVR Utilize	.88889
Telephone Utilize	.91000
Agent Utilize	.66667
Success Percent	88.642

Beginning replication 2 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 2 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
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Transfer Time	234.82	14.509	17.531	1167.4	1558
Agent_Q Queue Time	10.506	8.2287	.00000	198.15	2009
Agent Time	301.10	14.148	7.1670	4529.6	1993
IVR Time	152.90	(Corr)	4.2622	2127.2	14281
IVR_Q Queue Time	.03652	.04246	.00000	18.395	15926

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Final Value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000
Agent Number Available	27.000	(Insuf)	27.000	27.000	27.000
# in Agent_Q	.65150	(Corr)	.00000	16.000	.00000
Agent Number Busy	21.397	(Corr)	.00000	27.000	21.000
IVR Ports Busy	78.958	(Corr)	.00000	90.000	87.000
IVR Utilization	.87731	(Corr)	.00000	1.0000	.96667
Telephone Utilization	.93954	.00894	.00000	1.0000	1.0000
Agent Utilization	.79251	(Corr)	.00000	1.0000	.77778
Telephone Lines Busy	93.954	.89375	.00000	100.00	100.00
# in IVR_Q	.01795	.02111	.00000	4.0000	.00000
Telephone Lines Availa	100.00	(Insuf)	100.00	100.00	100.00

COUNTERS

Identifier	Count	Limit
Lines Success	15926	Infinite
Lines Busy	1887	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	.03652
Avg Agent Q Time	10.506
Busy Lines	1887.0
Success Lines	15926.
IVR Utilize	.96667
Telephone Utilize	1.0000
Agent Utilize	.77778
Success Percent	89.406

Beginning replication 3 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 3 of 10

Project: Call Center Anal	Run execution date :	4/21/2001
Analyst:	Model revision date:	4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Observations
Transfer Time	229.30	15.506	16.021	1691.5	1551
Agent_Q Queue Time	12.696	9.6168	.00000	227.10	2000
Agent Time	304.35	20.229	6.8984	9502.0	1987
IVR Time	152.66	(Corr)	5.3697	2178.5	14193
IVR_Q Queue Time	.12177	.11782	.00000	19.383	15824

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final Value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000
Agent Number Available	27.000	(Insuf)	27.000	27.000	27.000
# in Agent_Q	.78372	.65526	.00000	15.000	.00000
Agent Number Busy	21.586	(Corr)	.00000	27.000	13.000
IVR Ports Busy	78.130	(Corr)	.00000	90.000	80.000
IVR Utilization	.86811	(Corr)	.00000	1.0000	.88889
Telephone Utilization	.93366	.01208	.00000	1.0000	.90000
Agent Utilization	.79950	(Corr)	.00000	1.0000	.48148
Telephone Lines Busy	93.366	1.2075	.00000	100.00	90.000
# in IVR_Q	.05947	.05716	.00000	8.0000	.00000
Telephone Lines Availa	100.00	(Insuf)	100.00	100.00	100.00

COUNTERS

Summary for Replication 5 of 10

Project: Call Center Anal
Analyst:Run execution date : 4/21/2001
Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Observations
Transfer Time	232.51	13.456	15.117	1616.7	1552
Agent_Q Queue Time	29.336	20.051	.00000	320.15	2016
Agent Time	302.99	24.482	8.4676	16475.	2003
IVR Time	153.12	(Corr)	6.6387	2831.6	14129
IVR_Q Queue Time	.09408	(Corr)	.00000	23.915	15748

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Final Value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000
Agent Number Available	27.000	(Insuf)	27.000	27.000	27.000
# in Agent_Q	1.8254	(Corr)	.00000	20.000	.00000
Agent Number Busy	21.703	(Corr)	.00000	27.000	15.000
IVR Ports Busy	78.167	(Corr)	.00000	90.000	67.000
IVR Utilization	.86853	(Corr)	.00000	1.0000	.74444
Telephone Utilization	.94386	(Corr)	.00000	1.0000	.76000
Agent Utilization	.80384	(Corr)	.00000	1.0000	.55556
Telephone Lines Busy	94.385	(Corr)	.00000	100.00	76.000
# in IVR_Q	.04573	(Corr)	.00000	7.0000	.00000
Telephone Lines Availa	100.00	(Insuf)	100.00	100.00	100.00

COUNTERS

Identifier	Count	Limit
Lines Success	15748	Infinite
Lines Bus,	2170	Infinite

OUTPUTS

Identifier	value
Avg IVR Q Time	.09408
Avg Agent Q Time	29.336
Busy Lines	2170.0
Success Lines	15748.
IVR Utilize	.74444
Telephone utilize	.76000
Agent Utilize	.55556
Success Percent	87.889

Beginning replication 6 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 6 of 10

Project: Call Center Anal
Analyst:Run execution date : 4/21/2001
Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Transfer Time	232.00	14.046	15.123	1681.7	1566
Agent_Q Queue Time	17.254	12.123	.00000	279.16	2074
Agent Time	300.66	(Corr)	6.9278	5344.9	2051
IVR Time	154.01	(Corr)	6.3859	2485.9	14174
IVR_Q Queue Time	.05080	.03732	.00000	14.776	15817

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000

Transfer Time	235.58	14.138	15.100	1821.7	1589
Agent_Q Queue Time	22.458	(Corr)	.00000	368.70	2022
Agent Time	300.42	(Corr)	7.0675	8542.4	2005
IVR Time	153.71	(Corr)	6.6461	2255.4	14078
IVR_Q Queue Time	.02058	.01669	.00000	11.414	15750

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Final Value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000
Agent Number Available	27.000	(Insuf)	27.000	27.000	27.000
# in Agent_Q	1.4015	(Corr)	.00000	26.000	.00000
Agent Number Busy	21.560	(Corr)	.00000	27.000	20.000
IVR Ports Busy	78.700	(Corr)	.00000	90.000	83.000
IVR Utilization	.87445	(Corr)	.00000	1.0000	.92222
Telephone Utilization	.94632	(Corr)	.00000	1.0000	.95000
Agent Utilization	.79853	(Corr)	.00000	1.0000	.74074
Telephone Lines Busy	94.632	(Corr)	.00000	100.00	95.000
# in IVR_Q	.01001	(Insuf)	.00000	3.0000	.00000
Telephone Lines Availa	100.00	(Insuf)	100.00	100.00	100.00

COUNTERS

Identifier	Count	Limit
Lines Success	15750	Infinite
Lines Busy	2453	Infinite

OUTPUTS

Identifier	value
Avg IVR Q Time	.02058
Avg Agent Q Time	22.458
Busy Lines	2453.0
Success Lines	15750.
IVR Utilize	.92222
Telephone Utilize	.95000
Agent Utilize	.74074
Success Percent	86.524

Beginning replication 10 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 10 of 10

Project: Call Center Anal	Run execution date :	4/21/2001
Analyst:	Model revision date:	4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Transfer Time	239.46	13.269	15.336	1277.0	1600
Agent_Q Queue Time	8.8687	8.5889	.00000	230.11	2059
Agent Time	291.85	(Corr)	6.8223	2840.3	2040
IVR Time	153.83	(Corr)	7.2887	2950.8	14082
IVR_Q Queue Time	.11401	(Corr)	.00000	16.450	15766

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final Value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000
Agent Number Available	27.000	(Insuf)	27.000	27.000	27.000
# in Agent_Q	.56360	(Corr)	.00000	13.000	.00000
Agent Number Busy	21.408	(Corr)	.00000	27.000	25.000
IVR Ports Busy	79.031	(Corr)	.00000	90.000	84.000
IVR Utilization	.87813	(Corr)	.00000	1.0000	.93333
Telephone Utilization	.94133	.00798	.00000	1.0000	1.0000
Agent Utilization	.79290	(Corr)	.00000	1.0000	.92593
Telephone Lines Busy	94.133	.79782	.00000	100.00	100.00
# in IVR_Q	.05548	(Corr)	.00000	6.0000	.00000
Telephone Lines Availa	100.00	(Insuf)	100.00	100.00	100.00

COUNTERS

Agent Utilize .57143
Success Percent 88.524

Beginning replication 3 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 3 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Observations
Transfer Time	238.80	18.339	15.340	2246.6	1587
Agent_Q Queue Time	15.882	12.141	.00000	237.61	2086
Agent Time	300.32	16.798	6.2353	4420.9	2072
IVR Time	152.43	(Corr)	5.3697	2579.6	14156
IVR_Q Queue Time	.08761	.08320	.00000	26.002	15833

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Final Value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000
Agent Number Available	28.000	(Insuf)	28.000	28.000	28.000
# in Agent_Q	1.0225	.83911	.00000	19.000	.00000
Agent Number Busy	22.258	(Corr)	.00000	28.000	17.000
IVR Ports Busy	78.659	(Corr)	.00000	90.000	90.000
IVR Utilization	.87399	(Corr)	.00000	1.0000	1.0000
Telephone Utilization	.93943	.00909	.00000	1.0000	.99000
Agent Utilization	.79495	(Corr)	.00000	1.0000	.60714
Telephone Lines Busy	93.943	.90947	.00000	100.00	99.000
# in IVR_Q	.04282	(Corr)	.00000	9.0000	1.0000
Telephone Lines Availa	100.00	(Insuf)	100.00	100.00	100.00

COUNTERS

Identifier	Count	Limit
Lines Success	15834	Infinite
Lines Busy	2130	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	.08761
Avg Agent Q Time	15.882
Busy Lines	2130.0
Success Lines	15834.
IVR Utilize	1.0000
Telephone Utilize	.99000
Agent Utilize	.60714
Success Percent	88.142

Beginning replication 4 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 4 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Transfer Time	236.07	13.104	15.717	1542.2	1492
Agent_Q Queue Time	2.3191	(Corr)	.00000	131.23	1965
Agent Time	293.64	23.016	6.0736	4137.7	1946
IVR Time	152.89	(Corr)	3.4089	1474.4	14574
IVR_Q Queue Time	.10439	.10031	.00000	18.098	16153

Success Percent 88.275

Beginning replication 10 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 10 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Transfer Time	238.52	16.259	16.836	1584.2	1610
Agent_Q Queue Time	10.862	6.6767	.00000	159.70	2061
Agent Time	305.93	27.296	8.1598	11647.	2051
IVR Time	153.23	(Corr)	5.0741	1566.3	14016
IVR_Q Queue Time	.05060	(Corr)	.00000	20.024	15703

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final value
IVR Ports Available	90.000	(Insuf)	90.000	90.000	90.000
Agent Number Available	28.000	(Insuf)	28.000	28.000	28.000
# in Agent_Q	.69100	.44981	.00000	13.000	.00000
Agent Number Busy	22.329	1.2672	.00000	28.000	14.000
IVR Ports Busy	78.431	1.0481	.00000	90.000	77.000
IVR Utilization	.87146	.01165	.00000	1.0000	.85556
Telephone Utilization	.94425	(Corr)	.00000	1.0000	.83000
Agent Utilization	.79749	.04526	.00000	1.0000	.50000
Telephone Lines Busy	94.424	(Corr)	.00000	100.00	83.000
# in IVR_Q	.02452	.02981	.00000	6.0000	.00000
Telephone Lines Availa	100.00	(Insuf)	100.00	100.00	100.00

COUNTERS

Identifier	Count	Limit
Lines Success	15703	Infinite
Lines Busy	2467	Infinite

OUTPUTS

Identifier	Value
Avg IVR Q Time	.05060
Avg Agent Q Time	10.862
Busy Lines	2467.0
Success Lines	15703.
IVR Utilize	.85556
Telephone Utilize	.83000
Agent Utilize	.50000
Success Percent	86.422

ARENA Simulation Results
Pa - License #9400000

Output Summary for 10 Replications

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

OUTPUTS

Identifier	Average	Half-width	Minimum	Maximum	# Replications
Avg IVR Q Time	.06893	.02140	.03175	.13209	10
Avg Agent Q Time	7.9150	4.1201	2.3191	20.464	10
Busy Lines	2102.8	105.85	1817.0	2467.0	10
Success Lines	15879.	97.705	15648.	16153.	10
IVR Utilize	.90778	.05268	.74444	1.0000	10
Telephone Utilize	.92600	.04336	.80000	1.0000	10
Agent Utilize	.62500	.09527	.42857	.82143	10
Success Percent	88.308	.56825	86.422	89.888	10

# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.87205	.04441	.00000	1.0000	1.0000

OUTPUTS

Identifier	Value
Agent Queue Time	42.370
Agent Utilize	.87205

Beginning replication 10 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 10 of 10

Project: Call Center Anal	Run execution date :	4/21/2001
Analyst:	Model revision date:	4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Observations
Agent_Q Queue Time	52.245	(Corr)	.00000	348.65	2264
Agent Time	212.54	12.494	5.0885	5130.0	2247

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Final Value
Agent Number Available	20.000	(Insuf)	20.000	20.000	20.000
# in Agent_Q	3.6507	(Corr)	.00000	27.000	.00000
Agent Number Busy	17.980	(Corr)	.00000	20.000	19.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.89904	(Corr)	.00000	1.0000	.95000

OUTPUTS

Identifier	Value
Agent Queue Time	52.245
Agent Utilize	.89904

ARENA Simulation Results
Pa - License #9400000

Output Summary for 10 Replications

Project: Call Center Anal	Run execution date :	4/21/2001
Analyst:	Model revision date:	4/21/2001

OUTPUTS

Identifier	Average	Half-width	Minimum	Maximum	# Replications
Agent Queue Time	72.357	23.354	30.796	130.95	10
Agent Utilize	.89497	.01907	.83879	.93637	10

Simulation run time: 0.68 minutes.
Simulation run complete.

Simulation Result for Agent Analysis (agent = 22)

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 1 of 10

Project: Call Center Anal	Run execution date :	4/21/2001
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Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Agent_Q Queue Time	11.347	7.6242	.00000	191.47	2216
Agent Time	202.18	10.859	6.4953	3493.3	2201

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final Value
Agent Number Available	22.000	(Insuf)	22.000	22.000	22.000
# in Agent_Q	.77612	.57846	.00000	14.000	.00000
Agent Number Busy	16.956	(Corr)	.00000	22.000	18.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.77075	(Corr)	.00000	1.0000	.81818

OUTPUTS

Identifier	value
Agent Queue Time	11.347
Agent Utilize	.77075

Beginning replication 2 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 2 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Agent_Q Queue Time	28.276	(Corr)	.00000	289.09	2239
Agent Time	205.14	14.228	5.4699	2742.7	2227

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final Value
Agent Number Available	22.000	(Insuf)	22.000	22.000	22.000
# in Agent_Q	1.9540	(Corr)	.00000	25.000	.00000
Agent Number Busy	17.390	(Corr)	.00000	22.000	16.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.79048	(Corr)	.00000	1.0000	.72727

OUTPUTS

Identifier	value
Agent Queue Time	28.276
Agent Utilize	.79048

Beginning replication 3 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 3 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
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Agent_Q Queue Time	27.348	(Corr)	.00000	277.40	2246
Agent Time	229.99	14.567	6.8006	5122.3	2227

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final Value
Agent Number Available	22.000	(Insuf)	22.000	22.000	22.000
# in Agent_Q	1.8958	(Corr)	.00000	22.000	.00000
Agent Number Busy	19.052	(Corr)	.00000	22.000	21.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.86604	(Corr)	.00000	1.0000	.95455

OUTPUTS

Identifier	Value
Agent Queue Time	27.348
Agent Utilize	.86604

Beginning replication 4 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 4 of 10

Project: Call Center Anal	Run execution date :	4/21/2001
Analyst:	Model revision date:	4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Agent_Q Queue Time	12.093	(Corr)	.00000	180.40	2233
Agent Time	214.37	12.494	6.3524	3354.0	2220

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final Value
Agent Number Available	22.000	(Insuf)	22.000	22.000	22.000
# in Agent_Q	.83351	.69342	.00000	16.000	.00000
Agent Number Busy	17.829	(Corr)	.00000	22.000	16.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.81045	(Corr)	.00000	1.0000	.72727

OUTPUTS

Identifier	Value
Agent Queue Time	12.093
Agent Utilize	.81045

Beginning replication 5 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 5 of 10

Project: Call Center Anal	Run execution date :	4/21/2001
Analyst:	Model revision date:	4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Agent_Q Queue Time	22.967	(Corr)	.00000	202.10	2326
Agent Time	221.80	12.592	6.9191	4242.7	2309

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final Value
Agent Number Available	22.000	(Insuf)	22.000	22.000	22.000

# in Agent_Q	1.6488	(Corr)	.00000	18.000	.00000
Agent Number Busy	19.150	.83868	.00000	22.000	21.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.87049	.03812	.00000	1.0000	.95455

OUTPUTS

Identifier	value
Agent Queue Time	22.967
Agent Utilize	.87049

Beginning replication 6 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 6 of 10

Project: Call Center Anal	Run execution date :	4/21/2001
Analyst:	Model revision date:	4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Agent_Q Queue Time	7.8550	(Corr)	.00000	123.73	2233
Agent Time	208.76	10.992	5.8633	4995.0	2214

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final value
Agent Number Available	22.000	(Insuf)	22.000	22.000	22.000
# in Agent_Q	.54137	(Corr)	.00000	12.000	.00000
Agent Number Busy	17.624	.71085	.00000	22.000	22.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.80112	.03231	.00000	1.0000	1.0000

OUTPUTS

Identifier	value
Agent Queue Time	7.8550
Agent Utilize	.80112

Beginning replication 7 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 7 of 10

Project: Call Center Anal	Run execution date :	4/21/2001
Analyst:	Model revision date:	4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Agent_Q Queue Time	16.446	10.831	.00000	246.30	2157
Agent Time	227.64	16.873	6.1465	9190.3	2144

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final value
Agent Number Available	22.000	(Insuf)	22.000	22.000	22.000
# in Agent_Q	1.0949	.73524	.00000	17.000	.00000
Agent Number Busy	18.243	.70049	.00000	22.000	14.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.82923	.03184	.00000	1.0000	.63636

OUTPUTS

Identifier	value
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Agent Queue Time 16.446
Agent Utilize .82923

Beginning replication 8 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 8 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Agent_Q Queue Time	5.9617	3.4866	.00000	136.60	2226
Agent Time	206.37	10.496	6.8797	2302.3	2209

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final value
Agent Number Available	22.000	(Insuf)	22.000	22.000	22.000
# in Agent_Q	.44668	.21223	.00000	16.000	14.000
Agent Number Busy	17.391	.74063	.00000	22.000	22.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.79052	.03366	.00000	1.0000	1.0000

OUTPUTS

Identifier	value
Agent Queue Time	5.9617
Agent Utilize	.79052

Beginning replication 9 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 9 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Observations
Agent_Q Queue Time	11.911	(Corr)	.00000	237.64	2108
Agent Time	212.39	(Corr)	6.2731	3564.8	2093

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Final value
Agent Number Available	22.000	(Insuf)	22.000	22.000	22.000
# in Agent_Q	.77500	.79465	.00000	20.000	.00000
Agent Number Busy	16.896	.98560	.00000	22.000	18.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.76802	.04480	.00000	1.0000	.81818

OUTPUTS

Identifier	value
Agent Queue Time	11.911
Agent Utilize	.76802

Beginning replication 10 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 10 of 10

Project: Call Center Anal Run execution date : 4/21/2001
 Analyst: Model revision date: 4/21/2001
 Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Agent_Q Queue Time	21.884	(Corr)	.00000	249.75	2256
Agent Time	215.76	12.215	4.8514	5849.3	2239

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final value
Agent Number Available	22.000	(Insuf)	22.000	22.000	22.000
# in Agent_Q	1.5238	(Corr)	.00000	20.000	.00000
Agent Number Busy	18.251	(Corr)	.00000	22.000	21.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.82962	(Corr)	.00000	1.0000	.95455

OUTPUTS

Identifier	Value
Agent Queue Time	21.884
Agent Utilize	.82962

ARENA Simulation Results
 Pa - License #9400000

Output Summary for 10 Replications

Project: Call Center Anal Run execution date : 4/21/2001
 Analyst: Model revision date: 4/21/2001

OUTPUTS

Identifier	Average	Half-width	Minimum	Maximum	# Replications
Agent Queue Time	16.609	5.3812	5.9617	28.276	10
Agent Utilize	.81267	.02409	.76802	.87049	10

Simulation run time: 1.60 minutes.
 Simulation run complete.

Simulation Result for Agent Analysis (agent = 23)

ARENA Simulation Results
 Pa - License #9400000

Summary for Replication 1 of 10

Project: Call Center Anal Run execution date : 4/21/2001
 Analyst: Model revision date: 4/21/2001
 Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Agent_Q Queue Time	5.7940	4.4283	.00000	176.44	2195
Agent Time	204.48	12.249	6.4953	3379.5	2178

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final value
Agent Number Available	23.000	(Insuf)	23.000	23.000	23.000

```
# in Agent_Q      .39273      .23987      .00000      15.000      2.0000
Agent Number Busy 16.920      .91239      .00000      23.000      23.000
# in Agent Number_Q .00000      (Insuf)     .00000      .00000      .00000
Agent Utilization .73568      .03967      .00000      1.0000     1.0000
```

OUTPUTS

Identifier	Value
Agent Queue Time	5.7940
Agent Utilize	.73568

Beginning replication 2 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 2 of 10

```
Project: Call Center Anal      Run execution date : 4/21/2001
Analyst:                       Model revision date: 4/21/2001
```

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Agent_Q Queue Time	11.796	(Corr)	.00000	259.49	2225
Agent Time	210.99	12.133	5.4699	2742.7	2205

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final value
Agent Number Available	23.000	(Insuf)	23.000	23.000	23.000
# in Agent_Q	.81010	.94777	.00000	23.000	.00000
Agent Number Busy	17.635	1.1231	.00000	23.000	23.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.76676	.04883	.00000	1.0000	1.0000

OUTPUTS

Identifier	Value
Agent Queue Time	11.796
Agent Utilize	.76676

Beginning replication 3 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 3 of 10

```
Project: Call Center Anal      Run execution date : 4/21/2001
Analyst:                       Model revision date: 4/21/2001
```

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Observations
Agent_Q Queue Time	34.758	(Corr)	.00000	408.77	2315
Agent Time	224.31	16.878	6.8006	5122.3	2300

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final value
Agent Number Available	23.000	(Insuf)	23.000	23.000	23.000
# in Agent_Q	2.4835	(Corr)	.00000	29.000	.00000
Agent Number Busy	19.275	(Corr)	.00000	23.000	19.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.83805	(Corr)	.00000	1.0000	.82609

OUTPUTS

Identifier	Value
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Agent Queue Time 34.758
 Agent Utilize .83805

Beginning replication 4 of 10

ARENA Simulation Results
 Pa - License #9400000

Summary for Replication 4 of 10

Project: Call Center Anal Run execution date : 4/21/2001
 Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Agent_Q Queue Time	5.1004	4.6559	.00000	153.68	2241
Agent Time	212.92	9.3458	6.3524	3846.9	2224

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final Value
Agent Number Available	23.000	(Insuf)	23.000	23.000	23.000
# in Agent_Q	.35278	.31924	.00000	13.000	.00000
Agent Number Busy	17.798	.85556	.00000	23.000	18.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.77387	.03720	.00000	1.0000	.78261

OUTPUTS

Identifier	Value
Agent Queue Time	5.1004
Agent Utilize	.77387

Beginning replication 5 of 10

ARENA Simulation Results
 Pa - License #9400000

Summary for Replication 5 of 10

Project: Call Center Anal Run execution date : 4/21/2001
 Analyst: Model revision date: 4/21/2001

Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Agent_Q Queue Time	9.3459	3.8970	.00000	149.57	2314
Agent Time	220.62	11.611	8.2710	5006.3	2304

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final Value
Agent Number Available	23.000	(Insuf)	23.000	23.000	23.000
# in Agent_Q	.66749	.31773	.00000	11.000	.00000
Agent Number Busy	18.954	.83516	.00000	23.000	11.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.82413	.03631	.00000	1.0000	.47826

OUTPUTS

Identifier	Value
Agent Queue Time	9.3459
Agent Utilize	.82413

Beginning replication 6 of 10

ARENA Simulation Results
 Pa - License #9400000

Identifier	Average	Half Width	Minimum	Maximum	Observations
Agent_Q Queue Time	4.6314	2.7459	.00000	116.12	2238
Agent Time	210.02	12.405	6.3250	2921.3	2221

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Final Value
Agent Number Available	23.000	(Insuf)	23.000	23.000	23.000
# in Agent_Q	.31991	.19756	.00000	13.000	.00000
Agent Number Busy	17.628	.71876	.00000	23.000	21.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.76644	.03125	.00000	1.0000	.91304

OUTPUTS

Identifier	Value
Agent Queue Time	4.6314
Agent Utilize	.76644

Beginning replication 9 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 9 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001
Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Observations
Agent_Q Queue Time	3.0731	1.8559	.00000	77.624	2115
Agent Time	218.55	11.194	8.1155	3564.8	2096

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Final Value
Agent Number Available	23.000	(Insuf)	23.000	23.000	23.000
# in Agent_Q	.20061	.15551	.00000	7.0000	.00000
Agent Number Busy	17.190	1.0207	.00000	23.000	22.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.74741	.04438	.00000	1.0000	.95652

OUTPUTS

Identifier	Value
Agent Queue Time	3.0731
Agent Utilize	.74741

Beginning replication 10 of 10

ARENA Simulation Results
Pa - License #9400000

Summary for Replication 10 of 10

Project: Call Center Anal Run execution date : 4/21/2001
Analyst: Model revision date: 4/21/2001
Replication ended at time : 32400.0

TALLY VARIABLES

Identifier	Average	Half width	Minimum	Maximum	Observations
Agent_Q Queue Time	4.7586	3.3042	.00000	132.34	2242
Agent Time	206.48	12.676	4.8514	4418.1	2224

DISCRETE-CHANGE VARIABLES

Identifier	Average	Half Width	Minimum	Maximum	Final Value
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Agent Number Available	23.000	(Insuf)	23.000	23.000	23.000
# in Agent_Q	.32928	.21669	.00000	11.000	.00000
Agent Number Busy	17.568	(Corr)	.00000	23.000	23.000
# in Agent Number_Q	.00000	(Insuf)	.00000	.00000	.00000
Agent Utilization	.76385	(Corr)	.00000	1.0000	1.0000

OUTPUTS

Identifier	Value
Agent Queue Time	4.7586
Agent Utilize	.76385

ARENA Simulation Results
Pa - License #9400000

Output Summary for 10 Replications

Project: Call Center Anal	Run execution date : 4/21/2001
Analyst:	Model revision date: 4/21/2001

OUTPUTS

Identifier	Average	Half-width	Minimum	Maximum	# Replications
Agent Queue Time	9.1328	6.2698	3.0731	34.758	10
Agent Utilize	.77674	.02145	.73568	.83805	10

Simulation run time: 0.83 minutes.
Simulation run complete.

Bibliography



Patomporn Nakornvichaikul was born in 1976 in Bangkok, Thailand. He completes his undergraduate studies at Mahidol University in Industrial Engineering. Then, he studies Master of Engineering in Engineering Management and Master of Science in Engineering Business Management at The Regional Centre for Manufacturing Systems Engineering, Chulalongkorn University.