

Online Supplement to: Inter-Dependent, Heterogeneous, and Time-Varying Service-Time Distributions in Call Centers

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Abstract

Traditionally, both researchers and practitioners rely on standard Erlang queueing models to analyze call center operations. In those models, service times are assumed to be independent and identically distributed exponential random variables with a constant mean. Going beyond such unrealistic assumptions has strong implications, as is evidenced by theoretical advances in the recent literature. However, there is very little empirical research, analyzing the statistical properties of service times in practice, to support that body of theoretical work. In this paper, we carry out a large-scale data-based investigation of service times in a call center with many heterogeneous agents and multiple call types. We observe that, for a given call type: (a) the service-time distribution depends strongly on the individual agent, (b) that it changes with time, and (c) that average service times are correlated across successive days or weeks. We develop stochastic models that account for these facts. In our proposed models, the service-time distribution is assumed to be lognormal with a mean that obeys a linear mixed-effects model with a weekly Gaussian random effect, and these successive weekly effects obey an autoregressive process of order one. We compare our models to simpler ones, e.g., where the mean service time depends only on the agent and call type, or only on the call type, and we find that our proposed models have a better goodness-of-fit, both in-sample and out-of-sample. We also perform simulation experiments to show that the choice of model can have a significant impact on the estimates of common measures of quality of service in the call center. Our study provides empirical support to the theoretical

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research that goes beyond standard modelling assumptions in service systems.

In this online supplement, we present further supporting material. In §1, we describe several alternative service-time models which we considered but which did not lead to any improvement in the out-of-sample prediction of mean service times. In §2, we present a detailed description of our estimation/ prediction procedure for corresponding to §5 of the paper. In §3, we present additional details for the simulation experiments. In §4, we present additional tables and plots.

1. Alternative Models

In addition to Models 1, 2, and 3, and the two benchmark models, we experimented with several other models and compared their performances via a detailed statistical analysis of the data. In what follows, we briefly describe those models and explain why we do not report them separately in the main paper.

Number of call types handled. As illustrated in Figure 9 of the paper, the number of different call types handled by an agent might influence his/her average service time. For example, Figure 9 suggests that the agent slows down as he handles more call types, e.g., she/he may be getting tired and therefore less efficient. We observed a similar pattern for a few other agents in our data set as well. Based on this observation, we considered a fixed-effects model, for the mean service time of an agent/skill combination, where we included the number of different call types handled concurrently by the agent as a covariate.

Specifically, for each agent, we calculated the number of call types that this agent handles on each day. Then, for each agent/skill pair, we considered two different models: (1) we let the number of call types be a categorical variable in the model; and (2) we let the number of call types be a numerical variable in the model (i.e., we add a slope times the number of call types handled on each day, and an intercept). We did not include a linear trend in either models. We found that both models perform worse, in terms of predictive accuracy, than the rest of the models considered in this paper, so we did not consider them here.

Jointly modelling different agents. There may be some unobserved (to us) reason which affects the performance of all agents handling a given call type in a similar way, on a given day or week, by making their service times either longer or shorter. Motivated by this, we considered a model where we jointly modeled the service times of different agents who handle the same call type. Specifically, we considered a mixed-effects model for the mean service time (just as in Models 2 and 3) where we merged alternative agents together and had the same weekly random effect common to all agents. The intercepts and the slopes of the linear trends in the model were specific to each agent considered.

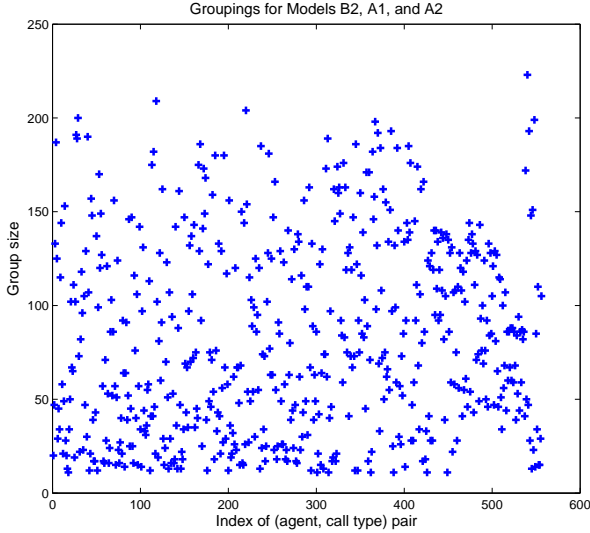


Figure 1: Groupings for Models $B2$, $A1$ and $A2$.

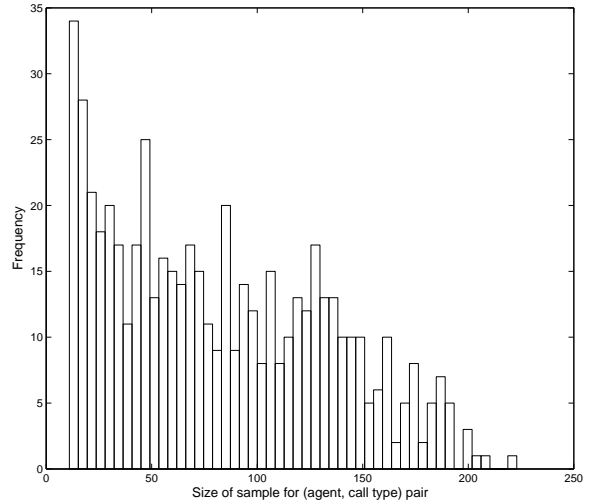


Figure 2: Histogram for Models $B2$, $A1$ and $A2$.

We found that such a model usually performs worse than Model 2 and Model 3. Moreover, due to computational restrictions, we were only able to jointly model relatively few agents (typically about 10 agents) at a time, which is not representative of the entire agent population. Therefore, we do not consider this model separately in this paper.

Multiplicative models. Since it may be natural to have multiplicative random factors affecting the mean, we considered multiplicative models in addition to the additive ones of this paper. In particular, we modelled the logarithm of the mean service time, which amounts to considering a multiplicative model for the mean. We found that modelling the mean was generally better than modelling its logarithm. For example, we tested whether the logarithm of the mean was well modelled by a Gaussian process, and found that this was generally not the case. Also, we found that such models (of the logarithm) did not generally lead to improvement in predictive accuracy over models of the mean.

2. Prediction of Average Service Times

We now present detailed numerical results describing the accuracy of out-of-sample predictions for each agent in our cohort C . We reported our results for the in-sample goodness-of-fit of our models in §4 of the paper. Here, in Figures 1-6, we plot scatter plots and histograms for the sample sizes for the alternative groupings of the overall dataset which were employed to formulate the different service-time models. It is important to do so since several ways of grouping data correspond to different size of the sample employed to estimate appropriate model statistics, and the sample size is a primary determinant of the estimation accuracy.

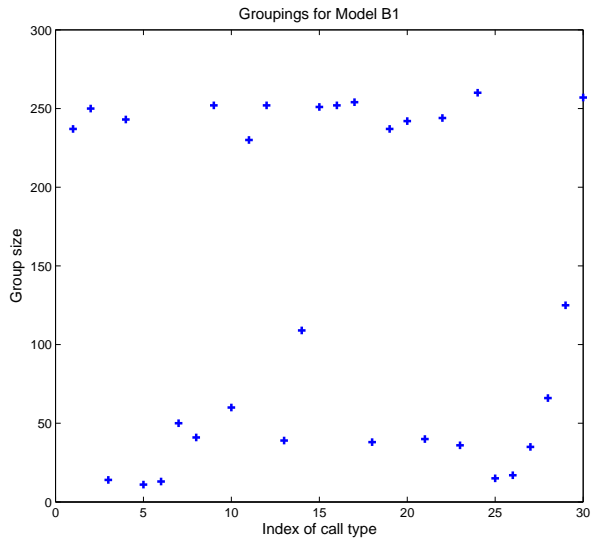


Figure 3: Groupings for Models *B1*.

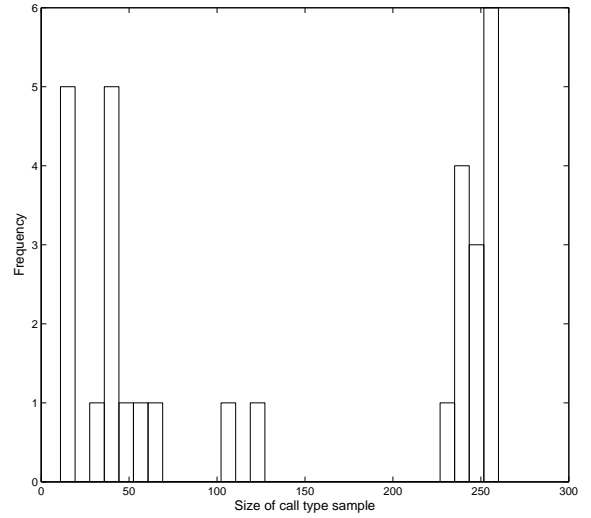


Figure 4: Histogram for Model *B1*.

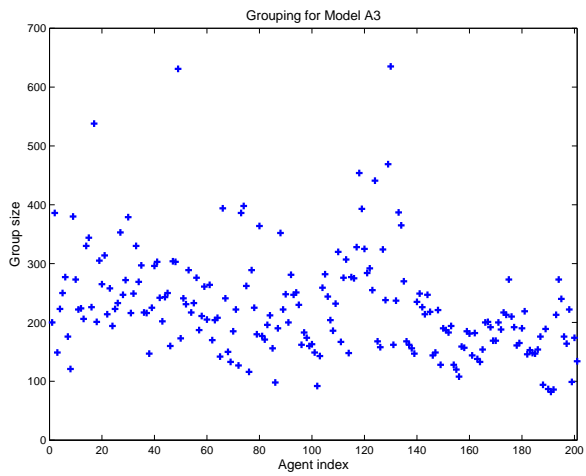


Figure 5: Groupings for Models *A3*.

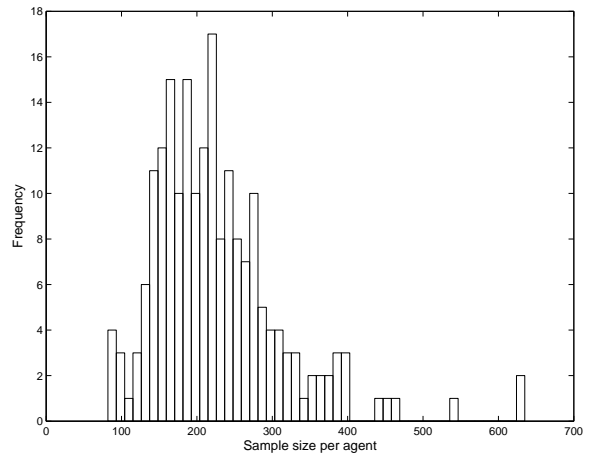


Figure 6: Histogram for Model *A3*.

The results that we present here were aggregated (averaged across all agents) and described in Table 6 of the main paper. In Tables 3, 4, and 5, we report the MAPE and RMSE for all agents in our cohort, with forecasting lead times of 1 day, 1 week, and 2 weeks, respectively. The results in Tables 3, 4, and 5 are averaged across all skills handled by the same agent. In each table, an agent may handle several call types, ranging from a minimum of 1 to a maximum of 8 call types.

For each agent, we report the total number of predictions made (this is the second column in Tables 3, 4, and 5), by combining all predictions made for that agent including all different call types that s/he handles. Since different agents handle different call types on different days, which need not be consecutive, we needed to think of systematic ways of determining the number of predictions to be made per agent. This issue was further complicated by the fact that our different models correspond to different ways of modelling the data. For example, in Model B2, Model 1, and Model 2, each (agent, call type) pair is modelled separately. In Model 3, each agent is modelled separately. And, in Model B1, each call type is modelled separately. So, the learning samples used for each prediction are different depending on the model. We first did predictions under each model separately, and then compared the predictions made under all models for the same days, in order to be consistent. We provide additional explanation below.

For Model B1, Model 1, and Model 2, we determined the number of predictions per (agent, call type) pair as follows. We focused on the subset of our data corresponding to a particular (agent, call type) pair, and divided this sample in half. We then made out-of-sample predictions for half of the data subset. For example, if we have a sample of 100 days where a given agent handles a particular call type, then we did out-of-sample predictions for the final 50 days. We did this for all (agent, call type) pairs. To further illustrate: Suppose that agent X handles only two call types A and B. In the data, suppose that agent X handles type A for 50 days, and handles type B for 100 days. In this case, we made 25 out-of-sample predictions for the pair (X, A) and 50 out-of-sample predictions for the pair (X, B). Then, the total number of predictions that we made for agent X would be: $25+50 = 75$.

For Model 3, we focused on subsets of the data corresponding to particular agents. Thus, in order to make out-of-sample predictions under this model, we focused on each agent and divided the total data corresponding to that agent in half (we indexed the data by the day, and truncated at the median of the sample of days). Then, we made out-of-sample predictions for the second half the data, using the first half as the learning set (and rolling the learning horizon forward, while preserving the forecasting lead time). For Model B1, we focused on subsets of the data that correspond to particular call types. Thus, in order to make out-of-sample predictions for this model, we focused on each call type and divided the total data

corresponding to that call type in half. Then, we made predictions for the second half the data as above. In order to make meaningful comparisons between the different models, we need to focus on days for which we have predictions under all models. We computed the number of such days per agent, and included those numbers in the tables below: These are the total number of predictions made per agent, which correspond to column 2 in the tables. The total number of predictions made across all agents is equal to 18,586 predictions.

3. Additional Details for the Simulations

We consider two call types and two agent groups, and an N model for call routing. The two call types are for the same type of service (related to billing), but one is in French (F) and the other in English (E). The first group (F, with 10 agents, numbered from 1 to 10) can only handle the first call type and the second group (EF, with 2 agents, numbered 11 and 12) can handle both. That is, F agents only answer calls in French and the EF agents are bilingual. Those 12 agents are the ones that worked on each day of week number 45 in our data set, and handled only those two call types. The center is open from 8h to 18h.

The arrival process for each of the two call types is piecewise-Poisson, with a gamma random arrival rate in each 15-minute time interval, and a normal copula to model the dependence between those rates. This model is explained in Oreshkin et al. (2015)¹, where it was also shown to provide a good fit to the arrival data for this HQ call center. The arrival rates were scaled down to fit our smaller number of agents. Table 7 and 8 give the rate and shape for the gamma distribution in arrival process respectively for call type F and E. Tables 9, 10 and 11, 12 give respectively the correlation matrix between rate for call type F and call type E.

Abandons were modeled with exponential patience times, with an abandonment rate of 1.87 call per hour for call F and an abandonment rate of 1.57 call per hour for call E. We use a routing policy that works as follows. The calls of the same type are first-come first-served. For a call type F, the router will first try to match it with an idle F agent. If there is no such free agent, then the router will try to assign it to an idle EF agent. EF agents give same priority to two calls types. If an agent of this group become free and there are calls in two waiting queues, the priority is given to call who have waited longer. The staffing vector for all 40 periods for F agents is given in Table 6. The staffing for EF agent is 2 in all periods. Calls are served in first-come-first-served order within each group.

¹B. N. Oreshkin, P. L'Ecuyer, and N. Regnard. 2015. Rate-Based Daily Arrival Process Models with Application to Call Centers, *working paper*.

F				
Model	$B1$	$B2$	$A2$	$A3$
RMSE	112.1	78.8	72.4	69.9
MAPE(%)	17.6	11.8	8.5	8.4
E				
Model	$B1$	$B2$	$A2$	$A3$
RMSE	22.6	28.7	11.5	4.8
MAPE(%)	4.1	5.9	2.6	1.0

Table 1: RMSE and MAPE for the average service times, for call types F and E, on Friday of Week 45.

Agent	Skill	M	\hat{M}				σ_v^2				v	
			$B1$	$B2$	$A2$	$A3$	$B1$	$B2$	$A2$	$A3$	$A2$	$A3$
1	F	549	415	563	562	562	1895421	261328	209593	210088	80	76
2	F	649	415	500	500	501	1895421	138991	134835	172225	83	94
3	F	280	415	321	299	284	1895421	189993	107504	113044	38	81
4	F	523	415	367	386	395	1895421	145158	128098	115399	20	18
5	F	538	415	443	442	445	1895421	262364	220645	222747	60	67
6	F	427	415	461	422	430	1895421	244324	127759	131373	81	82
7	F	342	415	369	354	330	1895421	131124	73490	83064	281	168
8	F	446	415	480	447	449	1895421	296428	212969	269650	164	10
9	F	397	415	419	408	414	1895421	134825	105224	90411	74	152
10	F	387	415	424	424	424	1895421	200555	202556	186808	40	12
11	F	385	415	362	388	401	1895421	149662	126127	129976	92	94
12	F	453	415	409	487	499	1895421	105126	127125	130946	48	64
11	E	417	412	378	428	415	331230	157662	125483	129976	158	100
12	E	444	412	456	456	451	331230	158621	124253	128232	59	56

Table 2: Observed M_k and predictions of M_k , σ^2 and v_k for some agents on Friday of week 45 for each model.

The target day that we simulate is Friday of week 45. For each selected agent, and each skill for the EF agents, we estimate the parameters of models $B1$, $B2$, $A2$, and $A3$ based on all data collected until Thursday of week 45. (We omit model $A1$ because it is dominated by $A2$ and $A3$.) Using those parameter estimates, we generate service times for each agent on that Friday. For $B1$ and $B2$, this is straightforward. For $A2$, as in equation (3.4) of the paper, we can write, omitting the specific indices for simplicity, the average of service times on the target day as $M = \beta + \gamma + \nu$ where (conditional on past information) β is a constant, γ is normally-distributed with conditional mean $\hat{\gamma}$ and conditional variance v , and ν is normal with mean 0 and variance σ_v^2/N , where N is the number of calls of that type handled by the agent on that day. To simulate one day, we first generate γ from the appropriate normal distribution and, conditional on γ , we generate independent service times that are lognormal with mean $\beta + \gamma$ and variance σ_v^2 . For $A3$, we proceed in a similar way. In Table 1 below,

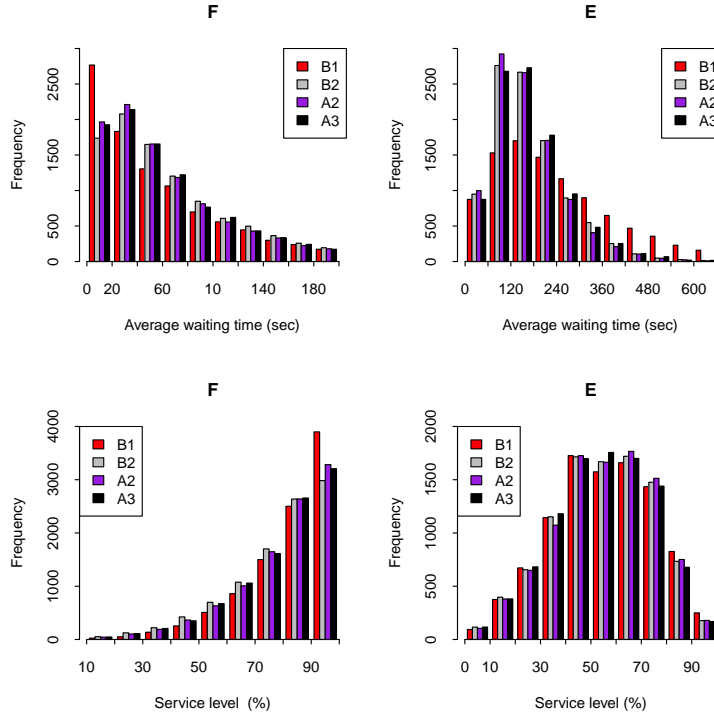


Figure 7: N model with original 12 agents.

we present the RMSE and MAPE for call types E and F, corresponding to each service-time model. And, in Table 2, we present the observed average service times for our simulated Friday, the forecasts from each service-time model, and estimated values for σ_v^2 and v for each agent and skill. Agents 11 and 12 are the EF agents considered.

In Figures 7-9, we plot histograms for the AWT simulation values corresponding to our original N model (summarized in Table 8 of the paper), our modified N model with 3 faster agents (summarized in Table 9 of the paper), and our modified N model with only 1 agent replaced with a slower one (summarized in Table 10 of the paper).

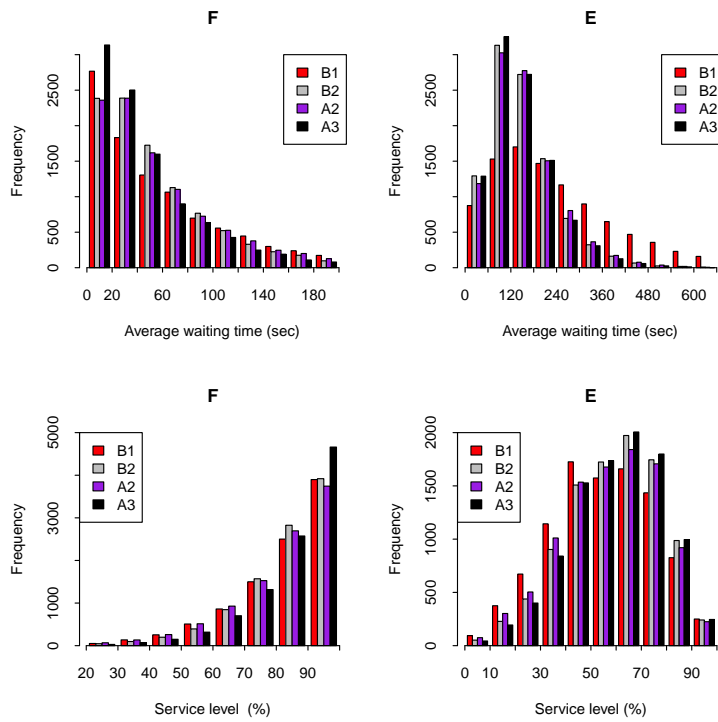


Figure 8: N model replacing 3 slow F agents with 3 fast F agents.

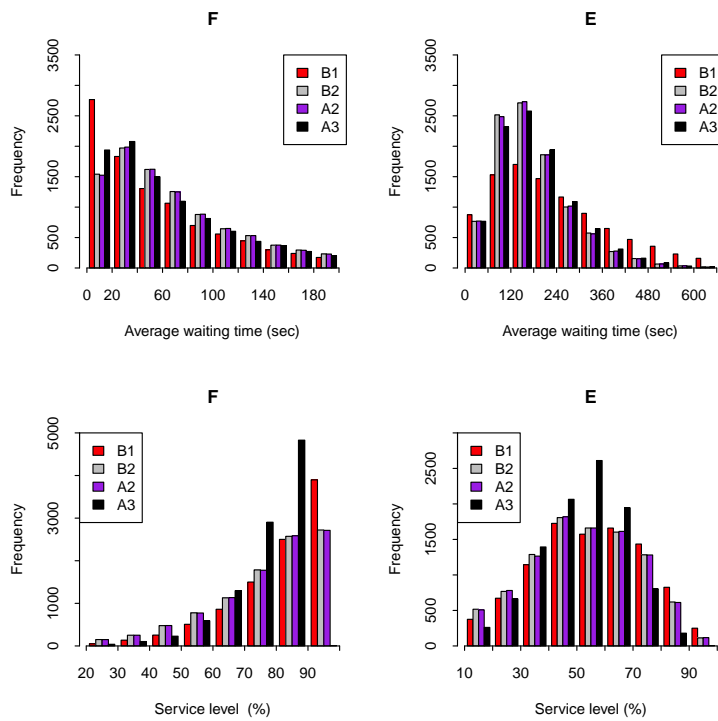


Figure 9: N model replacing one fast EF agent with one slow EF agent.

4. Additional Tables

Table 3: Predictions made one day in advance

Agent Information		Model B1		Model B2		Model 1		Model 2		Model 3	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A1	89	115.489	0.284	102.319	0.235	103.730	0.179	97.606	0.202	95.129	0.172
A2	160	120.545	0.471	82.384	0.222	81.923	0.201	77.548	0.212	83.340	0.242
A3	74	72.259	0.507	30.347	0.185	27.987	0.147	30.241	0.182	28.400	0.171
A4	102	147.819	0.162	120.594	0.182	131.277	0.171	118.200	0.169	112.192	0.145
A5	108	128.921	0.220	102.639	0.201	103.613	0.196	103.060	0.196	99.220	0.188
A6	123	97.177	0.321	52.395	0.136	61.837	0.159	51.270	0.133	50.237	0.132
A7	80	232.583	0.286	187.460	0.268	201.556	0.277	177.736	0.244	173.357	0.233
A8	60	53.427	0.275	44.732	0.250	39.340	0.174	43.288	0.238	40.390	0.217
A9	190	102.402	0.260	83.838	0.297	73.850	0.178	71.655	0.185	70.418	0.184
A10	135	64.340	0.128	74.419	0.170	67.159	0.133	69.552	0.146	68.133	0.141
A11	100	88.852	0.176	86.296	0.140	147.728	0.284	83.932	0.141	78.887	0.142
A12	101	70.274	0.428	45.333	0.202	44.215	0.225	37.819	0.187	44.195	0.196
A13	100	199.322	0.277	127.854	0.165	133.265	0.190	124.692	0.168	112.556	0.152
A14	147	116.982	0.330	111.468	0.277	139.990	0.313	96.879	0.232	79.510	0.187
A15	162	107.607	0.227	108.241	0.230	123.734	0.233	109.488	0.233	109.233	0.227
A16	85	113.349	0.207	114.952	0.196	110.373	0.180	116.810	0.200	112.563	0.190
A17	260	87.930	0.320	83.158	0.312	88.549	0.303	79.129	0.296	81.380	0.325
A18	93	185.325	0.261	99.132	0.138	111.842	0.158	105.521	0.144	102.007	0.138
A19	119	98.515	0.234	113.288	0.211	116.965	0.209	107.461	0.206	100.642	0.196
A20	122	153.471	0.244	107.909	0.197	138.494	0.212	108.724	0.195	104.980	0.185
A21	139	107.803	0.235	101.345	0.248	102.586	0.252	104.577	0.256	100.389	0.247
A22	96	140.700	0.213	112.764	0.186	113.216	0.211	111.971	0.185	100.978	0.175
A23	90	104.041	0.221	65.704	0.170	73.065	0.179	68.898	0.173	65.669	0.170
A24	94	187.061	0.825	94.210	0.302	97.695	0.174	96.635	0.260	89.317	0.213
A25	99	217.648	0.308	99.432	0.123	98.130	0.124	99.519	0.127	96.691	0.132
A26	102	164.262	0.242	126.448	0.244	157.314	0.273	132.579	0.255	129.097	0.249
A27	139	258.569	0.453	182.758	0.305	134.313	0.290	146.259	0.283	148.694	0.288
A28	111	148.911	0.208	112.437	0.158	124.058	0.191	110.411	0.168	103.552	0.157
A29	138	78.334	0.166	77.317	0.152	82.207	0.163	77.812	0.152	77.855	0.152
A30	164	96.216	0.287	81.465	0.189	87.512	0.211	81.384	0.192	69.547	0.174

Table 3 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A31	106	83.346	0.178	140.803	0.344	93.579	0.205	111.260	0.249	95.169	0.217
A32	110	315.175	0.310	216.438	0.251	253.651	0.233	224.669	0.261	216.606	0.251
A33	154	129.643	0.171	107.231	0.146	114.857	0.153	109.326	0.148	109.330	0.147
A34	136	122.180	0.391	107.923	0.314	106.227	0.284	107.043	0.309	111.437	0.311
A35	142	126.187	0.174	100.973	0.150	133.600	0.204	99.850	0.153	98.963	0.142
A36	89	136.395	0.195	121.367	0.181	136.719	0.205	121.170	0.181	120.373	0.182
A37	87	156.428	0.215	101.014	0.154	105.145	0.162	100.436	0.157	107.037	0.166
A38	70	91.308	0.313	79.645	0.257	70.139	0.165	74.078	0.216	74.794	0.207
A39	96	148.521	0.222	90.521	0.141	103.328	0.149	91.429	0.144	89.312	0.138
A40	144	140.252	0.198	111.718	0.180	118.958	0.176	107.465	0.174	105.149	0.171
A41	130	164.515	0.297	99.217	0.167	143.456	0.236	102.644	0.173	93.989	0.168
A42	111	87.389	0.267	70.860	0.328	64.284	0.217	67.072	0.261	65.031	0.240
A43	100	176.541	0.242	115.768	0.165	118.851	0.171	115.375	0.167	114.533	0.169
A44	117	112.758	0.181	114.389	0.183	120.834	0.208	82.956	0.142	81.084	0.137
A45	126	206.263	0.277	151.578	0.205	172.066	0.252	156.749	0.226	148.282	0.223
A46	71	106.104	0.338	95.260	0.212	90.565	0.197	77.893	0.191	87.299	0.200
A47	144	105.337	0.326	73.143	0.169	73.420	0.174	72.129	0.163	73.510	0.164
A48	134	111.967	0.158	101.390	0.164	116.490	0.186	101.578	0.163	100.294	0.165
A49	314	57.449	0.381	51.470	0.233	58.444	0.231	51.992	0.244	52.078	0.245
A50	84	77.738	0.852	24.766	0.236	31.877	0.327	24.731	0.236	25.170	0.244
A51	118	62.307	0.227	59.257	0.217	61.740	0.222	59.042	0.218	58.750	0.217
A52	102	161.824	0.212	127.040	0.165	125.272	0.178	119.835	0.161	119.158	0.172
A53	124	117.441	0.179	131.674	0.200	111.468	0.178	111.879	0.169	104.521	0.164
A54	101	122.393	0.179	112.545	0.168	111.930	0.173	103.868	0.160	97.613	0.170
A55	102	139.174	0.194	111.088	0.185	130.650	0.200	115.245	0.188	105.822	0.174
A56	118	138.809	0.215	116.122	0.211	122.207	0.191	117.186	0.211	115.427	0.210
A57	83	71.409	0.146	80.407	0.188	76.549	0.161	76.407	0.179	77.041	0.186
A58	96	159.652	0.216	98.346	0.131	116.944	0.162	94.814	0.131	103.284	0.136
A59	105	72.587	0.148	72.118	0.142	108.486	0.213	70.209	0.141	71.438	0.142
A60	90	69.006	0.207	61.928	0.200	70.502	0.226	63.588	0.212	62.144	0.221
A61	118	147.865	0.238	119.987	0.230	140.233	0.235	121.481	0.238	121.384	0.244
A62	72	224.085	0.294	173.190	0.236	187.105	0.301	169.235	0.245	167.393	0.231

Table 3 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A63	102	53.658	0.077	60.846	0.082	53.179	0.072	54.283	0.068	54.283	0.068
A64	77	237.143	0.262	199.329	0.276	158.322	0.181	172.397	0.208	180.789	0.242
A65	71	179.034	0.809	128.368	0.252	134.384	0.287	126.759	0.254	126.051	0.239
A66	167	103.671	0.316	92.905	0.289	84.540	0.249	82.066	0.263	93.073	0.290
A67	121	85.111	0.268	79.521	0.224	81.947	0.227	78.722	0.224	78.729	0.225
A68	75	91.880	0.159	89.152	0.165	103.756	0.168	91.207	0.169	90.196	0.170
A69	60	224.770	0.277	138.163	0.156	165.032	0.196	138.457	0.158	138.492	0.161
A70	93	87.654	0.202	76.866	0.155	96.212	0.179	76.866	0.155	76.866	0.155
A71	70	135.800	0.198	102.374	0.162	169.879	0.263	102.809	0.160	101.489	0.158
A72	64	85.339	0.838	36.883	0.247	38.386	0.275	38.328	0.247	38.218	0.256
A73	191	84.880	0.204	75.761	0.156	103.642	0.203	72.917	0.149	72.241	0.151
A74	189	77.791	0.268	71.890	0.257	80.576	0.278	70.166	0.260	71.568	0.265
A75	111	205.026	0.327	132.317	0.264	145.126	0.286	146.512	0.276	134.350	0.264
A76	54	85.538	0.618	63.040	0.313	73.260	0.361	63.293	0.312	61.635	0.276
A77	131	103.573	0.346	82.353	0.245	96.403	0.219	82.154	0.241	81.686	0.234
A78	92	121.664	0.174	116.832	0.168	132.671	0.177	105.598	0.163	113.196	0.164
A79	84	73.718	0.757	29.770	0.259	34.521	0.262	30.421	0.253	30.286	0.249
A80	149	78.264	0.271	56.464	0.187	72.424	0.260	56.231	0.188	56.830	0.189
A81	83	172.732	0.245	95.171	0.162	101.381	0.144	95.139	0.157	93.668	0.150
A82	81	74.181	0.613	51.878	0.336	61.381	0.409	46.840	0.287	51.063	0.312
A83	95	69.904	0.172	66.239	0.153	69.328	0.143	63.929	0.139	62.597	0.136
A84	69	97.074	0.194	93.962	0.192	88.995	0.187	88.404	0.181	89.587	0.187
A85	78	130.613	0.187	77.321	0.120	80.029	0.109	75.544	0.110	75.544	0.110
A86	49	99.655	0.287	52.832	0.115	49.595	0.115	49.119	0.111	49.119	0.111
A87	80	176.912	0.247	103.020	0.149	158.095	0.238	103.569	0.149	104.584	0.167
A88	167	95.408	0.199	115.859	0.216	116.153	0.220	115.452	0.218	104.470	0.195
A89	107	103.572	0.330	57.644	0.164	60.047	0.148	56.335	0.156	52.692	0.138
A90	117	64.097	0.437	19.896	0.143	20.777	0.152	19.896	0.143	19.894	0.150
A91	96	91.153	0.205	96.830	0.218	107.604	0.216	102.566	0.232	96.983	0.218
A92	100	116.390	0.227	121.020	0.238	116.627	0.226	116.178	0.227	117.704	0.234
A93	120	125.263	0.166	103.587	0.128	96.235	0.130	102.321	0.130	99.486	0.124
A94	96	94.762	0.115	89.709	0.113	96.217	0.130	90.614	0.114	84.240	0.114

Table 3 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A95	97	158.462	0.196	157.588	0.210	164.407	0.215	147.856	0.212	146.483	0.205
A96	81	57.911	0.115	64.916	0.121	57.877	0.114	59.472	0.115	59.472	0.115
A97	76	92.453	0.307	118.822	0.404	86.214	0.245	105.671	0.328	117.214	0.398
A98	87	170.899	0.220	117.162	0.151	140.778	0.163	104.759	0.127	104.759	0.127
A99	80	72.199	0.170	82.741	0.140	65.731	0.124	66.455	0.123	66.455	0.123
A100	82	113.156	0.152	106.435	0.143	95.707	0.133	97.698	0.133	97.698	0.133
A101	75	65.901	0.123	91.165	0.164	73.525	0.125	66.843	0.123	66.843	0.123
A102	46	66.991	0.119	67.221	0.120	69.196	0.126	67.221	0.120	67.221	0.120
A103	69	127.710	0.481	66.245	0.191	71.906	0.152	62.547	0.153	62.847	0.158
A104	130	88.909	0.155	85.739	0.180	108.774	0.187	83.776	0.160	89.011	0.169
A105	134	84.907	0.220	81.824	0.185	96.669	0.189	80.654	0.179	81.016	0.191
A106	123	102.332	0.166	97.868	0.205	98.108	0.188	96.306	0.197	98.824	0.193
A107	98	74.726	0.187	71.131	0.156	68.323	0.157	69.737	0.154	68.284	0.153
A108	89	101.333	0.251	98.069	0.229	100.777	0.221	102.707	0.235	97.817	0.219
A109	109	167.269	0.211	124.199	0.172	178.852	0.267	116.079	0.162	116.458	0.163
A110	146	134.785	0.397	130.988	0.444	116.659	0.423	123.215	0.441	122.059	0.427
A111	80	92.101	0.252	124.054	0.272	132.457	0.274	120.190	0.299	95.743	0.249
A112	132	77.865	0.154	79.479	0.143	80.358	0.145	80.340	0.147	80.279	0.149
A113	150	115.958	0.385	90.855	0.271	87.618	0.242	90.988	0.265	91.189	0.265
A114	71	98.776	0.179	95.553	0.182	97.537	0.199	91.609	0.178	91.218	0.175
A115	124	121.322	0.176	128.969	0.198	133.181	0.201	135.329	0.212	118.075	0.184
A116	125	124.403	0.235	116.236	0.265	118.297	0.214	115.702	0.251	110.728	0.226
A117	163	70.688	0.137	70.431	0.132	90.981	0.161	66.022	0.123	64.199	0.121
A118	228	102.809	0.272	91.904	0.214	93.993	0.210	90.838	0.210	90.240	0.207
A119	198	91.830	0.192	88.251	0.196	90.640	0.196	89.566	0.196	88.247	0.192
A120	154	105.866	0.177	107.402	0.190	105.762	0.181	98.543	0.180	99.069	0.181
A121	133	102.846	0.205	108.138	0.242	113.811	0.205	108.135	0.227	105.023	0.227
A122	135	89.365	0.192	93.777	0.213	89.637	0.178	89.107	0.189	89.963	0.202
A123	124	97.957	0.217	100.756	0.230	98.778	0.207	98.904	0.224	104.434	0.242
A124	223	76.873	0.181	73.042	0.166	73.225	0.160	72.991	0.164	72.354	0.162
A125	73	74.879	0.783	29.963	0.250	41.456	0.297	28.858	0.231	32.052	0.245
A126	79	69.613	0.142	68.570	0.142	71.819	0.138	66.828	0.134	66.543	0.136

Table 3 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A127	160	67.311	0.132	66.103	0.129	92.667	0.169	66.753	0.127	66.599	0.122
A128	94	197.530	0.605	200.695	0.630	213.095	0.628	205.766	0.625	202.283	0.616
A129	232	64.009	0.587	38.559	0.264	41.536	0.254	37.496	0.244	38.705	0.265
A130	308	63.501	0.247	62.577	0.212	64.780	0.216	58.429	0.203	59.595	0.226
A131	116	112.759	0.179	108.935	0.174	127.972	0.205	96.339	0.160	92.218	0.159
A132	177	108.337	0.256	96.991	0.193	124.579	0.208	99.296	0.194	96.585	0.187
A133	171	99.336	0.267	80.653	0.185	101.083	0.209	79.100	0.181	76.476	0.176
A134	124	136.224	0.205	107.734	0.166	124.791	0.183	108.239	0.168	107.131	0.166
A135	82	67.436	0.581	37.238	0.283	40.209	0.285	27.735	0.203	35.013	0.268
A136	80	91.921	0.756	43.314	0.239	46.320	0.224	43.314	0.239	43.833	0.245
A137	77	85.127	0.764	34.570	0.220	37.976	0.212	34.429	0.212	39.206	0.246
A138	71	73.874	0.602	32.178	0.210	33.909	0.183	31.672	0.198	32.042	0.191
A139	110	118.307	0.380	75.620	0.152	77.697	0.152	74.323	0.153	75.906	0.157
A140	120	90.003	0.265	56.894	0.140	56.898	0.147	57.388	0.140	55.787	0.137
A141	107	92.374	0.257	73.173	0.160	73.951	0.151	73.703	0.160	74.276	0.161
A142	103	99.711	0.306	71.918	0.151	65.781	0.153	70.647	0.158	67.532	0.155
A143	120	84.128	0.228	70.459	0.144	75.989	0.143	67.794	0.143	69.925	0.149
A144	105	67.666	0.149	67.201	0.146	71.690	0.134	65.414	0.133	64.413	0.131
A145	67	112.314	0.178	114.186	0.187	118.444	0.210	104.324	0.176	102.394	0.183
A146	69	88.815	0.140	85.521	0.154	88.351	0.161	83.068	0.142	82.987	0.148
A147	104	87.235	0.238	83.010	0.215	82.151	0.203	82.460	0.208	84.386	0.215
A148	64	65.688	0.162	54.704	0.125	84.295	0.173	52.001	0.102	52.001	0.102
A149	80	92.998	0.217	106.626	0.259	109.351	0.227	97.405	0.217	100.286	0.236
A150	94	118.995	0.203	117.950	0.205	138.858	0.227	118.452	0.213	118.998	0.217
A151	92	68.873	0.145	59.659	0.116	66.538	0.118	59.492	0.115	58.819	0.111
A152	97	184.276	0.151	175.437	0.144	174.282	0.145	176.825	0.138	177.374	0.137
A153	64	80.126	0.183	70.997	0.145	83.680	0.137	70.464	0.126	70.464	0.126
A154	60	80.262	0.213	65.819	0.169	50.970	0.100	52.717	0.120	52.717	0.120
A155	54	52.628	0.112	48.455	0.098	49.580	0.102	48.702	0.100	48.702	0.100
A156	76	64.260	0.129	85.845	0.157	78.630	0.143	75.034	0.147	70.820	0.136
A157	77	109.119	0.313	70.962	0.151	74.878	0.188	71.604	0.161	72.249	0.155
A158	86	221.348	0.232	215.076	0.187	216.371	0.210	206.281	0.201	206.941	0.201

Table 3 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A159	79	78.219	0.156	80.740	0.178	86.669	0.169	81.308	0.170	82.458	0.172
A160	72	103.379	0.269	108.026	0.284	118.467	0.251	104.098	0.264	104.098	0.264
A161	83	102.455	0.244	84.035	0.157	83.249	0.142	81.563	0.148	78.606	0.136
A162	69	83.772	0.254	63.995	0.185	60.806	0.156	60.348	0.165	60.348	0.165
A163	67	75.300	0.128	83.844	0.164	110.630	0.182	78.638	0.134	78.638	0.134
A164	68	119.188	0.356	92.980	0.238	94.714	0.177	87.426	0.200	85.614	0.185
A165	95	88.359	0.166	106.903	0.248	100.144	0.161	90.988	0.174	90.217	0.173
A166	95	69.936	0.161	55.624	0.101	63.447	0.107	55.607	0.098	54.908	0.092
A167	87	92.027	0.174	91.794	0.170	91.494	0.140	87.003	0.140	85.625	0.135
A168	84	50.199	0.115	47.058	0.101	49.560	0.109	45.928	0.098	46.997	0.100
A169	83	82.737	0.145	77.752	0.145	79.118	0.150	70.877	0.128	71.366	0.134
A170	91	82.601	0.218	71.263	0.166	73.039	0.167	69.090	0.156	74.224	0.160
A171	93	85.575	0.177	101.056	0.183	87.135	0.162	93.360	0.172	87.640	0.162
A172	101	81.469	0.171	85.310	0.143	95.371	0.170	79.685	0.150	76.739	0.140
A173	98	120.069	0.398	90.829	0.239	93.828	0.188	83.044	0.187	83.663	0.200
A174	133	86.088	0.202	85.092	0.178	103.727	0.191	78.216	0.148	72.339	0.145
A175	98	68.642	0.172	65.917	0.155	64.441	0.145	67.639	0.159	67.413	0.159
A176	92	71.526	0.180	97.794	0.259	70.107	0.153	73.224	0.183	76.026	0.192
A177	69	88.906	0.192	82.226	0.155	83.823	0.158	82.824	0.156	82.225	0.157
A178	77	95.794	0.141	94.156	0.172	93.463	0.144	92.699	0.158	97.722	0.166
A179	96	85.829	0.123	82.071	0.118	78.774	0.131	81.790	0.122	78.787	0.117
A180	110	117.832	0.195	119.643	0.236	124.791	0.204	114.527	0.215	115.846	0.215
A181	69	92.594	0.158	87.740	0.171	91.720	0.159	87.740	0.171	87.740	0.171
A182	75	68.239	0.122	70.907	0.138	72.548	0.124	71.975	0.139	70.791	0.138
A183	72	68.196	0.104	63.972	0.110	62.886	0.099	63.314	0.107	63.884	0.108
A184	70	124.605	0.172	95.443	0.141	100.797	0.139	102.783	0.158	98.739	0.154
A185	76	95.364	0.291	62.692	0.161	70.314	0.151	62.339	0.144	61.573	0.142
A186	87	73.986	0.160	73.425	0.132	85.624	0.161	73.235	0.139	69.056	0.129
A187	47	77.517	0.098	80.114	0.141	86.494	0.114	77.332	0.115	77.332	0.115
A188	94	94.728	0.230	92.966	0.179	93.175	0.197	90.650	0.179	93.178	0.182
A189	44	90.085	0.253	72.054	0.192	65.078	0.152	31.351	0.077	31.351	0.077
A190	41	46.302	0.095	45.437	0.091	50.393	0.087	44.395	0.083	44.395	0.083

Table 3 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A191	43	44.735	0.086	44.935	0.085	57.621	0.097	49.822	0.089	49.822	0.089
A192	103	71.969	0.474	64.983	0.436	49.481	0.266	52.542	0.316	44.940	0.232
A193	137	87.772	0.378	84.229	0.295	85.974	0.315	81.765	0.277	82.164	0.277
A194	117	55.450	0.184	56.348	0.173	52.910	0.209	53.737	0.167	53.096	0.168
A195	88	50.012	0.295	33.582	0.187	30.187	0.158	34.047	0.190	32.103	0.166
A196	82	53.813	0.211	58.975	0.274	49.891	0.229	61.203	0.284	57.161	0.267
A197	111	63.856	0.172	58.589	0.199	57.851	0.186	53.283	0.171	54.172	0.178
A198	48	58.704	0.385	19.360	0.115	21.274	0.119	17.680	0.103	20.739	0.114
A199	88	61.708	0.141	144.083	0.236	183.579	0.278	146.088	0.242	133.403	0.222
A200	68	163.296	0.257	59.532	0.136	59.392	0.129	57.803	0.131	57.178	0.128

Table 4: Predictions made one week in advance

Agent Information		Model B1		Model B2		Model 1		Model 2		Model 3	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A1	89	115.441	0.284	103.598	0.239	111.908	0.196	102.140	0.211	96.233	0.174
A2	160	120.654	0.473	82.655	0.224	83.377	0.205	78.626	0.210	83.906	0.240
A3	74	71.888	0.503	30.484	0.186	28.012	0.147	30.492	0.184	29.779	0.182
A4	102	147.952	0.162	120.290	0.183	136.525	0.175	119.204	0.176	112.584	0.151
A5	108	128.809	0.220	103.155	0.202	108.206	0.204	102.585	0.199	100.894	0.196
A6	123	96.337	0.317	51.389	0.131	74.637	0.195	50.919	0.129	51.922	0.137
A7	80	232.613	0.287	189.664	0.274	208.840	0.293	184.036	0.273	180.377	0.267
A8	60	53.095	0.273	44.576	0.248	39.721	0.183	44.273	0.245	41.615	0.229
A9	190	102.253	0.260	84.979	0.304	74.547	0.182	75.436	0.209	73.979	0.205
A10	135	64.276	0.128	75.760	0.174	68.057	0.136	71.809	0.154	71.639	0.153
A11	100	88.868	0.176	86.709	0.140	149.228	0.289	86.995	0.140	82.635	0.135
A12	101	70.493	0.429	47.116	0.209	52.525	0.261	46.036	0.204	46.660	0.210
A13	100	199.022	0.276	128.098	0.165	132.648	0.186	125.481	0.165	118.908	0.156
A14	147	117.252	0.332	111.632	0.277	142.752	0.308	102.641	0.249	90.582	0.212
A15	162	107.546	0.228	108.466	0.231	126.888	0.239	108.943	0.231	108.373	0.230
A16	85	113.630	0.207	117.219	0.199	112.329	0.172	119.026	0.203	118.197	0.203
A17	260	88.107	0.321	83.737	0.315	91.411	0.313	83.672	0.317	84.389	0.329
A18	93	185.639	0.261	98.840	0.138	115.364	0.165	99.679	0.140	97.710	0.137
A19	119	97.754	0.231	116.595	0.218	130.949	0.230	115.596	0.224	105.342	0.203
A20	122	154.381	0.245	108.653	0.200	182.606	0.293	109.055	0.199	104.770	0.187
A21	139	107.768	0.236	99.094	0.238	100.600	0.240	99.255	0.239	97.051	0.235
A22	96	140.236	0.212	118.778	0.196	124.749	0.230	119.560	0.197	111.936	0.186
A23	90	104.001	0.220	67.492	0.174	75.673	0.182	68.954	0.176	67.524	0.174
A24	94	187.512	0.828	94.611	0.306	98.142	0.178	93.436	0.274	85.220	0.218
A25	99	217.518	0.308	99.674	0.124	101.236	0.124	97.668	0.123	96.563	0.127
A26	102	163.845	0.241	124.661	0.240	155.155	0.280	126.275	0.246	126.630	0.244
A27	139	259.521	0.454	185.463	0.308	140.837	0.303	167.490	0.324	157.226	0.309
A28	111	148.803	0.208	112.571	0.156	123.894	0.185	106.107	0.155	103.273	0.149
A29	138	78.425	0.166	77.332	0.152	84.098	0.169	77.336	0.152	76.851	0.152
A30	164	96.372	0.288	82.646	0.194	96.232	0.242	82.411	0.197	75.703	0.185
A31	106	83.172	0.178	142.860	0.348	93.944	0.212	116.669	0.267	101.285	0.231
A32	110	315.434	0.310	215.073	0.250	245.538	0.227	223.490	0.261	214.049	0.252

Table 4 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A33	154	129.565	0.171	106.617	0.143	115.018	0.154	107.937	0.146	108.333	0.145
A34	136	122.557	0.392	108.091	0.314	108.276	0.282	109.296	0.310	104.662	0.291
A35	142	126.477	0.174	101.428	0.151	140.753	0.218	100.928	0.155	96.276	0.137
A36	89	136.411	0.195	121.303	0.181	137.192	0.204	121.275	0.181	120.287	0.180
A37	87	155.777	0.214	105.221	0.161	119.694	0.177	103.761	0.166	107.201	0.167
A38	70	91.641	0.315	80.235	0.260	72.520	0.168	73.843	0.214	84.032	0.229
A39	96	149.019	0.223	89.213	0.140	218.498	0.252	87.541	0.141	88.458	0.137
A40	144	140.260	0.198	112.564	0.182	122.381	0.185	111.498	0.177	108.879	0.175
A41	130	164.467	0.297	99.028	0.167	145.177	0.240	102.608	0.174	95.309	0.169
A42	111	87.632	0.268	72.137	0.334	66.080	0.221	69.314	0.272	66.225	0.248
A43	100	176.317	0.241	116.485	0.166	123.520	0.176	116.689	0.169	117.027	0.171
A44	117	112.717	0.181	115.638	0.185	131.720	0.228	84.458	0.144	82.270	0.141
A45	126	187.761	0.270	129.429	0.199	146.855	0.227	133.316	0.209	127.312	0.216
A46	71	106.700	0.341	97.831	0.221	101.855	0.222	89.153	0.210	94.586	0.213
A47	144	105.684	0.327	73.274	0.169	74.024	0.176	73.491	0.170	73.954	0.170
A48	134	112.081	0.158	99.644	0.162	114.053	0.183	99.929	0.161	98.877	0.162
A49	314	57.478	0.381	51.477	0.233	59.692	0.235	51.837	0.242	52.265	0.245
A50	84	77.269	0.845	24.883	0.237	32.221	0.331	25.094	0.238	25.371	0.243
A51	118	62.449	0.227	59.722	0.220	64.531	0.226	59.231	0.224	59.690	0.228
A52	102	162.381	0.212	127.973	0.165	126.491	0.183	120.984	0.160	120.343	0.169
A53	124	117.451	0.179	134.508	0.205	117.067	0.183	117.611	0.178	114.277	0.183
A54	101	122.286	0.179	113.543	0.169	119.379	0.189	108.094	0.170	102.669	0.177
A55	102	139.020	0.193	111.893	0.188	153.036	0.242	114.157	0.190	106.773	0.177
A56	118	138.911	0.216	116.439	0.213	124.519	0.201	117.445	0.218	118.077	0.220
A57	83	71.733	0.146	84.639	0.202	78.595	0.165	85.223	0.207	78.054	0.191
A58	96	159.673	0.216	98.287	0.131	118.214	0.161	94.583	0.131	95.484	0.129
A59	105	71.519	0.146	72.297	0.143	110.977	0.222	70.512	0.140	72.119	0.143
A60	90	69.295	0.208	62.182	0.201	77.154	0.250	63.467	0.211	61.616	0.228
A61	118	148.292	0.239	120.798	0.232	152.218	0.265	122.964	0.240	120.518	0.240
A62	72	224.002	0.294	174.899	0.237	195.938	0.315	175.793	0.243	168.145	0.227
A63	102	53.778	0.077	61.137	0.083	53.633	0.073	55.529	0.071	55.529	0.071
A64	77	237.011	0.262	207.019	0.289	164.474	0.186	186.514	0.241	187.022	0.248

Table 4 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A65	71	178.721	0.807	128.588	0.254	136.028	0.301	128.482	0.263	130.352	0.288
A66	167	103.731	0.316	94.958	0.294	85.948	0.250	85.768	0.273	95.099	0.297
A67	121	85.178	0.268	80.012	0.225	83.642	0.236	80.041	0.227	78.780	0.226
A68	75	91.845	0.159	89.151	0.165	106.293	0.171	90.412	0.168	88.190	0.168
A69	60	228.125	0.276	141.823	0.155	212.583	0.256	144.729	0.162	141.848	0.158
A70	93	87.870	0.203	77.249	0.156	101.037	0.189	77.249	0.156	77.249	0.156
A71	70	136.435	0.199	103.026	0.166	175.962	0.276	103.099	0.166	100.544	0.160
A72	64	85.437	0.839	36.893	0.248	38.698	0.284	39.067	0.272	37.903	0.256
A73	191	85.148	0.205	76.065	0.156	109.336	0.217	73.840	0.150	70.655	0.148
A74	189	77.896	0.269	72.060	0.258	82.491	0.280	71.231	0.257	71.499	0.261
A75	111	204.691	0.327	133.816	0.274	169.917	0.380	136.144	0.282	134.970	0.275
A76	54	85.175	0.615	63.367	0.315	75.285	0.380	67.260	0.333	66.973	0.313
A77	131	103.619	0.346	82.456	0.247	99.935	0.224	82.214	0.245	82.087	0.241
A78	92	121.639	0.174	115.372	0.167	129.469	0.166	115.116	0.176	108.557	0.156
A79	84	73.653	0.756	29.889	0.259	35.216	0.259	30.253	0.258	31.312	0.263
A80	149	78.665	0.273	57.210	0.189	73.380	0.263	57.375	0.190	58.541	0.197
A81	83	172.560	0.244	96.650	0.165	104.964	0.153	97.025	0.166	96.550	0.156
A82	81	74.820	0.614	51.944	0.331	60.764	0.399	48.023	0.277	50.843	0.327
A83	95	70.135	0.173	67.773	0.158	72.883	0.152	66.683	0.156	66.624	0.152
A84	69	97.137	0.195	95.018	0.195	93.009	0.194	88.951	0.180	90.425	0.185
A85	78	130.322	0.187	77.581	0.121	82.582	0.111	79.355	0.116	79.355	0.116
A86	49	100.008	0.288	53.187	0.115	50.666	0.119	51.290	0.113	51.290	0.113
A87	80	177.521	0.249	103.260	0.148	166.881	0.253	106.917	0.154	108.650	0.169
A88	167	94.738	0.198	116.917	0.222	130.140	0.261	117.821	0.225	105.036	0.199
A89	107	103.651	0.330	58.460	0.167	61.746	0.154	57.551	0.162	58.178	0.162
A90	117	65.027	0.443	19.386	0.137	24.377	0.168	19.386	0.137	19.303	0.139
A91	96	91.207	0.205	97.804	0.221	139.576	0.282	97.763	0.221	96.073	0.217
A92	100	116.156	0.227	121.473	0.239	118.593	0.228	118.283	0.231	119.851	0.237
A93	120	124.753	0.165	104.423	0.130	98.241	0.131	104.212	0.131	101.397	0.128
A94	96	94.515	0.115	89.988	0.113	98.978	0.134	91.485	0.115	85.556	0.117
A95	97	154.151	0.192	154.668	0.206	171.759	0.246	146.821	0.205	138.833	0.190
A96	81	57.903	0.115	65.202	0.121	58.183	0.114	61.193	0.117	61.193	0.117

Table 4 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A97	76	92.469	0.307	133.035	0.456	88.653	0.239	126.803	0.425	132.405	0.454
A98	87	170.714	0.220	117.612	0.151	146.808	0.175	115.359	0.144	115.359	0.144
A99	80	72.344	0.170	83.264	0.142	66.897	0.125	71.052	0.124	71.052	0.124
A100	82	112.950	0.151	106.839	0.143	96.333	0.134	99.180	0.135	99.180	0.135
A101	75	65.765	0.123	92.118	0.166	75.040	0.129	69.928	0.124	69.928	0.124
A102	46	66.969	0.119	67.361	0.121	70.924	0.130	67.361	0.121	67.361	0.121
A103	69	127.988	0.482	67.661	0.201	74.445	0.160	65.927	0.184	64.878	0.183
A104	130	88.862	0.155	86.798	0.183	113.584	0.195	87.134	0.170	92.553	0.178
A105	134	85.096	0.221	82.013	0.185	100.176	0.194	81.332	0.182	81.843	0.189
A106	123	102.392	0.166	98.343	0.206	99.646	0.188	97.549	0.201	98.506	0.191
A107	98	74.834	0.187	71.388	0.156	69.168	0.158	71.070	0.156	70.525	0.155
A108	89	101.372	0.251	98.462	0.232	102.640	0.231	101.520	0.247	98.064	0.229
A109	109	166.847	0.211	124.414	0.173	204.186	0.310	114.851	0.160	115.520	0.161
A110	146	134.758	0.399	134.406	0.463	123.641	0.472	124.609	0.456	126.172	0.455
A111	80	92.063	0.252	125.061	0.274	148.886	0.312	122.700	0.305	97.594	0.238
A112	132	77.973	0.154	79.551	0.143	80.943	0.146	79.490	0.144	80.789	0.148
A113	150	116.213	0.386	91.284	0.272	88.224	0.243	90.916	0.269	92.441	0.280
A114	71	98.732	0.179	96.309	0.181	97.722	0.197	97.753	0.186	94.897	0.180
A115	124	121.227	0.177	128.762	0.199	141.716	0.227	122.273	0.192	117.447	0.182
A116	125	124.193	0.235	116.650	0.267	116.321	0.197	114.559	0.253	112.281	0.233
A117	163	70.782	0.137	70.912	0.134	96.340	0.173	67.992	0.124	66.926	0.119
A118	228	102.975	0.273	92.343	0.215	95.826	0.216	93.019	0.217	93.112	0.217
A119	198	91.840	0.193	88.040	0.195	90.458	0.196	87.845	0.194	88.274	0.193
A120	154	105.789	0.177	107.871	0.190	108.529	0.188	100.247	0.179	104.231	0.190
A121	133	102.889	0.205	108.721	0.245	117.027	0.214	111.251	0.240	110.182	0.241
A122	135	89.244	0.191	94.433	0.215	90.919	0.178	91.659	0.201	96.912	0.224
A123	124	97.819	0.217	101.186	0.231	100.133	0.209	99.860	0.223	105.861	0.244
A124	223	76.991	0.181	73.428	0.167	74.313	0.162	73.760	0.168	73.396	0.164
A125	73	74.908	0.784	30.312	0.255	41.550	0.291	29.617	0.238	36.366	0.306
A126	79	69.607	0.143	69.242	0.144	75.734	0.146	68.218	0.139	68.788	0.143
A127	160	67.417	0.132	66.198	0.129	97.317	0.178	66.575	0.126	67.952	0.123
A128	94	197.855	0.606	201.039	0.635	211.247	0.638	201.293	0.635	201.153	0.621

Table 4 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A129	232	62.941	0.562	37.407	0.241	41.760	0.241	37.499	0.237	37.527	0.242
A130	308	63.852	0.249	62.952	0.215	66.285	0.222	60.125	0.210	60.888	0.227
A131	76	112.594	0.179	109.676	0.175	134.044	0.213	104.071	0.174	105.015	0.177
A132	116	108.437	0.256	97.299	0.194	137.291	0.232	98.569	0.194	96.796	0.190
A133	177	99.510	0.268	81.052	0.185	113.702	0.223	80.685	0.181	76.385	0.173
A134	171	135.994	0.205	109.400	0.168	139.701	0.207	110.530	0.170	109.538	0.169
A135	124	68.762	0.588	40.063	0.301	43.635	0.310	37.570	0.252	41.614	0.309
A136	82	91.678	0.754	43.334	0.239	46.457	0.220	43.334	0.239	43.162	0.241
A137	80	84.950	0.762	34.358	0.218	38.123	0.207	34.034	0.209	36.682	0.223
A138	77	73.801	0.602	32.316	0.211	34.778	0.197	30.895	0.199	31.214	0.195
A139	71	118.535	0.381	75.727	0.152	78.628	0.153	74.784	0.158	76.771	0.163
A140	110	90.067	0.265	57.205	0.141	57.870	0.151	56.845	0.141	56.176	0.141
A141	120	92.484	0.258	73.101	0.160	73.504	0.149	72.889	0.159	72.635	0.158
A142	107	99.998	0.307	72.420	0.153	66.938	0.157	71.312	0.157	69.962	0.157
A143	103	84.291	0.228	70.679	0.145	77.886	0.147	68.409	0.141	71.156	0.148
A144	120	67.759	0.150	68.259	0.150	73.335	0.135	67.902	0.143	68.402	0.144
A145	105	112.271	0.178	115.513	0.190	134.913	0.244	116.696	0.201	115.772	0.205
A146	67	92.889	0.154	92.020	0.171	97.364	0.181	93.014	0.174	93.475	0.179
A147	69	87.446	0.239	84.027	0.220	85.531	0.216	83.798	0.219	84.765	0.221
A148	104	65.954	0.163	55.412	0.127	90.759	0.192	50.992	0.107	50.992	0.107
A149	64	93.292	0.218	111.218	0.271	125.009	0.262	112.359	0.276	102.368	0.242
A150	80	118.978	0.202	117.599	0.206	146.368	0.241	117.525	0.213	114.698	0.211
A151	94	68.934	0.146	59.743	0.117	69.485	0.126	59.759	0.117	59.590	0.117
A152	92	184.407	0.152	176.258	0.145	174.334	0.143	177.684	0.141	178.591	0.141
A153	97	80.320	0.183	71.517	0.148	86.957	0.146	71.240	0.136	71.240	0.136
A154	64	80.543	0.214	66.910	0.173	51.585	0.100	58.974	0.141	58.974	0.141
A155	60	52.808	0.113	48.636	0.098	50.509	0.104	48.914	0.100	48.914	0.100
A156	54	64.285	0.129	87.174	0.159	81.973	0.149	75.567	0.145	70.787	0.133
A157	76	109.536	0.314	71.009	0.151	78.705	0.199	73.387	0.165	72.301	0.156
A158	77	221.569	0.234	216.213	0.190	222.008	0.224	216.068	0.203	216.022	0.201
A159	86	78.027	0.157	80.723	0.178	88.364	0.174	78.644	0.166	82.276	0.176
A160	79	103.575	0.270	109.919	0.290	127.006	0.282	105.017	0.271	105.017	0.271

Table 4 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A161	72	102.884	0.246	84.595	0.159	85.494	0.146	80.465	0.150	79.877	0.146
A162	83	84.053	0.255	64.353	0.187	61.669	0.157	61.439	0.167	61.439	0.167
A163	69	75.324	0.128	84.767	0.166	118.047	0.203	76.245	0.122	76.245	0.122
A164	67	119.685	0.357	93.746	0.241	97.082	0.184	89.336	0.207	87.610	0.196
A165	68	88.365	0.166	110.565	0.259	103.688	0.171	105.570	0.223	103.940	0.221
A166	95	70.058	0.161	55.700	0.102	65.390	0.115	56.478	0.103	58.305	0.109
A167	95	92.329	0.175	92.855	0.174	93.223	0.145	90.147	0.154	89.810	0.151
A168	87	50.300	0.115	47.075	0.101	51.448	0.117	46.786	0.101	46.905	0.100
A169	84	82.780	0.145	79.254	0.147	85.751	0.166	77.117	0.143	78.003	0.146
A170	83	82.631	0.218	71.632	0.166	75.126	0.173	71.124	0.164	71.919	0.161
A171	91	85.767	0.178	102.803	0.187	88.915	0.167	97.318	0.178	90.368	0.165
A172	93	81.544	0.171	85.578	0.143	101.052	0.187	82.160	0.150	80.360	0.144
A173	101	120.203	0.398	92.817	0.248	96.821	0.196	90.663	0.221	94.415	0.244
A174	98	86.085	0.202	86.185	0.182	113.373	0.218	78.258	0.164	77.720	0.160
A175	133	68.719	0.173	66.174	0.156	66.730	0.145	66.670	0.161	66.225	0.158
A176	98	71.568	0.181	101.170	0.269	70.987	0.154	76.615	0.189	82.230	0.214
A177	92	89.089	0.192	82.188	0.154	84.482	0.159	82.318	0.152	82.922	0.157
A178	69	95.775	0.141	94.346	0.173	92.186	0.139	93.772	0.162	97.149	0.167
A179	77	86.027	0.123	83.426	0.120	83.918	0.148	78.334	0.116	82.810	0.124
A180	96	117.885	0.195	120.256	0.237	128.341	0.209	122.773	0.255	119.686	0.237
A181	110	92.561	0.158	88.109	0.172	93.919	0.161	88.109	0.172	88.109	0.172
A182	69	68.256	0.122	71.583	0.141	75.151	0.133	72.035	0.140	71.507	0.140
A183	75	68.131	0.104	64.174	0.112	63.029	0.102	64.765	0.114	63.911	0.111
A184	72	124.525	0.171	96.060	0.143	106.543	0.148	92.326	0.139	96.464	0.147
A185	70	95.527	0.292	63.662	0.166	73.547	0.159	63.218	0.154	62.269	0.148
A186	76	74.070	0.160	74.205	0.134	99.858	0.191	72.655	0.139	72.062	0.138
A187	87	77.442	0.098	81.118	0.144	89.235	0.118	76.875	0.115	76.875	0.115
A188	47	94.670	0.229	93.631	0.179	95.955	0.209	92.604	0.179	94.147	0.183
A189	94	90.464	0.255	77.234	0.207	75.799	0.182	42.145	0.099	42.145	0.099
A190	44	46.475	0.095	46.037	0.094	54.432	0.096	48.166	0.092	48.166	0.092
A191	41	44.775	0.086	44.701	0.085	63.603	0.113	43.964	0.080	43.964	0.080
A192	43	72.371	0.478	65.876	0.443	50.895	0.282	57.557	0.367	51.464	0.301

Table 4 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A193	103	87.983	0.381	84.018	0.293	85.616	0.311	84.781	0.298	83.934	0.290
A194	137	55.612	0.185	56.738	0.174	54.537	0.219	57.637	0.176	55.071	0.169
A195	117	50.306	0.296	33.752	0.188	30.481	0.161	33.064	0.182	31.259	0.168
A196	88	53.881	0.212	58.869	0.274	48.755	0.219	66.960	0.310	58.689	0.273
A197	82	63.517	0.172	59.019	0.199	59.296	0.189	56.542	0.185	52.998	0.174
A198	111	59.064	0.387	19.682	0.117	23.273	0.131	19.085	0.108	20.952	0.116
A199	88	0.144	62.947	147.239	0.243	222.854	0.314	149.500	0.249	135.082	0.224
A200	68	0.267	167.844	60.669	0.138	61.724	0.135	59.709	0.136	57.556	0.131

Table 5: Predictions made two weeks in advance

Agent Information		Model B1		Model B2		Model 1		Model 2		Model 3	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A1	89	115.328	0.284	105.035	0.244	118.494	0.207	100.840	0.218	96.440	0.176
A2	160	120.741	0.475	83.268	0.228	84.649	0.212	79.885	0.213	84.726	0.243
A3	74	71.318	0.499	30.491	0.186	27.985	0.146	30.192	0.182	29.676	0.182
A4	102	148.478	0.162	120.959	0.185	153.499	0.179	119.922	0.180	113.179	0.154
A5	108	127.689	0.217	103.138	0.202	222.966	0.368	102.952	0.199	101.896	0.199
A6	123	96.835	0.317	53.237	0.140	86.506	0.228	53.392	0.141	54.588	0.146
A7	80	232.613	0.287	191.863	0.279	221.101	0.310	196.275	0.305	192.487	0.298
A8	60	52.456	0.269	45.458	0.253	39.901	0.188	45.046	0.251	42.549	0.237
A9	190	102.097	0.260	86.198	0.312	75.336	0.184	78.553	0.227	76.208	0.218
A10	135	64.190	0.128	77.438	0.179	69.804	0.140	74.550	0.164	74.561	0.164
A11	100	88.765	0.176	86.989	0.142	166.544	0.338	87.878	0.147	85.893	0.140
A12	101	70.670	0.430	50.854	0.226	71.266	0.348	47.915	0.207	49.979	0.222
A13	100	198.529	0.276	128.734	0.165	138.831	0.193	126.902	0.165	120.565	0.156
A14	147	119.535	0.339	113.924	0.284	149.789	0.326	105.718	0.265	93.782	0.235
A15	162	107.606	0.229	108.331	0.231	129.286	0.244	109.108	0.230	106.972	0.226
A16	85	112.574	0.204	118.006	0.203	201.578	0.283	119.853	0.207	118.899	0.207
A17	260	88.307	0.322	84.086	0.318	93.992	0.322	84.699	0.322	85.715	0.329
A18	93	186.002	0.261	99.220	0.139	218.392	0.252	99.257	0.141	97.397	0.137
A19	119	95.440	0.227	118.713	0.223	154.973	0.282	117.863	0.229	110.456	0.210
A20	122	155.060	0.247	107.782	0.200	229.798	0.346	108.067	0.197	105.591	0.189
A21	139	107.658	0.236	102.168	0.250	105.269	0.256	105.881	0.261	99.368	0.243
A22	96	138.805	0.210	124.188	0.209	156.860	0.278	122.270	0.207	118.422	0.197
A23	90	103.916	0.220	66.655	0.172	74.626	0.176	67.768	0.173	66.667	0.172
A24	94	188.514	0.833	95.072	0.309	100.160	0.170	97.161	0.270	88.156	0.207
A25	99	217.185	0.307	99.412	0.124	103.353	0.126	98.101	0.125	97.275	0.130
A26	102	163.452	0.240	128.687	0.251	168.079	0.300	129.543	0.256	129.236	0.252
A27	139	259.577	0.454	187.222	0.310	140.061	0.301	169.891	0.319	159.300	0.315
A28	111	148.558	0.208	111.870	0.156	132.570	0.194	107.940	0.159	101.796	0.153
A29	138	78.564	0.167	77.282	0.152	84.819	0.170	77.727	0.153	77.180	0.152
A30	164	96.052	0.288	84.202	0.197	106.582	0.280	83.448	0.197	79.529	0.191
A31	106	82.996	0.178	145.048	0.356	95.332	0.208	121.418	0.285	103.749	0.240
A32	110	316.524	0.312	215.308	0.250	254.697	0.242	223.922	0.263	214.195	0.256

Table 5 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A33	154	129.192	0.170	108.002	0.146	135.899	0.177	108.541	0.147	110.478	0.149
A34	136	123.290	0.395	108.466	0.315	108.878	0.287	109.587	0.317	107.933	0.310
A35	142	124.781	0.172	97.488	0.145	131.606	0.197	97.124	0.144	93.835	0.134
A36	89	136.622	0.195	121.307	0.180	140.923	0.212	121.322	0.181	120.189	0.179
A37	87	157.686	0.214	107.440	0.166	119.143	0.186	92.198	0.148	109.431	0.175
A38	70	92.450	0.320	80.921	0.265	73.807	0.170	72.527	0.209	80.670	0.221
A39	96	143.929	0.218	87.248	0.139	357.860	0.430	87.113	0.142	86.457	0.137
A40	144	140.104	0.198	111.559	0.181	120.240	0.183	110.165	0.179	110.714	0.183
A41	130	164.051	0.296	99.181	0.167	165.719	0.285	101.018	0.174	95.565	0.168
A42	111	87.915	0.268	72.767	0.341	66.168	0.221	70.233	0.284	67.641	0.263
A43	100	176.036	0.241	116.738	0.165	126.639	0.177	117.381	0.168	115.852	0.168
A44	117	112.631	0.180	116.932	0.187	146.230	0.253	86.551	0.151	80.768	0.138
A45	126	190.458	0.273	132.143	0.202	147.527	0.224	134.457	0.205	131.913	0.215
A46	71	107.421	0.345	99.487	0.225	115.580	0.258	93.729	0.213	98.193	0.220
A47	144	106.228	0.329	73.228	0.169	73.936	0.175	73.300	0.170	73.316	0.169
A48	134	112.470	0.159	104.169	0.163	137.829	0.224	104.020	0.163	104.329	0.167
A49	314	57.564	0.381	51.489	0.233	60.905	0.238	50.801	0.236	52.286	0.247
A50	84	77.276	0.845	24.893	0.237	32.631	0.334	24.930	0.238	25.024	0.239
A51	118	62.683	0.227	60.051	0.221	67.998	0.235	60.198	0.224	59.888	0.225
A52	102	162.353	0.212	130.360	0.167	148.655	0.220	123.754	0.162	125.743	0.174
A53	124	118.483	0.180	136.078	0.206	115.005	0.183	120.946	0.180	116.315	0.174
A54	101	121.909	0.178	113.495	0.169	118.692	0.191	107.684	0.167	98.207	0.169
A55	102	138.778	0.193	111.307	0.188	153.867	0.247	115.166	0.193	110.478	0.184
A56	118	137.908	0.214	117.126	0.215	175.066	0.264	118.019	0.219	119.325	0.223
A57	83	72.088	0.147	90.099	0.212	92.960	0.206	92.318	0.221	86.091	0.206
A58	96	159.696	0.216	99.166	0.133	166.208	0.214	96.449	0.134	97.467	0.133
A59	105	71.678	0.146	72.389	0.143	117.277	0.237	71.150	0.141	72.455	0.143
A60	90	69.630	0.210	62.803	0.203	84.313	0.265	62.098	0.203	62.109	0.230
A61	118	148.220	0.238	118.543	0.227	154.129	0.251	119.406	0.228	117.409	0.241
A62	72	223.928	0.294	175.525	0.237	198.913	0.339	178.727	0.255	173.433	0.229
A63	102	53.926	0.078	61.410	0.084	53.673	0.074	54.557	0.069	54.557	0.069
A64	77	236.916	0.262	213.845	0.299	164.751	0.192	193.805	0.260	176.524	0.223

Table 5 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A65	71	178.257	0.803	128.370	0.254	135.807	0.303	128.309	0.264	129.646	0.281
A66	167	103.901	0.317	97.292	0.301	88.538	0.254	90.413	0.282	97.622	0.303
A67	121	85.172	0.268	79.893	0.223	87.032	0.241	80.188	0.225	78.851	0.223
A68	75	91.763	0.159	89.160	0.164	110.621	0.176	89.248	0.163	90.051	0.164
A69	60	228.002	0.275	143.453	0.156	229.083	0.300	146.133	0.165	143.533	0.162
A70	93	88.148	0.204	77.547	0.156	107.038	0.203	77.547	0.156	77.547	0.156
A71	70	136.275	0.198	103.910	0.169	182.647	0.293	105.656	0.173	101.831	0.165
A72	64	85.029	0.835	37.078	0.251	38.941	0.288	38.826	0.265	38.520	0.261
A73	191	85.643	0.206	76.419	0.157	116.339	0.237	74.259	0.150	71.433	0.146
A74	189	77.975	0.270	72.051	0.257	83.500	0.281	71.379	0.257	71.723	0.261
A75	111	204.376	0.326	129.455	0.259	202.350	0.472	130.840	0.265	129.745	0.257
A76	54	84.876	0.613	63.064	0.308	74.062	0.339	65.809	0.317	65.103	0.316
A77	131	103.859	0.347	83.090	0.250	107.387	0.270	83.441	0.251	84.192	0.252
A78	92	121.335	0.173	116.833	0.169	156.000	0.224	114.837	0.174	113.397	0.165
A79	84	73.014	0.750	29.822	0.260	34.537	0.244	30.089	0.262	31.523	0.272
A80	149	78.468	0.273	58.532	0.192	74.675	0.268	59.254	0.195	60.717	0.203
A81	83	171.537	0.242	96.608	0.165	105.753	0.155	96.678	0.165	96.239	0.157
A82	81	74.289	0.608	51.584	0.327	61.285	0.401	48.562	0.283	50.451	0.320
A83	95	70.351	0.174	68.506	0.160	73.891	0.153	69.296	0.163	68.298	0.156
A84	69	97.015	0.195	93.615	0.191	92.037	0.185	88.648	0.181	92.464	0.186
A85	78	129.899	0.186	77.728	0.121	84.224	0.112	82.479	0.120	82.479	0.120
A86	49	100.468	0.289	53.568	0.116	52.619	0.126	52.535	0.114	52.535	0.114
A87	80	177.282	0.249	103.787	0.149	182.906	0.283	101.816	0.150	106.290	0.165
A88	167	94.923	0.200	114.898	0.218	133.770	0.252	111.668	0.213	106.989	0.207
A89	107	103.870	0.331	58.688	0.168	62.135	0.153	58.111	0.166	57.924	0.164
A90	117	66.359	0.451	19.541	0.140	23.832	0.162	19.541	0.140	19.449	0.140
A91	96	90.767	0.204	97.838	0.221	154.339	0.307	97.422	0.221	98.637	0.222
A92	100	116.088	0.227	121.467	0.240	116.148	0.223	119.559	0.236	119.499	0.238
A93	120	124.187	0.164	105.156	0.132	98.833	0.133	105.435	0.134	101.567	0.127
A94	96	94.324	0.115	90.544	0.113	104.679	0.141	92.430	0.116	91.892	0.115
A95	97	176.216	0.184	179.070	0.203	204.192	0.257	176.059	0.209	170.071	0.207
A96	81	57.812	0.115	65.416	0.122	58.122	0.115	61.791	0.118	61.791	0.118

Table 5 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A97	76	92.417	0.307	151.660	0.529	125.688	0.358	153.688	0.537	151.169	0.527
A98	87	170.439	0.219	118.157	0.153	154.660	0.189	123.093	0.159	123.093	0.159
A99	80	72.530	0.171	83.844	0.143	68.540	0.127	76.883	0.132	76.883	0.132
A100	82	112.729	0.151	107.265	0.144	97.124	0.133	101.339	0.136	101.339	0.136
A101	75	65.665	0.123	92.997	0.168	76.513	0.133	69.864	0.124	69.864	0.124
A102	46	66.953	0.119	67.313	0.120	71.375	0.134	67.313	0.120	67.313	0.120
A103	69	128.449	0.484	69.907	0.214	77.820	0.174	70.528	0.214	68.714	0.207
A104	130	88.679	0.155	87.375	0.185	118.156	0.206	87.590	0.177	96.168	0.188
A105	134	85.332	0.222	82.239	0.186	104.368	0.198	80.899	0.180	83.733	0.197
A106	123	102.340	0.166	97.838	0.206	98.064	0.186	95.834	0.198	94.386	0.186
A107	98	75.023	0.188	71.824	0.157	71.148	0.161	71.736	0.157	72.177	0.159
A108	89	101.396	0.252	98.916	0.232	105.820	0.239	99.868	0.243	98.043	0.231
A109	109	161.143	0.203	126.772	0.176	222.443	0.354	120.735	0.170	120.403	0.169
A110	146	134.690	0.400	135.074	0.462	123.879	0.468	128.755	0.459	126.617	0.448
A111	80	91.903	0.252	125.775	0.276	165.278	0.361	109.814	0.282	107.207	0.259
A112	132	78.205	0.155	79.484	0.143	80.867	0.146	78.980	0.142	80.739	0.147
A113	150	116.619	0.388	91.597	0.274	87.891	0.244	93.149	0.277	93.510	0.287
A114	71	98.655	0.179	97.436	0.186	94.908	0.194	95.094	0.180	96.444	0.183
A115	124	120.868	0.175	133.059	0.207	244.929	0.369	130.777	0.209	121.907	0.189
A116	125	123.778	0.235	118.276	0.275	117.281	0.208	116.668	0.266	114.469	0.250
A117	163	70.994	0.138	71.414	0.135	100.662	0.183	68.074	0.130	67.581	0.126
A118	228	103.167	0.273	92.489	0.216	96.996	0.219	91.897	0.217	93.079	0.219
A119	198	91.749	0.192	88.222	0.196	91.472	0.198	88.034	0.194	88.750	0.195
A120	154	105.719	0.177	108.763	0.192	117.344	0.205	104.712	0.188	108.835	0.203
A121	133	102.926	0.206	109.290	0.247	120.122	0.221	112.460	0.249	110.571	0.248
A122	135	89.338	0.192	94.765	0.216	92.977	0.180	92.979	0.202	98.978	0.226
A123	124	97.552	0.217	101.240	0.231	100.554	0.210	100.688	0.225	104.588	0.242
A124	223	77.188	0.182	73.682	0.167	75.270	0.165	73.666	0.168	74.611	0.167
A125	73	74.707	0.781	30.965	0.263	41.825	0.302	30.461	0.252	35.036	0.292
A126	79	69.550	0.143	70.301	0.147	79.764	0.155	70.252	0.148	70.237	0.147
A127	160	67.648	0.133	66.533	0.130	103.508	0.193	68.269	0.129	70.054	0.125
A128	94	198.111	0.606	200.594	0.634	207.255	0.622	200.552	0.634	198.819	0.612

Table 5 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A129	232	63.330	0.563	37.707	0.242	42.032	0.244	37.742	0.246	37.677	0.245
A130	308	64.436	0.250	63.570	0.215	68.084	0.227	61.097	0.212	60.921	0.222
A131	76	112.432	0.180	110.248	0.177	140.879	0.228	106.148	0.170	103.784	0.168
A132	116	108.430	0.257	97.498	0.195	145.814	0.261	98.521	0.196	97.443	0.192
A133	177	99.766	0.269	81.200	0.186	136.289	0.269	80.833	0.179	79.732	0.183
A134	171	134.957	0.196	104.590	0.155	156.312	0.201	108.308	0.159	106.149	0.157
A135	124	67.719	0.577	38.346	0.279	40.743	0.291	37.450	0.268	37.195	0.263
A136	82	91.461	0.752	43.334	0.239	47.171	0.222	43.334	0.239	43.339	0.241
A137	80	84.576	0.759	34.422	0.218	38.650	0.211	34.444	0.213	38.416	0.245
A138	77	73.549	0.600	32.714	0.213	35.713	0.201	32.318	0.208	31.773	0.201
A139	71	118.872	0.382	75.959	0.153	80.770	0.162	77.180	0.164	78.481	0.172
A140	110	90.213	0.266	57.647	0.142	59.822	0.153	57.378	0.141	56.354	0.140
A141	120	92.694	0.259	73.318	0.161	74.285	0.151	73.393	0.162	73.314	0.162
A142	107	100.319	0.308	72.615	0.153	67.045	0.157	71.269	0.156	70.980	0.156
A143	103	84.532	0.229	70.918	0.147	79.427	0.151	69.084	0.143	70.824	0.148
A144	120	67.886	0.150	68.708	0.152	74.893	0.138	67.962	0.146	68.227	0.145
A145	105	112.770	0.178	116.569	0.191	147.459	0.279	119.658	0.205	117.982	0.210
A146	67	95.605	0.149	86.509	0.146	87.265	0.143	85.237	0.144	86.951	0.149
A147	69	87.711	0.240	84.864	0.224	89.115	0.232	84.841	0.224	85.881	0.227
A148	104	66.305	0.163	56.284	0.129	99.470	0.218	48.806	0.102	48.806	0.102
A149	64	93.867	0.220	117.861	0.289	154.404	0.329	116.341	0.284	109.444	0.261
A150	80	118.832	0.202	114.756	0.198	155.358	0.258	115.490	0.209	111.935	0.201
A151	94	69.011	0.146	60.115	0.118	77.577	0.144	61.313	0.123	61.273	0.124
A152	92	184.427	0.152	178.160	0.150	186.052	0.171	179.828	0.148	180.589	0.150
A153	97	80.543	0.184	72.139	0.150	92.214	0.157	75.745	0.148	75.745	0.148
A154	64	80.838	0.215	67.919	0.176	51.467	0.099	60.778	0.150	60.778	0.150
A155	60	53.076	0.114	48.740	0.098	51.634	0.107	49.039	0.099	49.039	0.099
A156	54	64.327	0.129	88.595	0.161	87.510	0.156	74.704	0.140	73.122	0.132
A157	76	110.068	0.315	71.660	0.152	84.524	0.219	76.056	0.175	73.856	0.163
A158	77	221.992	0.235	215.936	0.190	222.652	0.229	215.369	0.203	214.928	0.201
A159	86	77.880	0.157	81.113	0.180	91.136	0.184	79.315	0.167	83.204	0.178
A160	79	103.855	0.271	112.367	0.299	139.687	0.325	106.980	0.280	106.980	0.280

Table 5 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A161	72	103.441	0.249	84.963	0.161	86.159	0.143	81.398	0.157	81.086	0.152
A162	83	84.408	0.256	64.650	0.188	62.733	0.158	59.916	0.167	59.916	0.167
A163	69	75.369	0.128	86.385	0.170	128.278	0.232	77.820	0.129	77.820	0.129
A164	67	120.227	0.359	94.492	0.243	99.797	0.193	86.779	0.193	86.839	0.194
A165	68	88.345	0.166	113.461	0.267	108.076	0.181	114.715	0.259	113.668	0.254
A166	95	70.285	0.162	55.825	0.103	71.106	0.135	55.248	0.102	59.008	0.112
A167	95	92.798	0.177	94.067	0.178	96.763	0.153	92.402	0.165	93.782	0.167
A168	87	50.419	0.115	47.415	0.102	55.314	0.125	47.546	0.102	47.508	0.102
A169	84	82.773	0.145	79.734	0.149	95.349	0.192	77.513	0.142	79.010	0.148
A170	83	82.673	0.219	72.413	0.169	79.598	0.187	73.934	0.173	74.235	0.171
A171	91	86.034	0.178	104.444	0.190	93.154	0.180	101.059	0.181	93.445	0.169
A172	93	81.663	0.172	85.812	0.143	110.280	0.218	81.107	0.150	78.004	0.146
A173	101	120.413	0.399	94.989	0.258	97.582	0.196	93.979	0.252	98.809	0.274
A174	98	86.085	0.202	88.040	0.188	123.297	0.239	83.907	0.187	82.959	0.187
A175	133	68.827	0.173	66.345	0.156	69.328	0.153	66.846	0.160	65.834	0.156
A176	98	71.657	0.181	106.621	0.284	74.597	0.166	92.474	0.237	99.842	0.263
A177	92	89.429	0.193	81.894	0.154	84.661	0.160	82.223	0.152	81.859	0.155
A178	69	95.713	0.141	94.944	0.177	91.699	0.142	94.891	0.173	95.702	0.170
A179	77	86.064	0.123	83.206	0.120	80.623	0.146	80.525	0.122	80.831	0.123
A180	96	117.901	0.195	120.431	0.241	128.015	0.206	114.909	0.229	120.244	0.248
A181	110	92.509	0.158	88.103	0.173	93.475	0.161	88.103	0.173	88.103	0.173
A182	69	68.304	0.122	72.363	0.144	76.246	0.132	72.517	0.145	72.363	0.144
A183	75	67.964	0.103	65.312	0.115	67.363	0.112	64.032	0.113	64.832	0.113
A184	72	124.346	0.171	95.329	0.140	110.410	0.147	94.268	0.141	95.243	0.145
A185	70	95.806	0.293	65.623	0.174	78.523	0.177	65.728	0.170	66.368	0.170
A186	76	74.192	0.161	75.604	0.136	117.626	0.231	73.521	0.140	74.390	0.143
A187	87	77.304	0.098	82.726	0.149	93.511	0.129	80.038	0.137	80.038	0.137
A188	47	94.650	0.229	94.820	0.180	101.796	0.226	95.058	0.181	94.354	0.180
A189	94	90.966	0.256	84.221	0.228	88.358	0.213	51.588	0.123	51.588	0.123
A190	44	46.714	0.096	46.502	0.096	65.018	0.119	50.281	0.105	50.281	0.105
A191	41	44.840	0.087	44.875	0.086	77.722	0.145	45.576	0.084	45.576	0.084
A192	43	72.697	0.480	66.749	0.450	53.318	0.301	58.874	0.378	53.120	0.321

Table 5 – continued from previous page

Agent Information		Model 3		Model 2		Model 1		Model B1		Model B2	
ID	Number of predictions	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE	MAPE	RMSE
A193	103	88.163	0.384	83.831	0.293	85.009	0.313	83.808	0.292	84.611	0.288
A194	137	55.691	0.187	56.684	0.172	53.940	0.220	57.527	0.173	56.450	0.173
A195	117	51.008	0.301	33.875	0.189	31.144	0.166	33.653	0.187	30.336	0.166
A196	88	54.054	0.215	60.323	0.281	49.124	0.221	73.000	0.354	59.528	0.278
A197	82	62.927	0.169	59.025	0.201	59.680	0.201	58.677	0.198	57.863	0.200
A198	111	59.670	0.391	19.890	0.118	26.406	0.148	19.851	0.116	19.167	0.108
A199	88	63.598	0.146	146.093	0.238	228.572	0.314	147.029	0.239	138.271	0.226
A200	68	166.719	0.261	61.360	0.141	61.986	0.141	61.244	0.140	60.232	0.139

Periods	Staffing	Periods	Staffing	Periods	Staffing	Periods	Staffing
1	5	11	10	21	10	31	8
2	5	12	10	22	10	32	8
3	5	13	10	23	10	33	8
4	5	14	10	24	10	34	8
5	8	15	10	25	10	35	8
6	8	16	10	26	10	36	8
7	8	17	9	27	10	37	6
8	8	18	9	28	10	38	6
9	10	19	9	29	8	39	6
10	10	20	9	30	8	40	6

Table 6: Staffing periods for the F agents.

Periods	Shape	Rate	Periods	Shape	Rate	Periods	Shape	Rate	Periods	Shape	Rate
1	17.1	12.5	11	27.1	22.3	21	38.4	20.1	31	62.9	18.7
2	14.1	12.0	12	37.6	22.9	22	18.4	19.5	32	36.0	17.4
3	10.3	14.0	13	29.9	22.8	23	13.9	19.0	33	14.6	15.4
4	11.3	15.5	14	52.5	21.1	24	16.4	19.1	34	11.4	14.9
5	9.4	17.4	15	42.4	20.2	25	16.8	19.5	35	8.4	13.7
6	11.7	18.4	16	44.8	19.3	26	33.9	19.3	36	15.1	13.3
7	28.7	18.8	17	33.6	17.8	27	24.5	19.7	37	11.1	11.3
8	35.8	18.6	18	15.0	17.1	28	36.7	19.2	38	15.1	9.8
9	18.6	20.7	19	35.1	18.4	29	54.3	19.7	39	14.1	9.0
10	35.2	21.3	20	14.4	18.1	30	40.6	19.9	40	22.2	7.5

Table 7: Periods Shape and Rate for Gamma distribution in arrival process for call type F

Periods	Shape	Rate	Periods	Shape	Rate	Periods	Shape	Rate	Periods	Shape	Rate
1	4.8	0.3	11	10.0	0.6	21	6.5	0.5	31	10.9	0.5
2	5.4	0.3	12	14.0	0.6	22	10.3	0.6	32	10.6	0.5
3	6.2	0.3	13	10.0	0.6	23	8.7	0.5	33	9.2	0.5
4	6.4	0.4	14	10.1	0.6	24	11.4	0.5	34	8.1	0.4
5	8.2	0.5	15	10.3	0.5	25	10.8	0.5	35	8.2	0.4
6	8.8	0.5	16	10.4	0.5	26	9.7	0.5	36	7.2	0.3
7	9.6	0.5	17	13.5	0.4	27	14.8	0.5	37	6.0	0.3
8	10.4	0.5	18	11.6	0.4	28	11.2	0.5	38	6.0	0.2
9	10.6	0.6	19	8.9	0.4	29	12.1	0.5	39	4.2	0.2
10	9.9	0.6	20	8.2	0.5	30	17.1	0.5	40	6.5	0.1

Table 8: Periods Shape and Rate for Gamma distribution in arrival process for the call type E

Periods	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20
P1	1.0	0.5	0.2	0.5	0.2	0.2	0.5	0.4	0.3	0.4	0.3	0.3	0.5	0.5	0.4	0.3	0.4	0.2	0.3	0.5
P2	0.5	1.0	0.7	0.8	0.5	0.8	0.6	0.6	0.6	0.7	0.5	0.7	0.6	0.6	0.6	0.6	0.7	0.5	0.7	0.8
P3	0.2	0.7	1.0	0.6	0.6	0.6	0.7	0.6	0.7	0.7	0.5	0.6	0.7	0.6	0.7	0.6	0.7	0.7	0.8	0.7
P4	0.5	0.8	0.6	1.0	0.6	0.6	0.7	0.6	0.7	0.6	0.6	0.7	0.6	0.5	0.6	0.5	0.7	0.6	0.6	0.8
P5	0.2	0.5	0.6	0.6	1.0	0.4	0.7	0.5	0.7	0.6	0.6	0.6	0.5	0.5	0.6	0.6	0.7	0.7	0.6	0.7
P6	0.2	0.8	0.6	0.6	0.4	1.0	0.6	0.6	0.7	0.8	0.4	0.6	0.6	0.5	0.6	0.6	0.5	0.5	0.6	0.7
P7	0.5	0.6	0.7	0.7	0.7	0.6	1.0	0.7	0.7	0.7	0.4	0.6	0.7	0.6	0.8	0.6	0.7	0.6	0.7	0.8
P8	0.4	0.6	0.6	0.6	0.5	0.6	0.7	1.0	0.7	0.5	0.6	0.6	0.6	0.5	0.4	0.5	0.5	0.5	0.5	0.5
P9	0.3	0.6	0.7	0.7	0.7	0.7	0.7	0.7	1.0	0.6	0.5	0.6	0.6	0.5	0.6	0.5	0.6	0.7	0.7	0.7
P10	0.4	0.7	0.7	0.6	0.6	0.8	0.7	0.5	0.6	1.0	0.6	0.8	0.6	0.8	0.7	0.8	0.8	0.5	0.8	0.7
P11	0.3	0.5	0.5	0.6	0.6	0.4	0.4	0.6	0.5	0.6	1.0	0.9	0.7	0.8	0.6	0.9	0.8	0.7	0.8	0.6
P12	0.3	0.7	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.8	0.9	1.0	0.8	0.9	0.8	0.9	0.9	0.7	0.9	0.8
P13	0.5	0.7	0.7	0.6	0.5	0.6	0.7	0.6	0.6	0.6	0.7	0.8	1.0	0.8	0.8	0.7	0.8	0.7	0.8	0.8
P14	0.5	0.6	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.8	0.8	0.9	0.8	1.0	0.8	0.9	0.9	0.6	0.9	0.8
P15	0.4	0.6	0.7	0.6	0.6	0.6	0.8	0.4	0.6	0.7	0.6	0.8	0.8	0.8	1.0	0.8	0.9	0.8	0.9	0.8
P16	0.3	0.6	0.6	0.5	0.6	0.6	0.6	0.5	0.5	0.8	0.9	0.9	0.7	0.9	0.8	1.0	0.9	0.7	0.9	0.7
P17	0.4	0.7	0.7	0.7	0.7	0.5	0.7	0.5	0.6	0.8	0.8	0.9	0.8	0.9	0.9	0.9	1.0	0.8	0.9	0.8
P18	0.2	0.5	0.7	0.6	0.7	0.5	0.6	0.5	0.7	0.5	0.7	0.7	0.7	0.6	0.8	0.7	0.8	1.0	0.8	0.8
P19	0.3	0.7	0.8	0.6	0.6	0.6	0.7	0.5	0.7	0.8	0.8	0.9	0.8	0.9	0.9	0.9	0.9	0.8	1.0	0.8
P20	0.5	0.8	0.7	0.8	0.7	0.7	0.8	0.5	0.7	0.7	0.6	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.8	1.0
P21	0.4	0.8	0.6	0.5	0.5	0.7	0.6	0.6	0.5	0.7	0.4	0.6	0.6	0.7	0.7	0.6	0.6	0.5	0.7	0.8
P22	0.3	0.6	0.5	0.3	0.4	0.7	0.6	0.4	0.6	0.6	0.4	0.5	0.6	0.5	0.8	0.5	0.6	0.6	0.6	0.6
P23	0.4	0.6	0.5	0.6	0.4	0.5	0.5	0.5	0.5	0.6	0.4	0.5	0.4	0.5	0.6	0.5	0.5	0.5	0.4	0.5
P24	0.0	0.6	0.7	0.6	0.5	0.8	0.7	0.5	0.7	0.7	0.5	0.6	0.6	0.6	0.7	0.6	0.7	0.7	0.7	0.7
P25	0.1	0.6	0.7	0.7	0.7	0.7	0.7	0.5	0.7	0.7	0.6	0.8	0.7	0.7	0.8	0.7	0.8	0.8	0.8	0.8
P26	0.1	0.6	0.8	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.6
P27	0.2	0.7	0.7	0.6	0.7	0.7	0.8	0.6	0.6	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.8	0.7	0.8	0.7
P28	0.1	0.5	0.5	0.7	0.6	0.4	0.6	0.4	0.5	0.6	0.8	0.8	0.6	0.7	0.6	0.7	0.9	0.7	0.7	0.6
P29	0.4	0.4	0.3	0.4	0.2	0.3	0.5	0.2	0.2	0.5	0.6	0.6	0.7	0.8	0.6	0.6	0.7	0.4	0.6	0.5
P30	0.5	0.5	0.5	0.5	0.4	0.4	0.5	0.4	0.4	0.7	0.8	0.9	0.8	1.0	0.7	0.8	0.8	0.5	0.8	0.7
P31	0.5	0.4	0.3	0.4	0.4	0.2	0.4	0.3	0.3	0.6	0.8	0.8	0.7	0.9	0.6	0.8	0.8	0.5	0.7	0.5
P32	0.1	0.3	0.3	0.3	0.3	0.2	0.3	0.1	0.2	0.5	0.6	0.5	0.3	0.5	0.4	0.5	0.6	0.4	0.5	0.3
P33	0.2	0.4	0.4	0.6	0.5	0.5	0.7	0.6	0.5	0.5	0.4	0.5	0.4	0.3	0.5	0.4	0.5	0.4	0.4	0.5
P34	0.3	0.6	0.6	0.7	0.6	0.5	0.8	0.6	0.6	0.7	0.5	0.7	0.5	0.6	0.6	0.6	0.8	0.6	0.7	0.7
P35	0.3	0.5	0.6	0.5	0.4	0.5	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.6	0.6	0.7	0.6	0.7	0.6
P36	0.5	0.5	0.6	0.5	0.4	0.3	0.6	0.6	0.6	0.6	0.5	0.7	0.8	0.8	0.6	0.6	0.7	0.5	0.7	0.6
P37	0.6	0.7	0.6	0.7	0.5	0.4	0.5	0.6	0.6	0.7	0.6	0.8	0.8	0.8	0.6	0.7	0.8	0.6	0.8	0.7
P38	0.5	0.6	0.4	0.5	0.3	0.2	0.3	0.6	0.4	0.6	0.5	0.6	0.6	0.6	0.3	0.5	0.5	0.4	0.6	0.5
P39	0.5	0.3	0.1	0.2	0.0	-0.1	0.1	0.1	0.1	0.4	0.4	0.4	0.4	0.6	0.3	0.5	0.4	0.2	0.4	0.4
P40	0.7	0.4	0.3	0.4	0.2	0.1	0.3	0.3	0.2	0.6	0.5	0.5	0.5	0.8	0.4	0.6	0.6	0.3	0.6	0.5

Table 9: Correlation matrix between arrival rate for the call type F part 1

Periods	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30	P31	P32	P33	P34	P35	P36	P37	P38	P39	P40
P1	0.4	0.3	0.4	0.0	0.1	0.1	0.2	0.1	0.4	0.5	0.5	0.1	0.2	0.3	0.3	0.5	0.6	0.5	0.5	0.7
P2	0.8	0.6	0.6	0.6	0.6	0.6	0.7	0.5	0.4	0.5	0.4	0.3	0.4	0.6	0.5	0.5	0.7	0.6	0.3	0.4
P3	0.6	0.5	0.5	0.7	0.7	0.8	0.7	0.5	0.3	0.5	0.3	0.3	0.4	0.6	0.6	0.6	0.6	0.4	0.1	0.3
P4	0.5	0.3	0.6	0.6	0.7	0.5	0.6	0.7	0.4	0.5	0.4	0.3	0.6	0.7	0.5	0.5	0.7	0.5	0.2	0.4
P5	0.5	0.4	0.4	0.5	0.7	0.6	0.7	0.6	0.2	0.4	0.4	0.3	0.5	0.6	0.4	0.4	0.5	0.3	0.0	0.2
P6	0.7	0.7	0.5	0.8	0.7	0.6	0.7	0.4	0.3	0.4	0.2	0.2	0.5	0.5	0.5	0.3	0.4	0.2	-0.1	0.1
P7	0.6	0.6	0.5	0.7	0.7	0.6	0.8	0.6	0.5	0.5	0.4	0.3	0.7	0.8	0.6	0.6	0.5	0.3	0.1	0.3
P8	0.6	0.4	0.5	0.5	0.5	0.6	0.6	0.4	0.2	0.4	0.3	0.1	0.6	0.6	0.6	0.6	0.6	0.6	0.1	0.3
P9	0.5	0.6	0.5	0.7	0.7	0.7	0.6	0.5	0.2	0.4	0.3	0.2	0.5	0.6	0.6	0.6	0.6	0.4	0.1	0.2
P10	0.7	0.6	0.6	0.7	0.7	0.7	0.7	0.6	0.5	0.7	0.6	0.5	0.5	0.7	0.6	0.6	0.7	0.6	0.4	0.6
P11	0.4	0.4	0.4	0.5	0.6	0.8	0.7	0.8	0.6	0.8	0.8	0.6	0.4	0.5	0.6	0.5	0.6	0.5	0.4	0.5
P12	0.6	0.5	0.5	0.6	0.8	0.8	0.8	0.8	0.6	0.9	0.8	0.5	0.5	0.7	0.7	0.7	0.8	0.6	0.4	0.5
P13	0.6	0.6	0.4	0.6	0.7	0.7	0.7	0.6	0.7	0.8	0.7	0.3	0.4	0.5	0.7	0.8	0.8	0.6	0.4	0.5
P14	0.7	0.5	0.5	0.6	0.7	0.7	0.7	0.7	0.8	1.0	0.9	0.5	0.3	0.6	0.7	0.8	0.8	0.6	0.6	0.8
P15	0.7	0.8	0.6	0.7	0.8	0.7	0.7	0.6	0.6	0.7	0.6	0.4	0.5	0.6	0.6	0.6	0.6	0.3	0.3	0.4
P16	0.6	0.5	0.5	0.6	0.7	0.8	0.7	0.7	0.6	0.8	0.8	0.5	0.4	0.6	0.6	0.6	0.7	0.5	0.5	0.6
P17	0.6	0.6	0.5	0.7	0.8	0.8	0.8	0.9	0.7	0.8	0.8	0.6	0.5	0.8	0.7	0.7	0.8	0.5	0.4	0.6
P18	0.5	0.6	0.5	0.7	0.8	0.8	0.7	0.7	0.4	0.5	0.5	0.4	0.4	0.6	0.6	0.5	0.6	0.4	0.2	0.3
P19	0.7	0.6	0.4	0.7	0.8	0.9	0.8	0.7	0.6	0.8	0.7	0.5	0.4	0.7	0.7	0.7	0.8	0.6	0.4	0.6
P20	0.8	0.6	0.5	0.7	0.8	0.6	0.7	0.6	0.5	0.7	0.5	0.3	0.5	0.7	0.6	0.6	0.7	0.5	0.4	0.5
P21	1.0	0.6	0.4	0.7	0.7	0.6	0.5	0.3	0.4	0.5	0.4	0.2	0.5	0.6	0.6	0.5	0.6	0.5	0.3	0.4
P22	0.6	1.0	0.5	0.6	0.7	0.6	0.6	0.4	0.3	0.4	0.3	0.3	0.5	0.4	0.4	0.3	0.4	0.2	0.1	0.1
P23	0.4	0.5	1.0	0.6	0.6	0.4	0.6	0.5	0.1	0.3	0.3	0.4	0.6	0.5	0.5	0.4	0.5	0.4	0.2	0.3
P24	0.7	0.6	0.6	1.0	0.8	0.8	0.8	0.7	0.4	0.5	0.3	0.5	0.7	0.7	0.7	0.5	0.5	0.4	0.1	0.2
P25	0.7	0.7	0.6	0.8	1.0	0.8	0.8	0.8	0.4	0.6	0.4	0.5	0.7	0.7	0.6	0.5	0.6	0.3	0.1	0.2
P26	0.6	0.6	0.4	0.8	0.8	1.0	0.8	0.7	0.5	0.7	0.6	0.6	0.4	0.7	0.6	0.5	0.6	0.4	0.2	0.3
P27	0.5	0.6	0.6	0.8	0.8	0.8	1.0	0.8	0.4	0.6	0.5	0.5	0.6	0.7	0.7	0.5	0.5	0.4	0.1	0.2
P28	0.3	0.4	0.5	0.7	0.8	0.7	0.8	1.0	0.7	0.7	0.7	0.7	0.6	0.7	0.5	0.5	0.6	0.4	0.3	0.4
P29	0.4	0.3	0.1	0.4	0.4	0.5	0.4	0.7	1.0	0.9	0.9	0.6	0.2	0.4	0.4	0.7	0.6	0.4	0.6	0.7
P30	0.5	0.4	0.3	0.5	0.6	0.7	0.6	0.7	0.9	1.0	0.9	0.5	0.3	0.6	0.7	0.9	0.8	0.6	0.7	0.8
P31	0.4	0.3	0.3	0.3	0.4	0.6	0.5	0.7	0.9	0.9	1.0	0.7	0.2	0.5	0.6	0.8	0.7	0.7	0.8	0.9
P32	0.2	0.3	0.4	0.5	0.5	0.6	0.5	0.7	0.6	0.5	0.7	1.0	0.4	0.5	0.3	0.3	0.5	0.5	0.5	0.5
P33	0.5	0.5	0.6	0.7	0.7	0.4	0.6	0.6	0.2	0.3	0.2	0.4	1.0	0.8	0.5	0.3	0.3	0.2	0.0	0.1
P34	0.6	0.4	0.5	0.7	0.7	0.7	0.7	0.7	0.4	0.6	0.5	0.5	0.8	1.0	0.7	0.6	0.6	0.5	0.3	0.5
P35	0.6	0.4	0.5	0.7	0.6	0.6	0.7	0.5	0.4	0.7	0.6	0.3	0.5	0.7	1.0	0.8	0.7	0.5	0.4	0.5
P36	0.5	0.3	0.4	0.5	0.5	0.5	0.5	0.5	0.7	0.9	0.8	0.3	0.3	0.6	0.8	1.0	0.8	0.6	0.7	0.7
P37	0.6	0.4	0.5	0.5	0.6	0.6	0.5	0.6	0.6	0.8	0.7	0.5	0.3	0.6	0.7	0.8	1.0	0.9	0.7	0.8
P38	0.5	0.2	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.6	0.7	0.5	0.2	0.5	0.5	0.6	0.9	1.0	0.8	0.8
P39	0.3	0.1	0.2	0.1	0.1	0.2	0.1	0.3	0.6	0.7	0.8	0.5	0.0	0.3	0.4	0.7	0.7	0.8	1.0	0.9
P40	0.4	0.1	0.3	0.2	0.2	0.3	0.2	0.4	0.7	0.8	0.9	0.5	0.1	0.5	0.5	0.7	0.8	0.8	0.9	1.0

Table 10: Correlation matrix between arrival rate for the call type F part 2

Periods	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20
P1	1.0	0.9	0.9	0.8	0.8	1.0	1.0	1.0	0.9	1.0	0.9	0.9	0.9	1.0	1.0	1.0	0.9	0.9	1.0	1.0
P2	0.9	1.0	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.9	0.8	0.9	0.9	0.9
P3	0.9	0.9	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9
P4	0.8	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.9	0.8	0.9	0.9	0.9
P5	0.8	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8
P6	1.0	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P7	1.0	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	1.0	1.0	1.0	0.9	0.9	1.0	1.0
P8	1.0	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	0.9	1.0	0.9	1.0	1.0	1.0
P9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0
P10	1.0	0.9	0.9	0.9	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0
P11	0.9	0.9	0.9	0.9	0.8	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.8	0.9	0.9	1.0	0.9	0.9	1.0	1.0
P12	0.9	0.9	0.9	0.9	0.8	0.9	0.9	1.0	1.0	1.0	0.9	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.0	0.9
P13	0.9	0.8	0.8	0.8	0.7	0.9	0.9	0.9	0.9	0.9	0.8	0.9	1.0	0.9	0.9	0.9	0.9	0.8	0.9	0.9
P14	1.0	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P15	1.0	0.8	0.8	0.8	0.8	1.0	1.0	0.9	1.0	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P16	1.0	0.9	0.9	0.9	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P17	0.9	0.8	0.9	0.8	0.8	1.0	0.9	0.9	1.0	1.0	0.9	1.0	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P18	0.9	0.9	0.9	0.9	0.8	0.9	0.9	1.0	1.0	1.0	0.9	1.0	0.8	0.9	0.9	0.9	0.9	1.0	0.9	0.9
P19	1.0	0.9	0.9	0.9	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P20	1.0	0.9	0.9	0.9	0.8	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P21	1.0	0.8	0.8	0.8	0.8	1.0	1.0	0.9	1.0	1.0	0.9	0.9	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P22	1.0	0.8	0.8	0.8	0.8	1.0	0.9	0.9	1.0	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P23	1.0	0.9	0.8	0.8	0.8	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P24	0.9	0.8	0.8	0.8	0.7	0.9	1.0	0.9	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.9
P25	1.0	0.9	0.9	0.9	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P26	1.0	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P27	1.0	0.9	0.9	0.9	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P28	1.0	0.9	0.9	0.9	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P29	1.0	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.0	1.0	0.9	1.0	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P30	1.0	0.8	0.8	0.8	0.7	1.0	1.0	1.0	0.9	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P31	0.9	0.8	0.8	0.7	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.9
P32	1.0	0.9	0.9	0.8	0.8	1.0	1.0	0.9	1.0	1.0	0.9	0.9	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P33	1.0	0.8	0.8	0.8	0.8	1.0	1.0	0.9	1.0	1.0	0.9	0.9	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P34	0.7	0.8	0.8	0.8	0.7	0.8	0.8	0.9	0.9	0.9	0.8	0.9	0.8	0.8	0.7	0.8	0.8	1.0	0.9	0.8
P35	0.9	0.8	0.7	0.7	0.6	0.8	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.8	0.9	0.9
P36	0.9	0.8	0.9	0.9	0.8	0.9	0.9	0.9	1.0	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0
P37	1.0	0.9	0.9	0.9	0.8	1.0	1.0	0.9	1.0	1.0	1.0	0.9	0.9	1.0	1.0	1.0	0.9	0.9	1.0	1.0
P38	0.9	0.7	0.8	0.8	0.6	0.9	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
P39	0.9	0.8	0.8	0.8	0.7	0.9	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.9
P40	1.0	0.9	0.9	0.9	0.8	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0

Table 11: Correlation matrix between arrival rate for the call type E part 1

Periods	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30	P31	P32	P33	P34	P35	P36	P37	P38	P39	P40
P1	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.7	0.9	0.9	1.0	0.9	0.9	1.0
P2	0.8	0.8	0.9	0.8	0.9	0.8	0.9	0.9	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.9	0.7	0.8	0.9
P3	0.8	0.8	0.8	0.8	0.9	0.8	0.9	0.9	0.8	0.8	0.8	0.9	0.8	0.8	0.7	0.9	0.9	0.8	0.8	0.9
P4	0.8	0.8	0.8	0.8	0.9	0.8	0.9	0.9	0.8	0.8	0.7	0.8	0.8	0.8	0.7	0.9	0.9	0.8	0.8	0.9
P5	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.7	0.6	0.8	0.8	0.6	0.7	0.8
P6	1.0	0.9	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.8	0.8	0.9	1.0	0.9	0.9	1.0
P7	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.8	0.9	0.9	1.0	0.8	0.8	1.0
P8	0.9	0.9	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	1.0
P9	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	1.0	1.0	0.9	0.9	1.0	1.0	0.9	1.0
P10	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.9	0.9	1.0	1.0	0.9	0.9	1.0
P11	0.9	0.9	0.9	0.9	1.0	0.9	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.9	1.0	0.9	0.9	1.0
P12	0.9	0.9	0.9	0.8	1.0	0.9	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.9	0.9
P13	1.0	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	0.8	0.8	0.9	0.9	0.9	0.9	0.9
P14	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.8	0.9	1.0	1.0	0.9	0.9	1.0
P15	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.7	0.9	1.0	1.0	0.9	0.9	1.0
P16	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.8	0.9	1.0	1.0	0.9	0.9	1.0
P17	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.8	0.9	1.0	0.9	0.9	0.9	1.0
P18	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.9	1.0	0.8	0.9	0.9	0.9	0.8	0.9
P19	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.9	0.9	1.0	1.0	0.9	0.9	1.0
P20	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.8	0.9	1.0	1.0	0.9	0.9	1.0
P21	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.8	0.9	0.9	1.0	0.9	0.9	1.0
P22	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.8	0.9	1.0	0.9	0.9	0.9	1.0
P23	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.8	0.9	0.9	1.0	0.9	0.9	1.0
P24	0.9	0.9	1.0	1.0	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.7	0.8	0.8	0.9	0.8	0.7	0.9
P25	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.8	0.9	1.0	1.0	0.9	0.9	1.0
P26	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.8	0.9	0.9	1.0	0.9	0.9	1.0
P27	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.8	0.9	1.0	1.0	0.9	0.9	1.0
P28	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.9	0.9	1.0	1.0	0.9	0.9	1.0
P29	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	1.0
P30	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.8	0.9	0.9	0.9	0.9	0.9	1.0
P31	1.0	0.9	0.9	0.9	0.9	1.0	1.0	0.9	1.0	0.9	1.0	0.9	1.0	0.8	0.9	0.9	0.9	0.9	0.8	0.9
P32	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.8	0.9	1.0	1.0	0.9	0.9	1.0
P33	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.8	0.9	1.0	0.9	0.9	0.9	1.0
P34	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.9	0.9	0.8	0.8	0.8	0.8	1.0	0.8	0.8	0.7	0.7	0.7	0.8
P35	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	1.0	0.8	0.8	0.9	0.8	0.9
P36	0.9	1.0	0.9	0.8	1.0	0.9	1.0	1.0	0.9	0.9	0.9	1.0	1.0	0.8	0.8	1.0	1.0	1.0	1.0	1.0
P37	1.0	0.9	1.0	0.9	1.0	1.0	1.0	1.0	0.9	0.9	0.9	1.0	0.9	0.7	0.8	1.0	1.0	0.9	0.9	1.0
P38	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.7	0.9	1.0	0.9	1.0	1.0	0.9
P39	0.9	0.9	0.9	0.7	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.9	0.7	0.8	1.0	0.9	1.0	1.0	0.9
P40	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.8	0.9	1.0	1.0	0.9	0.9	1.0

Table 12: Correlation matrix between arrival rate for the call type E part 2