4DK4 Lab 3

Caleb Gannon 400137271

Experiment Results and Analysis

Table of Contents

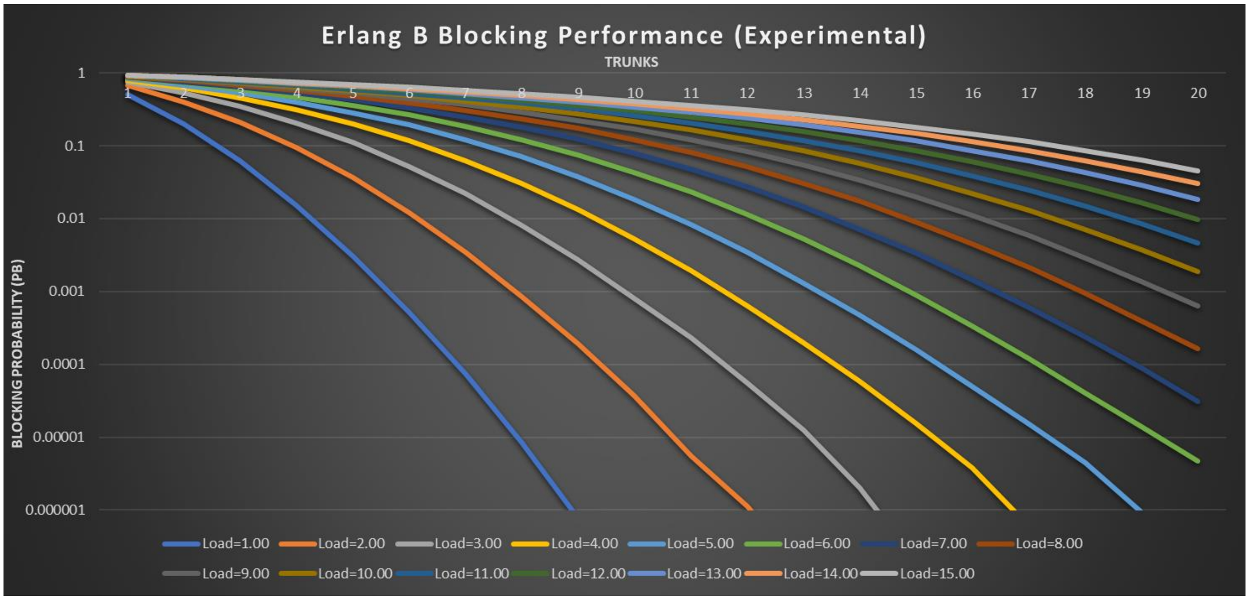
Section 2

I've generated two plots, displayed blow. The first demonstrates the experimental results of Erlang B Blocking Performance, and the second displays the theoretical results. The raw data for both sets will be available in the appendix.

To compute the experimental results, I ran simulations of 10 million calls, with a mean call length ($E[X]$) of 3 minutes. By changing the arrival rate (λ) in each simulation, I was able to change the offered load (A), because $A = \lambda E[X]$.

I ran the simulation through a range of arrival rate = [1,15], and number of trunks = [1,20]. I chose to run on 3 different seeds and average the results.

The offered load (A) is displayed through a variety of series plotted on the graph. The horizontal axis in the blocking probability, and the horizontal axis is the number of trunks used.



Data is in the appendix at Erlang B Blocking Performance (Experimental)

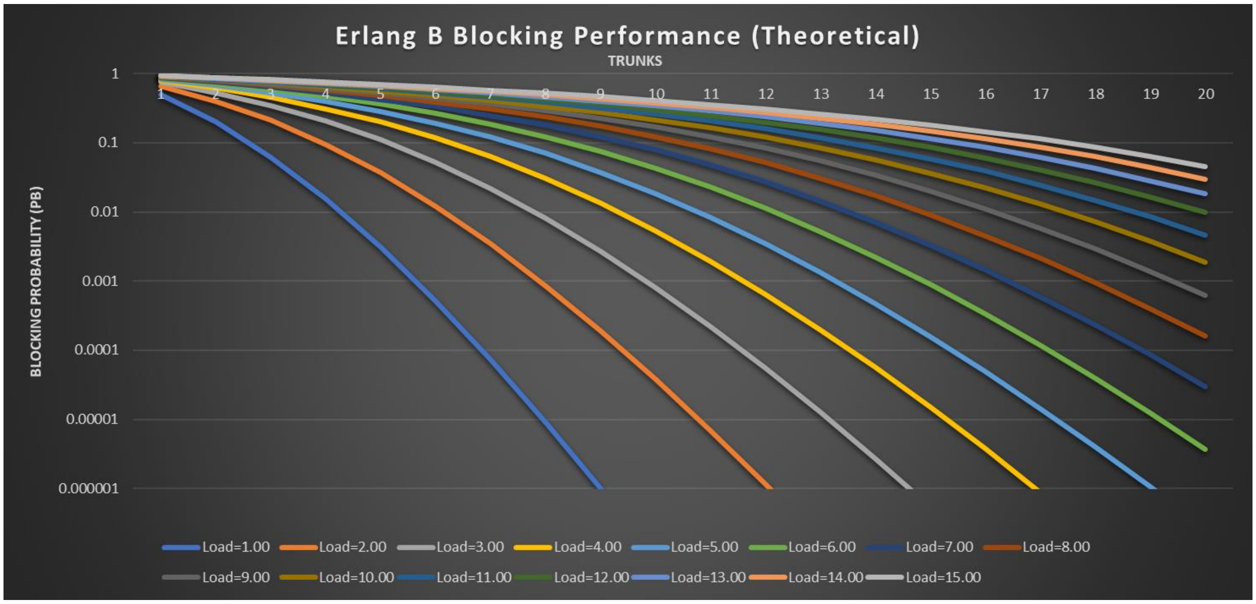
We can see that as the load increases, it requires more trunks to maintain the same blocking probability. The effects of **Trunking Efficiency** are also visible, as the difference in trunks required to maintain a given blocking probability becomes smaller as the load increases.

The theoretical results were calculated alongside each run in C, using the following code:

```
//theoretical_erlang_B
double accum = 0;
for (int i = 0; i <= data.trunk_count; i++) {
    accum += (double)pow(offered_load, i) / fact2(i);
}
double theoretical_erlang_B = ((double)pow(offered_load, data.trunk_count) / fact2(data.trunk_count)) / accum;
```

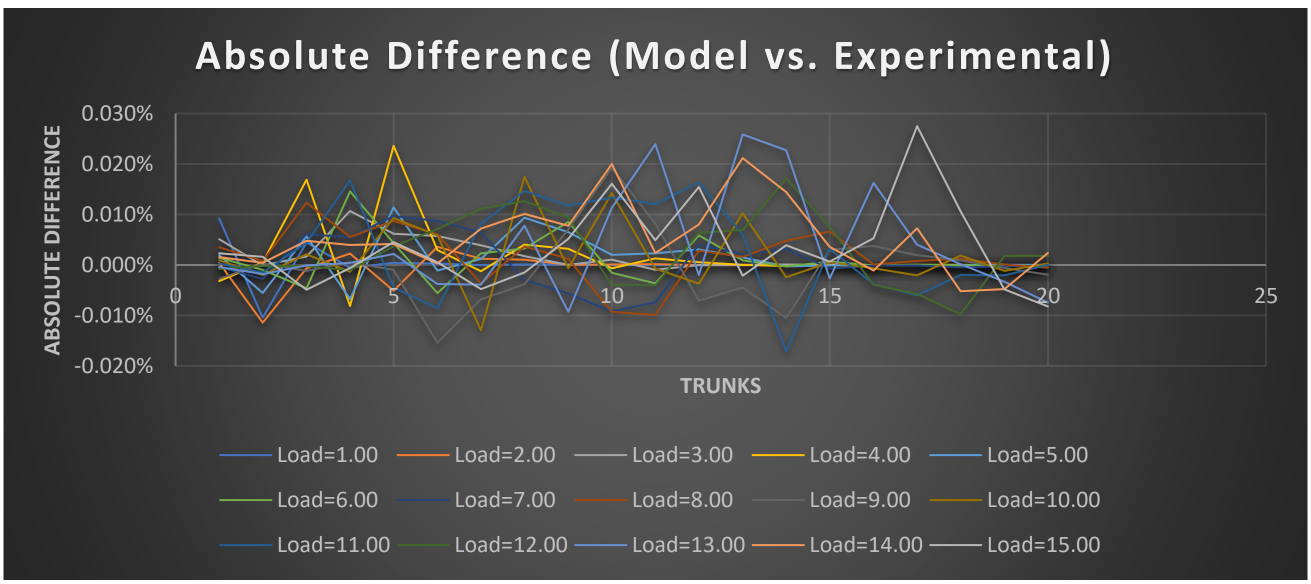
The results were verified using the erlang B online calculator at Westbay Engineers, Erlang and call center software (https://www.erlang.com/calculator/erlb/).

The theoretical results were plotted in the same style as the experimental, and the results are as follows.



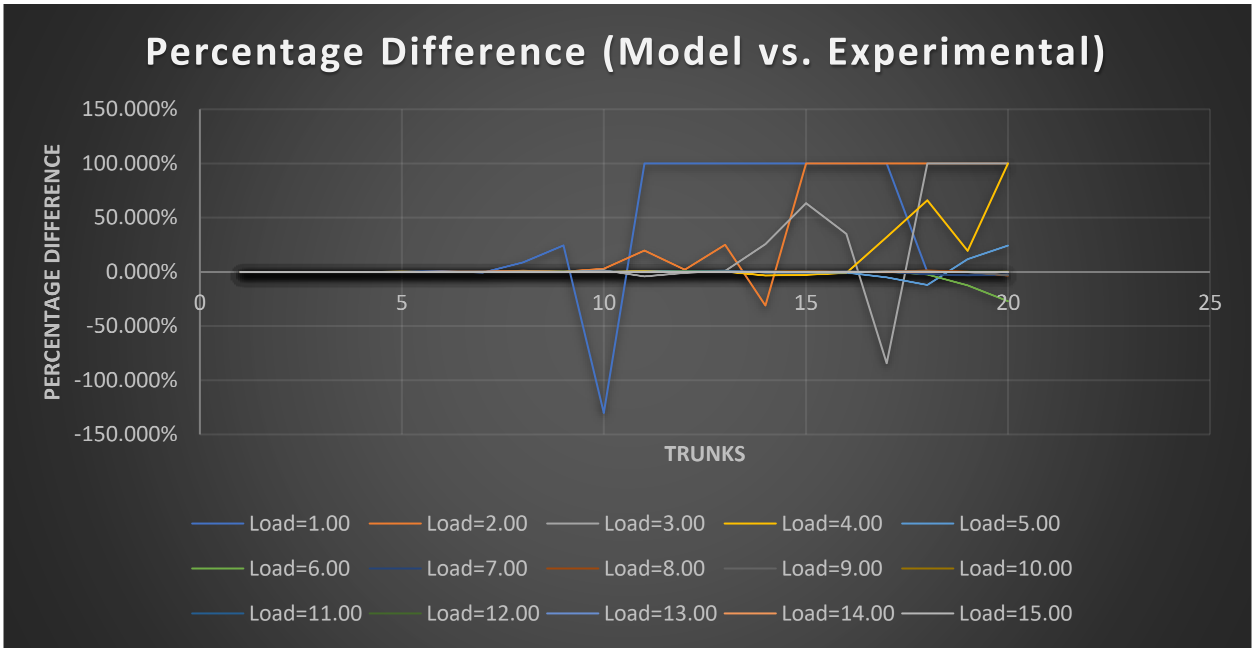
Data is in the appendix at Erlang B Blocking Performance (Theoretical)

The absolute difference between the theoretical and experimental model doesn't exceed $\pm$0.03%.



This small **absolute difference** tells us that the accuracy of the model is quite high at predicting the observed behaviour.

The relative difference between the experimental and theoretical values increases as the blocking probability becomes smaller (more trunks and smaller load lead to a smaller blocking probability).



This is because of the finite precision in floating point values, the relative change between two small numbers becomes increasingly large. These floating-point precision differences would be resolved by increasing the number of calls processed in the simulation due to the law of large numbers, however due to the small **absolute difference** the model is already very accurate.

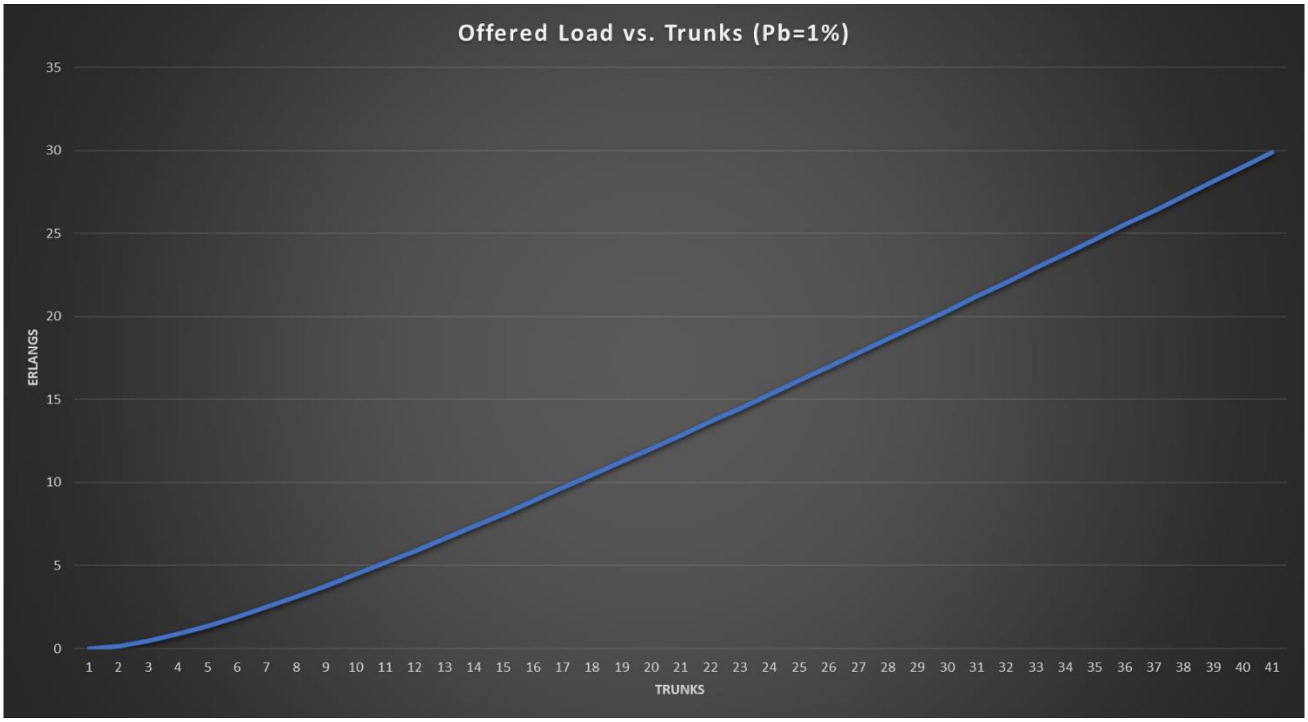
Section 3

To find the offered load vs. trunk count with a blocking probability of 1% (using the **theoretical** Erlang B formula to calculate the blocking probability), I used nested loops in order to iterate through a fine range of arrival rates, for each trunk value.

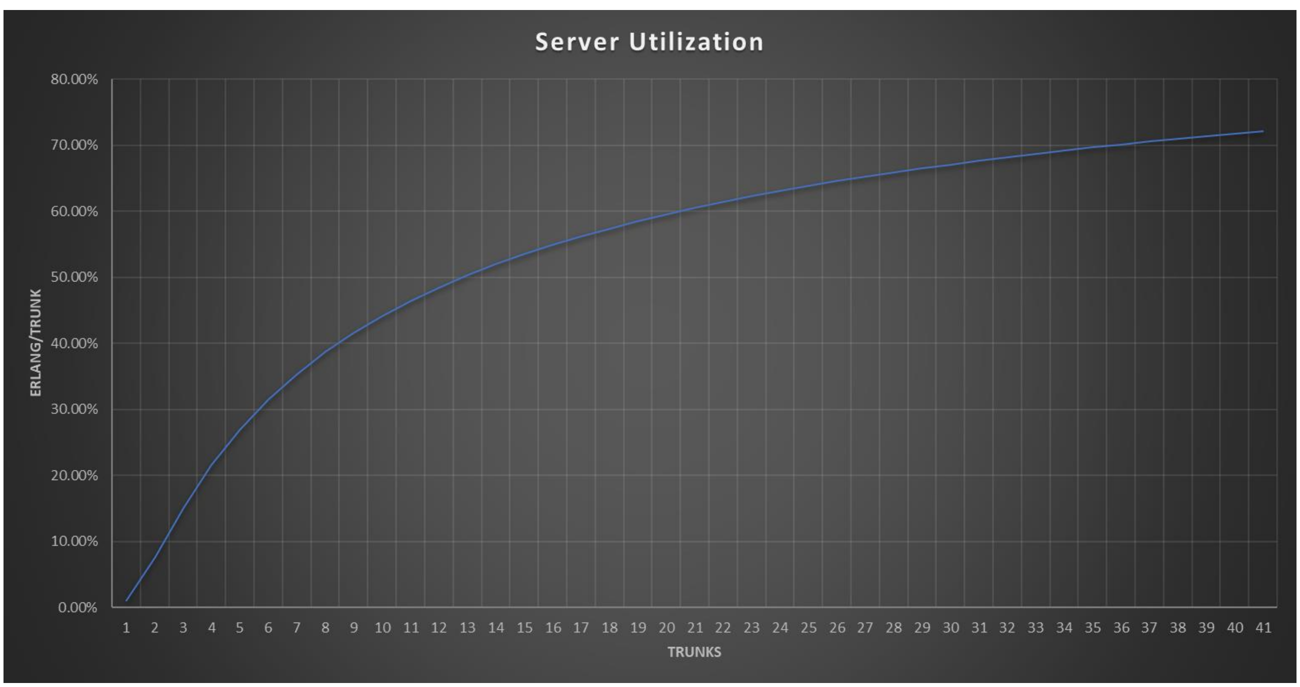
If I detected a blocking probability was greater than 1% (by using the erlang B formula on the offered load and trunk count), I would exit the loop and write the value to a file.

I ran this program with an arrival rate resolution of $\pm 0.3\ mErlangs$, in a range between [0.003,10] Erlangs.

The results are below.

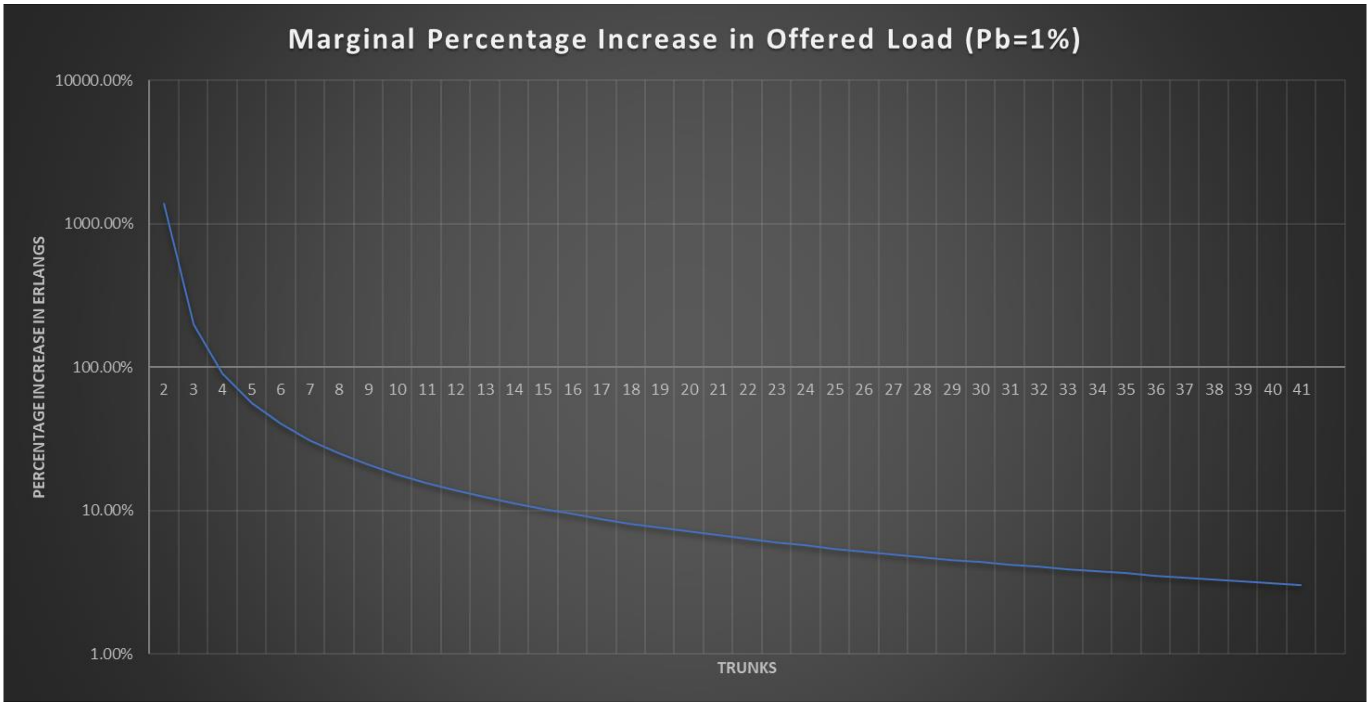


The maximum offered erlangs that achieve Pb=1% increase as the number of trunks increase. This increase is **not linear**, due to multiplexing gain (trunking efficiency). The ratio of trunks to erlangs decreases as the number of trunks increases.



The server utilization is calculated using $\frac{(1-P_b)A}{c}$. The utilization increases as the number of trunks increases. This is multiplexing gain.

When looking at the marginal increase in utilization, we can see number of new Erlangs that can be serviced with the addition of new trunks is marginally decreasing, however it does not reach 0.

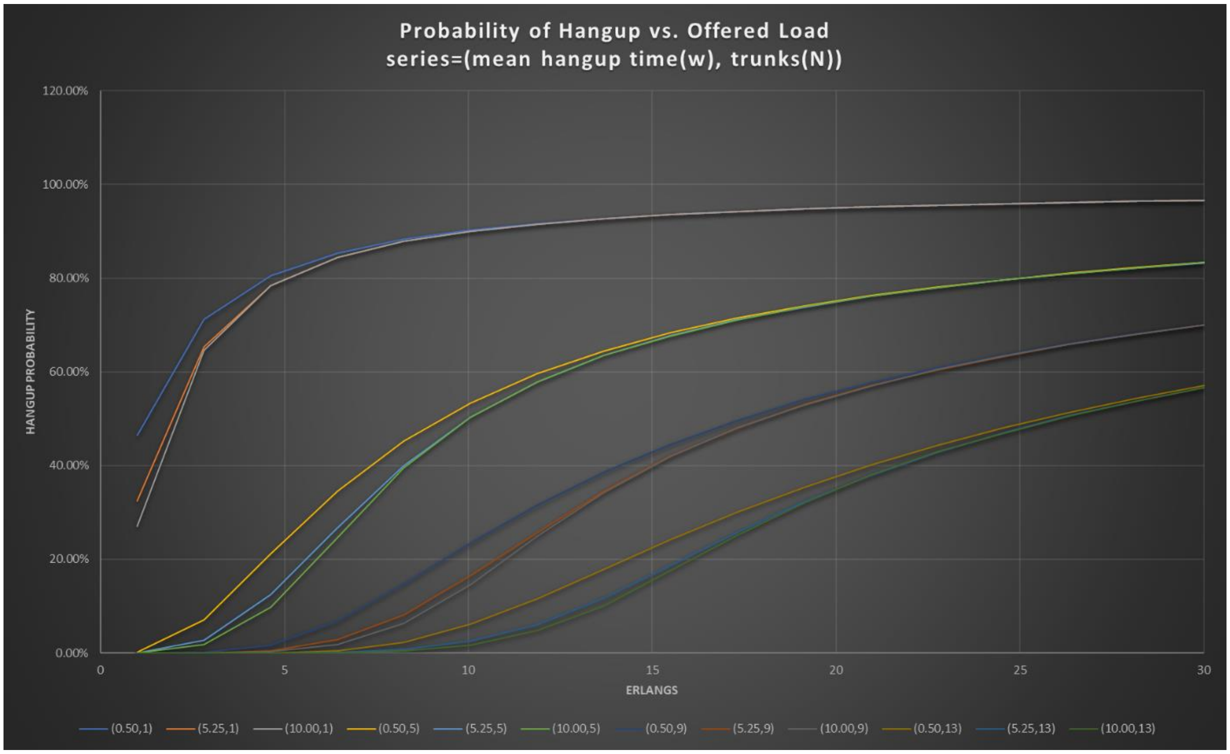


We can see that multiplexing gain is much higher at smaller trunk values, but the effect is still present even at larger trunk values.

Data for the above graphs is in the appendix at Multiplexing Gain (Pb=1%).

Section 4

I have used a Fifo queue to hold customers that arrive when all servers are busy. When a server becomes free, the queue is checked and if a customer is waiting then they are put into service. If the customer hanged up, then we increment a counter. At the end of the simulation, I calculate the hangup probability by taking the ration of customers that hang up against all arriving calls. I plot this probability against the arrival rate. I use separate series represented on the same graph to demonstrate the effect of the mean hangup time (w) and the number of trunks (N) on the hangup probability. I ran the simulation over 10 million processed calls, to apply the law of large numbers.



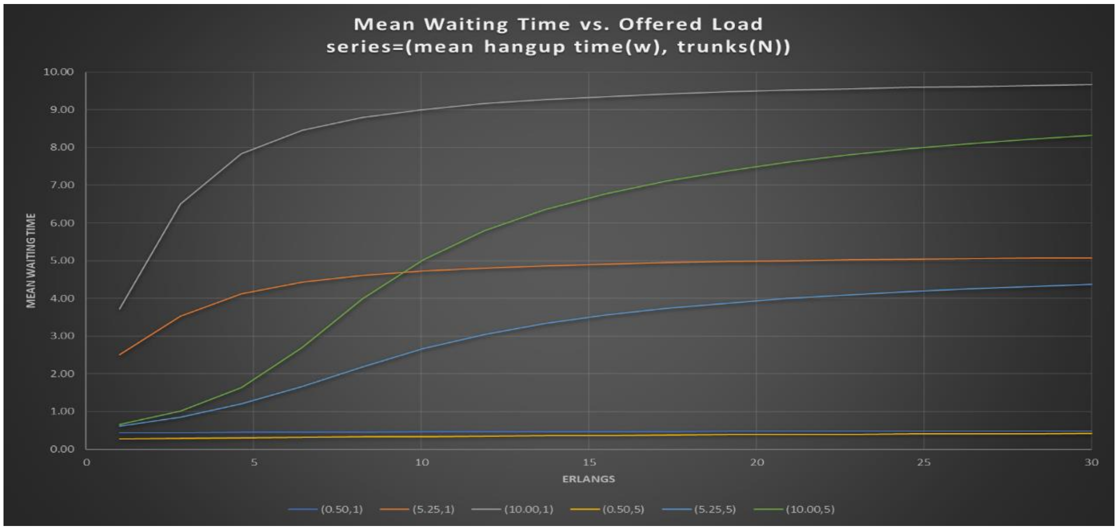
Data is in the appendix at Probability of Hangup vs. Offered Load

As the **arrival rate (offered load)** increases, the buffer will backfill, and the probability of a call being blocked will increase. As the number of **trunks** increases, the effect of the arrival rate is diminished as the utilization (A/N) decreases, and the probability of a hangup decreases. As the **mean hangup time** increases, the hangup probability decreases. This is because the customers will be willing to wait for a longer period in the buffer before they hang up. This effect is more noticeable when the server is **stable**, as the buffer has not begun to drastically backfill.

System Parameter	Effect on Hangup Probability
Offered load	Increase
Number of Trunks	Decrease
Mean hangup time	Decrease

When calculating the **mean waiting time**, I decided to make two independent observations. I wanted to explore the mean waiting time of **all customers who call,** and **all customers who are served.** I think that from an industry standpoint, the waiting time of all customers who call can provide insight to identify the **mean hangup time** of a system, while the waiting time of all customers who are served provides insight into the **throughput** or performance of a system.

I plotted first a graph of the mean waiting time, **<u>including customers who have hung up (1).</u>**



Data is in the appendix at Mean Waiting Time vs. Offered Load (Hangup included)

The **mean waiting time (*h*)** trends towards the **mean hangup time (*w*)** as the offered load increases. This is because as the system becomes **unstable** and the buffer begins to **backfill**, most calls will hang up after the mean hangup time.

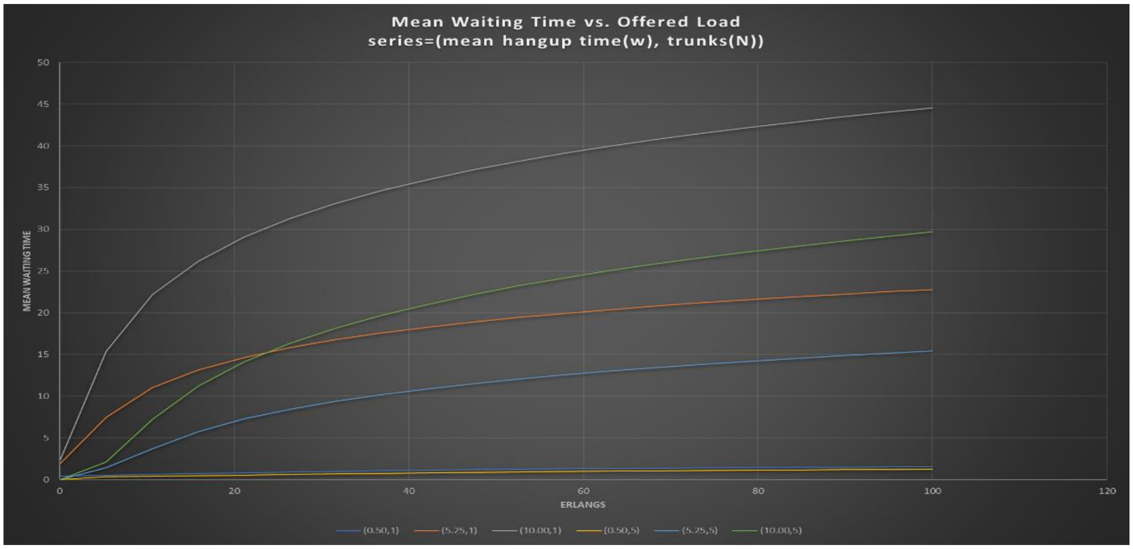
As the number of **trunks** increases, the system instability point increases, and therefore the mean waiting time **decreases** for a constant value of offered load.

The mean waiting time **decreases** as the mean hangup time **decreases**, even for non-asymptotic behaviour.

- This is because as more customers hangup, there is a decreased chance that other customers will have to continue to wait, as the have effectively <u>moved up</u> a spot in the FIFO.

This plot exposes that a technique to analyze the **mean hangup time** of a system is to drive a high utilization, and measure the average time that users stay in the queue.

I plotted second a graph of the mean waiting time, **<u>not including customers who have hung up (2).</u>**



Data is in the appendix at Mean Waiting Time vs. Offered Load (Hangup excluded)

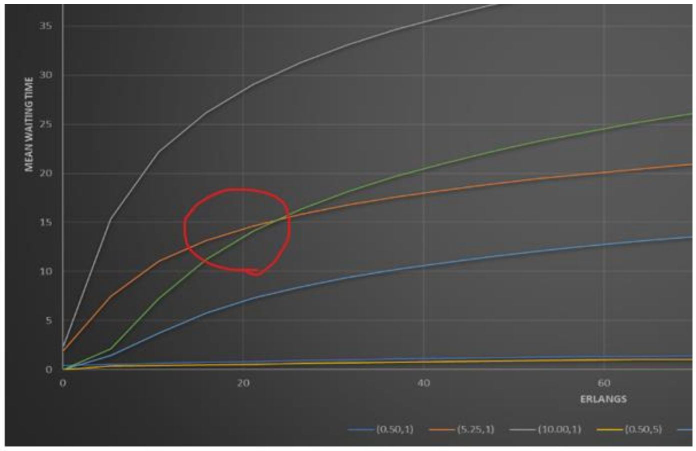
The **mean waiting time** trends towards **infinity**, as the queue continues to backfill when the system is unstable. This graph only includes customers who do not hang up, so the waiting time can now exceed the mean waiting time. The customers who do not hang up will still see a decrease in wait time as the number of trunks increase, and a decrease in wait time as mean hangup time decreases.

Both graphs (1 and 2) see the following relationships.

System Parameter	Effect on mean waiting time
Offered load	Increase
Number of Trunks	Decrease
Mean hangup time	Increase

The <u>first graph</u> sees a **horizontal asymptote** when the mean waiting time equals the mean hangup time. The <u>second graph</u> is unbounded, and customers who are served will see their mean waiting time increase to **infinity**.

It is **worth noting** that for non-asymptotic behaviour, when the system is stable, the number of trunks will have a <u>greater impact</u> on the mean waiting time than the mean hangup time will.



This is because a stable system will have a low mean waiting time, due to the servers being capable of handling the majority of arrivals. Once the system becomes unstable, the mean hangup time will have a greater impact than the number of trunks. This is because an unstable system will be unbounded, and the buffer will begin to **backfill**. The mean hangup time will then have a greater impact on whether customers will spend more or less time in the unstable system. As the hangup time **increases**, they will spend more time in the queue.

Theoretical Model Analysis

As discussed in Section 5, the mean waiting time is proportional to the probability of waiting in a queue.

When customers hang up, the **Erlang A** formula will calculate the probability of waiting in the queue.

We see the same properties as above graphs, as the Erlang A formula (https://help.calabrio.com/doc/Content/user-guides/schedules/about-erlang-formula.htm).

$$P_W = \frac{A\left(\frac{n\mu}{\theta}, \frac{\lambda}{\theta}\right) \cdot E_{1,n}}{1 + \left(A\left(\frac{n\mu}{\theta}, \frac{\lambda}{\theta}\right) - 1\right) \cdot E_{1,n}}$$

where

$$A(x, y) = 1 + \sum_{j=1}^{\infty} \frac{y^j}{\prod_{k=1}^{j}(x+k)}$$

and

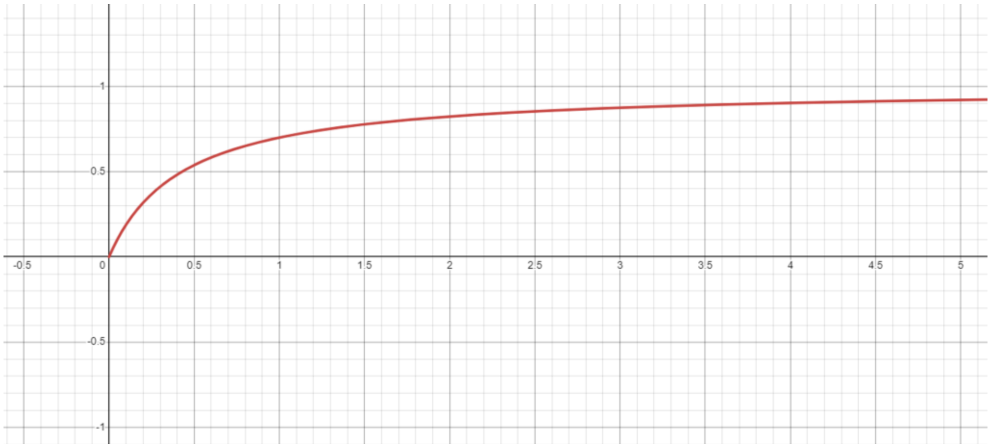
$$E_{1,0} = 1$$
$$E_{1,n} = \frac{\rho E_{1,n-1}}{1 + \rho E_{1,n-1}}$$

and

$$\rho = \frac{\lambda}{n\mu}$$

We can see that E1,n must be < 1, as the $\frac{\rho}{1+\rho}$ will always be < 1.

Therefore, if $A\left(\frac{nu}{\theta}, \frac{\lambda}{\theta}\right) = $ x, f(x) ≅ the below graph (plotted using https://www.desmos.com/calculator).



This shows us that as $A\left(\frac{nu}{\theta},\frac{\lambda}{\theta}\right)$ increases, the probability of waiting increases.

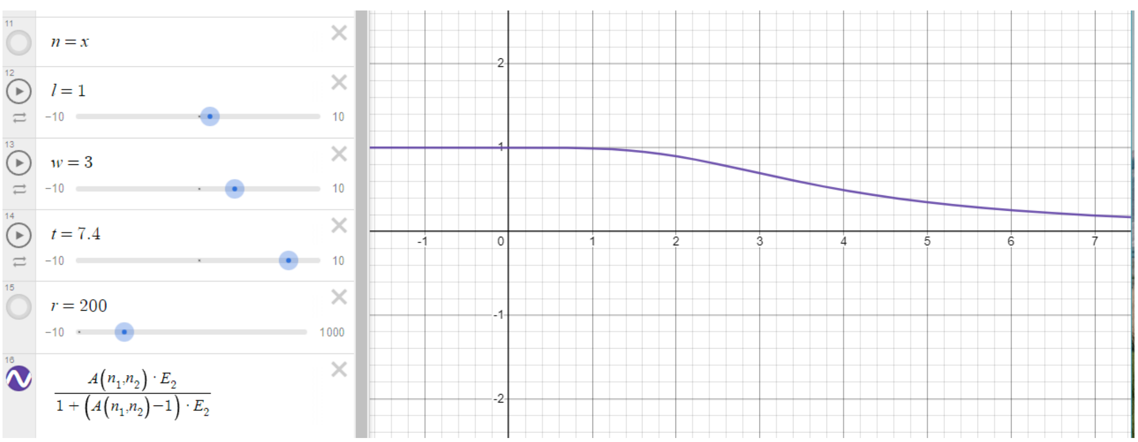
Erlang A Model Analsyis

I implemented the Erlang A model using an online graphing calculator tool, to quickly observe the effects of changing different system parameters (plotted using [desmos.com/calculator (Erlang A)]()).

To observe the effects of different parameters, I hold all parameters constant, and then plot one parameter against the queuing probability.

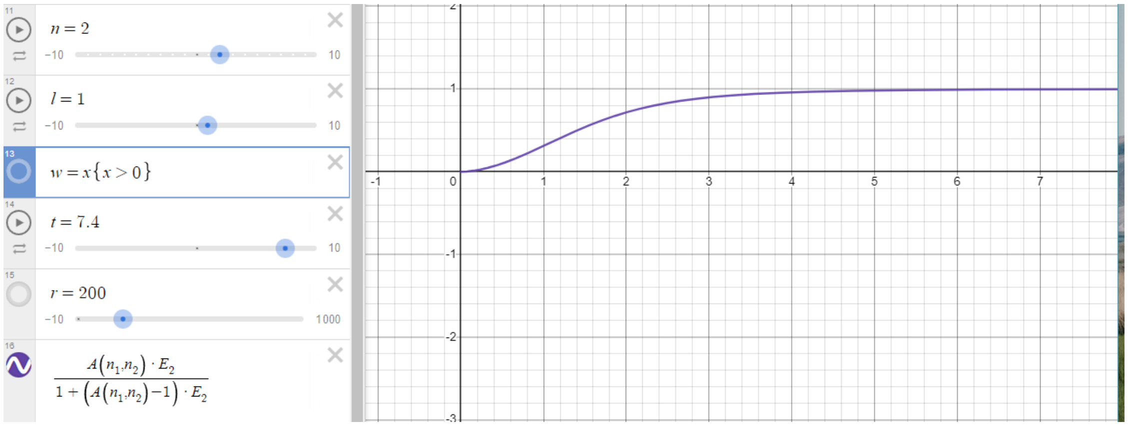
Trunks

We can see that as the **number of trunks** increases, the queuing probability decreases:



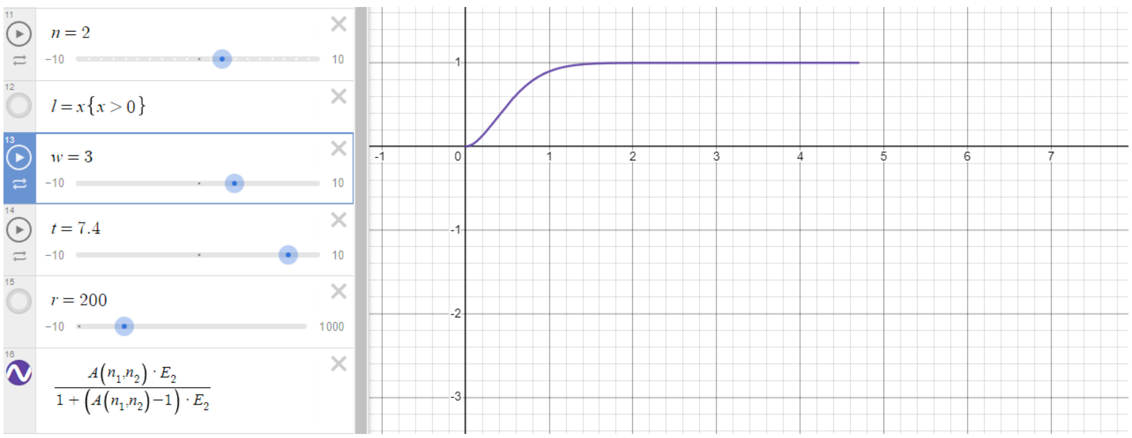
Call Length

We can see that as the **call length** increases, the queuing probability increases.



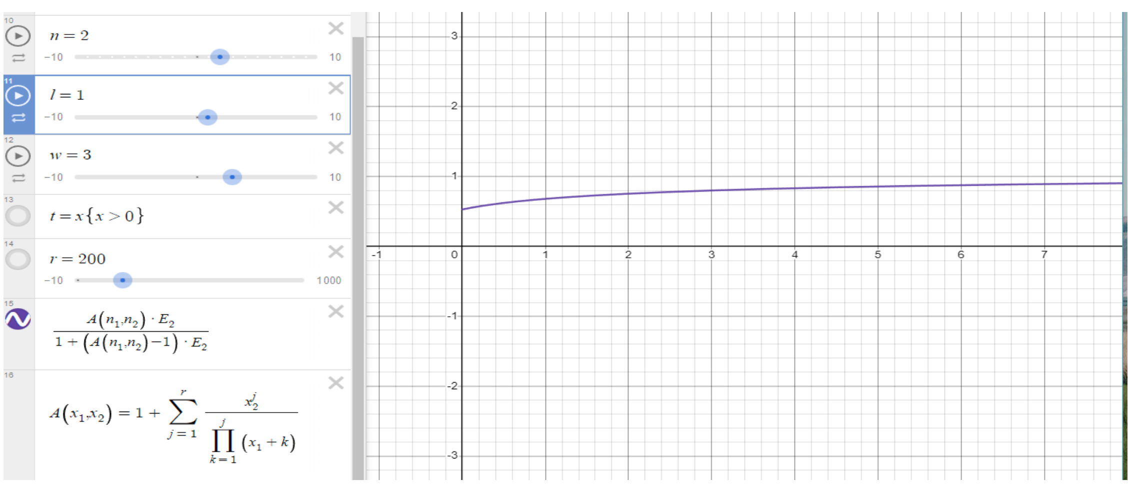
Arrival Rate

We can see that as the **arrival rate** increases, the queuing probability increases.



Mean Abandonment Time

We can see that as the **abandonment time** increases, the queuing probability increases.



Theoretical

System Parameter	Effect on queuing probability
Offered load	Increase
Number of Trunks	Decrease
Mean hangup (abandonment) time	Increase

Experimental

System Parameter	Effect on mean waiting time
Offered load	Increase
Number of Trunks	Decrease
Mean hangup time	Increase

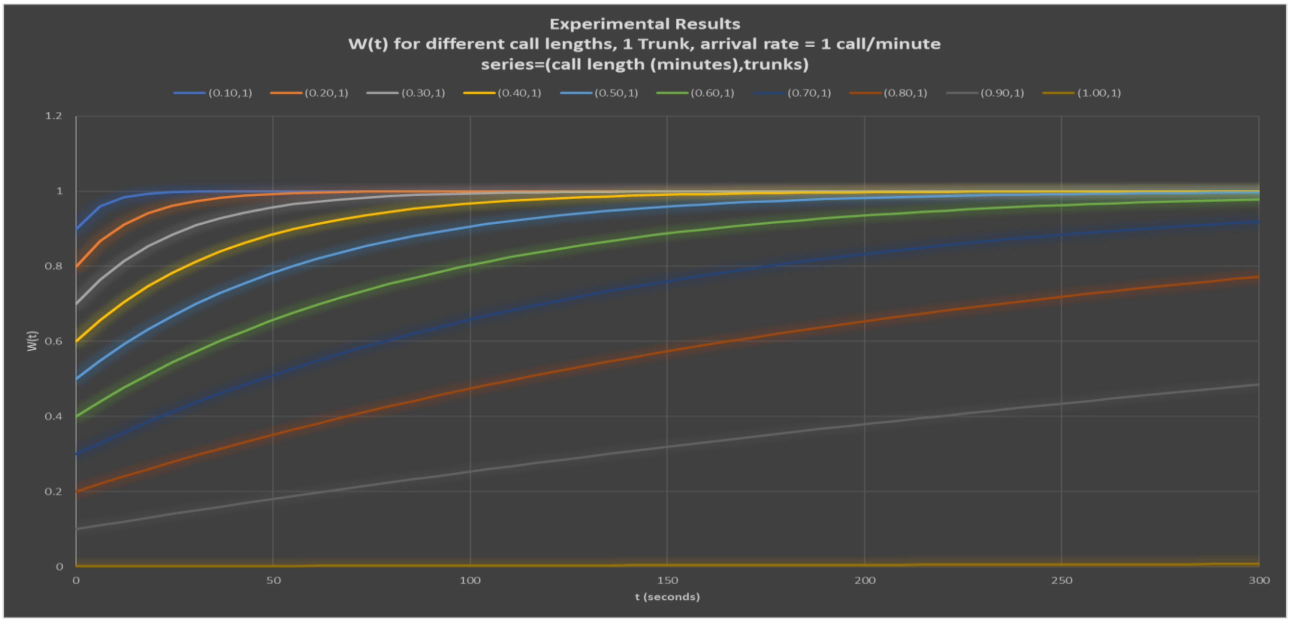
These theoretical analyses of the Erlang A formula align with the experimental results observed in the C simulation. The probability of being placed in the queue is shown to be proportional to the mean waiting time in Section 5.

Note on Erlang A

The results obtained by the erlang A formula are held with some controversy when used in isolation to derive plans for call centers. This is because is has a tendency to predict lower trunk requirements than the Erlang B and C, by expecting customers to abandon their calls. The controversy is that is good practice not to plan for customers to abandon their calls, as during busy periods this can lead to poor system performance (https://www.callcentrehelper.com/a-beginners-guide-to-the-erlang-a-formula-140998.htm).

Section 5

I removed the hang-up functionality from the code, and ran the simulations over a range of different *t* values, collecting the number of callers that had to queue for less than *t* minutes. I haven converted that values to *seconds* to align with the lab requirements, in the following graph.



Data is in the appendix at W(t) Experimental 1 trunk.

As the **mean call length** increases, the probability of a caller waiting in the queue less than *t* seconds **decreases**. This makes sense, as the calls will take longer to be serviced, and therefore the queue will take longer to empty.

We can see that when the system becomes **unstable** (series (1.00,1)), the probability of any call waiting less than any value of *t* becomes 0. This is because the buffer will **backfill** to infinity, and the mean queuing time will explode to infinity.

Using the **Erlang C** formula:

$$P_w = \frac{A^N/N!}{A^N/N! + (1-\rho)\sum_{i=0}^{N-1} A^i/i!}.$$

We can calculate the probability that a customer will have to wait in the queue.

It can be shown that the average waiting time is therefore:

$$T_w = \frac{P_w h}{N(1 - A/N)}$$

We can see that the probability of waiting in the queue is proportional to the time spent waiting in the queue. The proportionality factor, is then equal to the average service time, multiplied by the mean number of calls in the queue.

$$\rho = A/N$$

$$N(1-\rho) = Mean\ Free\ Servers$$

$$\frac{h}{N(1-\rho)} = Mean\ time\ until\ free\ server = T_f$$

The **mean time until free server** multiplied by the probability of being placed in a queue, is the **average queueing time**.

Given the arrivals follow an exponential distribution, we know that PDF of the waiting time will be:

$$P(T_f, t) = e^{-\lambda t}$$

Given λ is the average rate of server clearing events. From this we can derive:

$$\lambda = \frac{1}{T_f}$$

$$\lambda = \frac{1}{\frac{h}{N(1-\rho)}}$$

$$\lambda = \frac{N(1-\rho)}{h}$$

$$\lambda = \frac{N(1-A/N)}{h}$$

$$\lambda = \frac{(N-A)}{h}$$

Given that waiting will only occur if a customer enters the queue, and the probability of waiting and the server clearing are independent events, we can show that:

$$P(T_w, t) = P\left[P_w \cup P\left(T_f, t\right)\right] = P_w \cdot e^{-\lambda t}$$

From the exponential distribution CDF, we can derive that:

$$P(T_w < t) = 1 - P_w \cdot e^{-\lambda t}$$

This is the equation posed in the lab, to calculate theoretical values of:

$$W(t) = \mathrm{P}(T_w < t)$$

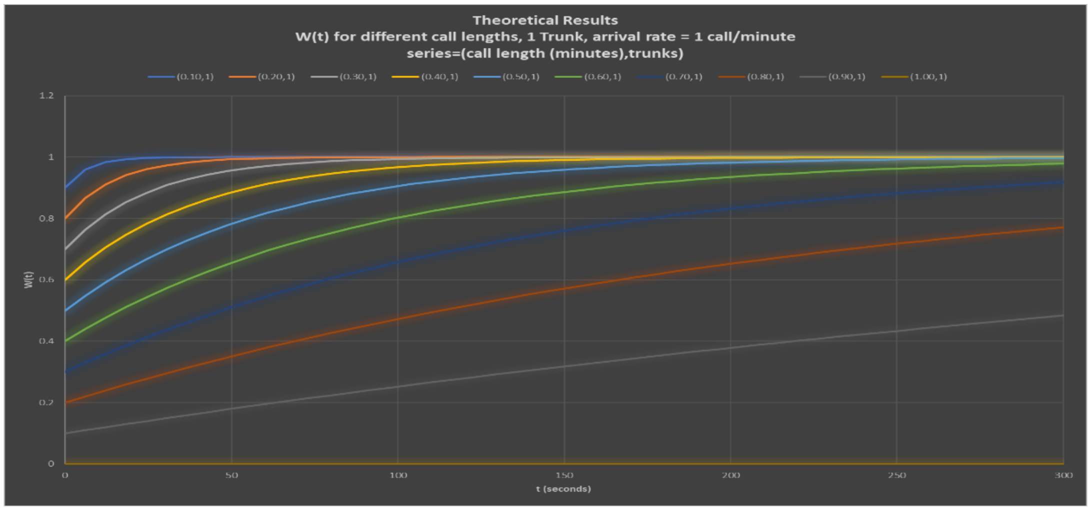
$$W(t) = 1 - P_w e^{-(N-A)t/h}.$$

I used a modified version of my erlang B C-code to calculate the theoretical W(t) values as my simulation ran.

```
//theoretical_erlang_C
double accum = 0;
for (int i = 0; i <= data.trunk_count-1; i++) {
    accum += (double)pow(offered_load, i) / fact2(i);
}
double theoretical_erlang_C = ((double)pow(offered_load, data.trunk_count) / fact2(data.trunk_count)) / (((double)pow(offered_load, data.trunk_count) / fact2(data.trunk_count)) + (1-(offered_load/ data.trunk_count))*accum);
double theoretical_waiting_time = theoretical_erlang_C * (data.mean_call_time / (data.trunk_count * (1 - (offered_load / data.trunk_count))));
double Wt = 1-theoretical_erlang_C * exp( ( -1 * (data.trunk_count - offered_load) * data.t_val) / data.mean_call_time);
```

The theoretical results are quite close to the experimental values. The only variance can likely be attributed to the law of large numbers.

The largest **discrepancy** in relative terms between the model and the experiment was on the order of 0.5%. The average relative difference is 0.05%.

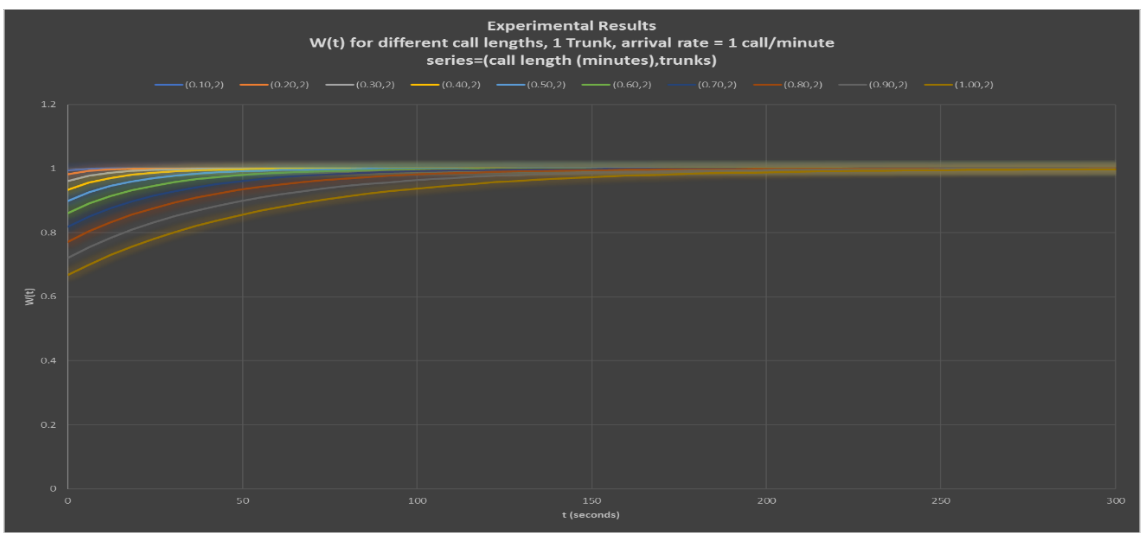


Data is in the appendix at W(t) Theoretical 1 trunk.

The results are visually similar to the experimental results, and show that as the **mean call time** increases, the probability of waiting less than *t* seconds will decrease.

I also simulated the effect of changing the **trunk** count on the waiting probability.

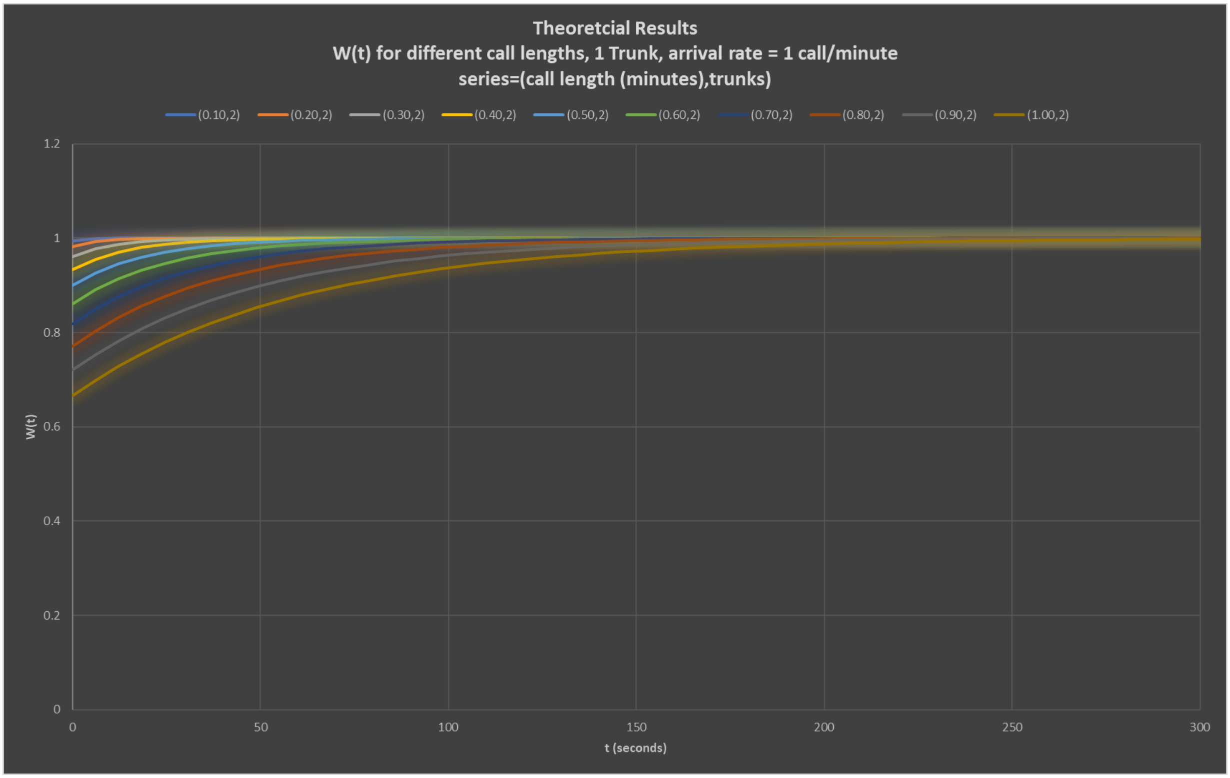
The experimental results below are for 2 trunks, an **increase** in trunk count.



Data is in the appendix at W(t) Experimental 2 trunks.

We can see that **increasing** the number of trunks leads to an **increase** in the probability of having to wait less than *t* seconds.

I have calculated the theoretical values as well and see the same accuracy as with 1 trunk.



Data is in the appendix at W(t) Theoretical 2 trunks.

Modifications to code

For-loops were used to allow a range of arrival rates, seeds, trunks, *t/W(t)* values to be generated: to collect a fine range of data.

Data was exported en-masse to a .csv file, where the data was manipulated in excel to create the plots.

The code was modified throughout the lab to enable:

- Counters were used to track how many callers were blocked, had to queue, or abandoned their calls.
- The theoretical Erlang B and C models were implemented in C (code snippet is shown in report).
- Variables were used to store the amount of time spent in the queue, which is divided by the number of customers who enter the queue to determine the average time spent in the queue.
- To simulate customer *hangups* (abandonment), a conditional was added to check whether a customer has hung up before starting service. When a free server checks the FIFO, it checks whether the customer at the front has been in the queue for longer than their “hangup_time” (a structural variable). If the customer has been in the queue for longer than their hangup_time, they are discarded, and the server tries to grab another customer form the queue.

- The W(t) function was implemented in C, to generate theoretical results in section 5. Conditionals were used to detect customers who queue for less than *t* seconds, and a counter was incremented. This counter was divided by the number of customers serviced, in order to calculate the probability of queuing for less than *t* seconds.

Appendix

Erlang B Blocking Performance (Experimental)

Seed	trunks	Load =1.00	Load =2.00	Load =3.00	Load =4.00	Load =5.00	Load =6.00	Load =7.00	Load =8.00	Load =9.00	Load= 10.00	Load= 11.00	Load= 12.00	Load= 13.00	Load= 14.00	Load= 15.00
400137271	1	0.499759	0.666586	0.749936	0.800121	0.833272	0.857061	0.874978	0.888858	0.899994	0.909085	0.916652	0.923091	0.928608	0.933338	0.937496
400137271	2	0.199949	0.399963	0.52931	0.615297	0.675502	0.719974	0.753866	0.780503	0.801979	0.819689	0.834499	0.847011	0.857853	0.867265	0.875459
400137271	3	0.062547	0.21056	0.346132	0.450464	0.529591	0.590419	0.637505	0.675223	0.706528	0.732092	0.753539	0.772174	0.788036	0.801824	0.8141
400137271	4	0.015365	0.09514	0.20601	0.310932	0.398462	0.469215	0.527251	0.574603	0.613865	0.646683	0.674425	0.698439	0.719122	0.737279	0.753356
400137271	5	0.003054	0.036732	0.109932	0.19878	0.284735	0.360225	0.424452	0.479004	0.524828	0.563853	0.597456	0.626366	0.651491	0.673561	0.693234
400137271	6	0.00051	0.01205	0.051929	0.117171	0.191889	0.264946	0.331148	0.389685	0.44064	0.484524	0.522932	0.555943	0.585394	0.61129	0.634109
400137271	7	7.04E-05	0.00341	0.021824	0.062682	0.120321	0.18503	0.248873	0.307993	0.361528	0.409273	0.451084	0.487799	0.520706	0.550049	0.575895
400137271	8	8.5E-06	0.000825	0.008098	0.030399	0.070007	0.12188	0.178855	0.235312	0.289151	0.338107	0.382728	0.422525	0.458429	0.490415	0.519283
400137271	9	8E-07	0.000189	0.002702	0.013393	0.037388	0.075017	0.122108	0.172875	0.224226	0.273167	0.318814	0.360076	0.398371	0.432483	0.463825
400137271	10	1E-07	3.96E-05	0.000799	0.005318	0.018404	0.043194	0.078753	0.121744	0.16755	0.214481	0.259365	0.30204	0.341089	0.376699	0.41012
400137271	11	0	5.9E-06	0.000238	0.00192	0.008224	0.022934	0.047715	0.081227	0.120805	0.163277	0.206136	0.247651	0.287043	0.324337	0.358523
400137271	12	0	8E-07	5.56E-05	0.000649	0.003387	0.011368	0.027062	0.051387	0.083268	0.119693	0.158749	0.198451	0.237453	0.274269	0.309174
400137271	13	0	1E-07	1.25E-05	0.000204	0.001321	0.005269	0.014457	0.030637	0.054405	0.084124	0.118257	0.154709	0.191363	0.227779	0.263396
400137271	14	0	1E-07	1.8E-06	6.07E-05	0.000488	0.002237	0.007119	0.017313	0.033831	0.056868	0.085213	0.116899	0.151008	0.185833	0.219837
400137271	15	0	0	3E-07	1.51E-05	0.000168	0.000891	0.003344	0.009028	0.019854	0.036409	0.05881	0.085693	0.115754	0.147744	0.180142
400137271	16	0	0	1E-07	3E-06	5.15E-05	0.000343	0.001449	0.004549	0.011053	0.022311	0.038855	0.060342	0.08576	0.114344	0.144593
400137271	17	0	0	0	6E-07	1.53E-05	0.00012	0.000608	0.00213	0.005842	0.012973	0.024586	0.040981	0.061639	0.085886	0.112718
400137271	18	0	0	0	0	5.4E-06	4.29E-05	0.000238	0.000936	0.002909	0.007114	0.014827	0.02675	0.042692	0.062955	0.086012
400137271	19	0	0	0	0	8E-07	1.43E-05	8.99E-05	0.000406	0.001366	0.003755	0.008574	0.016503	0.02853	0.04432	0.063648

400137271	20	0	0	0	0	2E-07	5.3E-06	2.99E-05	0.00017	0.000639	0.001848	0.004706	0.009853	0.018236	0.029968	0.045608
333	1	0.500074	0.666724	0.750021	0.799976	0.833325	0.85716	0.875006	0.888834	0.900042	0.909095	0.916656	0.923074	0.928564	0.933296	0.937452
333	2	0.200237	0.400244	0.529426	0.615344	0.675818	0.7199	0.753861	0.780532	0.802005	0.819658	0.834479	0.847056	0.857898	0.867278	0.875503
333	3	0.062517	0.210463	0.346006	0.450635	0.529697	0.590139	0.637604	0.675399	0.706277	0.731935	0.753606	0.772083	0.788083	0.801812	0.814122
333	4	0.015395	0.09532	0.206167	0.310708	0.398527	0.469603	0.527325	0.574534	0.6138	0.646584	0.6744	0.698405	0.719146	0.737252	0.753184
333	5	0.003076	0.03676	0.109994	0.198801	0.284577	0.360386	0.424627	0.47878	0.524986	0.563905	0.597489	0.626188	0.651629	0.673605	0.693125
333	6	0.000504	0.012068	0.052232	0.117034	0.191816	0.265098	0.331358	0.389797	0.440594	0.484532	0.52267	0.556015	0.585377	0.611183	0.634046
333	7	7.09E-05	0.003434	0.021817	0.062939	0.120737	0.18488	0.248733	0.308278	0.361725	0.409158	0.450765	0.488023	0.521041	0.550064	0.576254
333	8	7.5E-06	0.000852	0.00814	0.030384	0.070027	0.121947	0.178746	0.235821	0.289158	0.338233	0.382499	0.422653	0.45821	0.490291	0.519057
333	9	9E-07	0.000185	0.002712	0.013254	0.037357	0.075061	0.122343	0.173372	0.224067	0.273206	0.318415	0.360379	0.398291	0.432707	0.464012
333	10	5E-07	3.78E-05	0.000811	0.005338	0.018342	0.043115	0.078868	0.121781	0.167815	0.214567	0.259259	0.301755	0.341066	0.377271	0.41023
333	11	0	5.9E-06	0.000237	0.001921	0.008287	0.023024	0.04791	0.081513	0.120772	0.163005	0.206105	0.247849	0.287147	0.324375	0.358859
333	12	0	1.5E-06	5.79E-05	0.00063	0.003414	0.011261	0.026994	0.051353	0.083044	0.119728	0.158752	0.1985	0.23753	0.274663	0.309703
333	13	0	1E-07	1.21E-05	0.000193	0.001305	0.00516	0.01428	0.030701	0.054432	0.084313	0.118642	0.154914	0.191718	0.227981	0.263102
333	14	0	0	1.6E-06	5.83E-05	0.00047	0.002192	0.007059	0.017043	0.033948	0.056917	0.085528	0.117255	0.150783	0.18537	0.219925
333	15	0	0	1E-07	1.49E-05	0.000159	0.000884	0.003321	0.009052	0.019801	0.036478	0.058693	0.085781	0.116064	0.147956	0.180615
333	16	0	0	0	4.3E-06	5.27E-05	0.000321	0.001463	0.004512	0.010938	0.022284	0.038964	0.060646	0.085996	0.114558	0.144524
333	17	0	0	0	6E-07	1.49E-05	0.000115	0.000602	0.002121	0.005739	0.012851	0.024502	0.041006	0.061819	0.086139	0.113001
333	18	0	0	0	1E-07	4.1E-06	3.95E-05	0.000241	0.000926	0.002844	0.007072	0.014723	0.026433	0.042567	0.062818	0.086234
333	19	0	0	0	1E-07	7E-07	1.43E-05	8.81E-05	0.000392	0.001389	0.003769	0.008388	0.016428	0.028257	0.044219	0.063913
333	20	0	0	0	0	1E-07	3.7E-06	3.39E-05	0.000164	0.000645	0.001878	0.004582	0.009701	0.018042	0.029928	0.045688
4444	1	0.499891	0.666677	0.74989	0.799999	0.833345	0.857165	0.875028	0.888868	0.900047	0.909064	0.916683	0.92309	0.928553	0.933319	0.937482
4444	2	0.200126	0.400135	0.529502	0.615498	0.675874	0.720155	0.753894	0.780405	0.801947	0.81973	0.834516	0.847117	0.857908	0.867215	0.875449
4444	3	0.062301	0.210575	0.346272	0.450507	0.529525	0.59007	0.637347	0.675394	0.706416	0.732102	0.753765	0.772103	0.787944	0.801831	0.814038
4444	4	0.015409	0.095187	0.205823	0.310643	0.398241	0.46944	0.527293	0.574602	0.613745	0.646763	0.674307	0.698578	0.719274	0.737234	0.753219
4444	5	0.00306	0.036753	0.110051	0.198912	0.28495	0.36046	0.424789	0.478979	0.52494	0.563819	0.59746	0.62639	0.651476	0.673732	0.693187
4444	6	0.000511	0.012028	0.052139	0.117193	0.191869	0.26489	0.331224	0.389591	0.440776	0.484313	0.522863	0.556094	0.585407	0.61107	0.634162
4444	7	7.9E-05	0.003441	0.021834	0.062663	0.120463	0.185184	0.248815	0.308332	0.361705	0.409079	0.45086	0.487977	0.52096	0.549759	0.576165
4444	8	9E-06	0.000871	0.008107	0.030356	0.069828	0.121701	0.178953	0.235468	0.289282	0.338091	0.382599	0.422408	0.458346	0.490368	0.519472
4444	9	6E-07	0.000196	0.002696	0.013276	0.037434	0.075102	0.122022	0.173139	0.224395	0.273272	0.318561	0.36054	0.398717	0.432871	0.463796
4444	10	1E-07	3.37E-05	0.000789	0.005287	0.018347	0.043164	0.078878	0.121737	0.167947	0.214273	0.259717	0.302099	0.341061	0.377284	0.41019
4444	11	0	4.9E-06	0.000216	0.001898	0.00828	0.023124	0.047747	0.081421	0.12064	0.163437	0.205651	0.247918	0.287151	0.324436	0.358844
4444	12	0	1.1E-06	5.37E-05	0.00063	0.003429	0.01129	0.027067	0.051395	0.083159	0.119907	0.158692	0.19856	0.237269	0.274508	0.309537
4444	13	0	2E-07	1.33E-05	0.000193	0.001294	0.005198	0.014316	0.030608	0.054475	0.084272	0.118466	0.154872	0.1917	0.228219	0.26323
4444	14	0	0	2.7E-06	5.59E-05	0.000465	0.002274	0.00713	0.017162	0.033892	0.056745	0.08533	0.116962	0.151159	0.185774	0.22007
4444	15	0	0	2E-07	1.64E-05	0.000147	0.00088	0.003313	0.009025	0.019861	0.036588	0.058794	0.08549	0.115856	0.147557	0.180173

4444	16	0	0	1E-07	4.1E-06	4.41E-05	0.000341	0.001441	0.004526	0.011055	0.022331	0.03885	0.060367	0.085877	0.114652	0.144531
4444	17	0	0	1E-07	6E-07	1.53E-05	0.000118	0.000584	0.002108	0.005812	0.013085	0.024662	0.040884	0.061623	0.08628	0.112914
4444	18	0	0	0	1E-07	4E-06	3.85E-05	0.000231	0.000934	0.002921	0.007184	0.014804	0.026738	0.042784	0.062824	0.085942
4444	19	0	0	0	0	1.3E-06	1.33E-05	8.67E-05	0.000393	0.001378	0.003747	0.008526	0.016478	0.028438	0.044313	0.063669
4444	20	0	0	0	0	3E-07	5.2E-06	2.8E-05	0.00016	0.000623	0.001871	0.004631	0.009779	0.018275	0.03014	0.04573
MEAN	1	0.499908	0.666663	0.749949	0.800032	0.833314	0.857129	0.875004	0.888853	0.900027	0.909081	0.916664	0.923085	0.928575	0.933318	0.937477
MEAN	2	0.200104	0.400114	0.529413	0.61538	0.675731	0.72001	0.753874	0.78048	0.801977	0.819692	0.834498	0.847061	0.857886	0.867253	0.87547
MEAN	3	0.062455	0.210533	0.346137	0.450535	0.529604	0.59021	0.637485	0.675338	0.706407	0.732043	0.753637	0.77212	0.788021	0.801822	0.814087
MEAN	4	0.01539	0.095215	0.206	0.310761	0.39841	0.469419	0.52729	0.57458	0.613803	0.646677	0.674377	0.698474	0.719181	0.737255	0.753253
MEAN	5	0.003063	0.036748	0.109993	0.198831	0.284754	0.360357	0.424623	0.478921	0.524918	0.563859	0.597468	0.626315	0.651532	0.673633	0.693182
MEAN	6	0.000508	0.012049	0.0521	0.117133	0.191858	0.264978	0.331243	0.389691	0.44067	0.484456	0.522822	0.556017	0.585392	0.611181	0.634106
MEAN	7	7.34E-05	0.003428	0.021825	0.062761	0.120507	0.185031	0.248807	0.308201	0.361653	0.40917	0.450903	0.487933	0.520902	0.549957	0.576105
MEAN	8	8.33E-06	0.000849	0.008115	0.03038	0.069954	0.121843	0.178851	0.235534	0.289197	0.338144	0.382609	0.422529	0.458328	0.490358	0.519271
MEAN	9	7.67E-07	0.00019	0.002703	0.013308	0.037393	0.07506	0.122158	0.173129	0.22423	0.273215	0.318597	0.360332	0.39846	0.432687	0.463877
MEAN	10	2.33E-07	3.7E-05	0.0008	0.005314	0.018364	0.043158	0.078833	0.121754	0.167771	0.21444	0.259447	0.301965	0.341072	0.377085	0.41018
MEAN	11	0	5.57E-06	0.00023	0.001913	0.008264	0.023027	0.047791	0.081387	0.120739	0.16324	0.205964	0.247806	0.287113	0.324383	0.358742
MEAN	12	0	1.13E-06	5.57E-05	0.000636	0.00341	0.011306	0.027041	0.051378	0.083157	0.119776	0.158731	0.198503	0.237417	0.27448	0.309471
MEAN	13	0	1.33E-07	1.26E-05	0.000197	0.001307	0.005209	0.014351	0.030648	0.054437	0.084236	0.118455	0.154832	0.191594	0.227993	0.263243
MEAN	14	0	3.33E-08	2.03E-06	5.83E-05	0.000475	0.002234	0.007103	0.017173	0.03389	0.056843	0.085357	0.117039	0.150983	0.185659	0.219944
MEAN	15	0	0	2E-07	1.55E-05	0.000158	0.000885	0.003326	0.009035	0.019838	0.036492	0.058766	0.085654	0.115892	0.147752	0.18031
MEAN	16	0	0	6.67E-08	3.8E-06	4.94E-05	0.000335	0.001451	0.004529	0.011015	0.022309	0.03889	0.060452	0.085878	0.114518	0.144549
MEAN	17	0	0	3.33E-08	6E-07	1.52E-05	0.000118	0.000598	0.002119	0.005798	0.01297	0.024583	0.040957	0.061693	0.086101	0.112878
MEAN	18	0	0	0	6.67E-08	4.5E-06	4.03E-05	0.000237	0.000932	0.002891	0.007124	0.014785	0.02664	0.042681	0.062866	0.086063
MEAN	19	0	0	0	3.33E-08	9.33E-07	1.4E-05	8.82E-05	0.000397	0.001378	0.003757	0.008496	0.01647	0.028408	0.044284	0.063743
MEAN	20	0	0	0	0	2E-07	4.73E-06	3.06E-05	0.000165	0.000636	0.001866	0.00464	0.009777	0.018184	0.030012	0.045675

Erlang B Blocking Performance (Theoretical)

trunks	Load=1.00	Load=2.00	Load=3.00	Load=4.00	Load=5.00	Load=6.00	Load=7.00	Load=8.00	Load=9.00	Load=10.00	Load=11.00	Load=12.00	Load=13.00	Load=14.00	Load=15.00
1	0.5	0.666667	0.75	0.8	0.833333	0.857143	0.875	0.888889	0.9	0.909091	0.916667	0.923077	0.928571	0.933333	0.9375
2	0.2	0.4	0.529412	0.615385	0.675676	0.72	0.753846	0.780488	0.80198	0.819672	0.834483	0.847059	0.857868	0.867257	0.875486
3	0.0625	0.210526	0.346154	0.450704	0.529661	0.590164	0.637546	0.675462	0.706395	0.732064	0.753681	0.772118	0.78802	0.80187	0.814038
4	0.015385	0.095238	0.206107	0.31068	0.398343	0.469565	0.527345	0.574635	0.613809	0.646663	0.674545	0.698464	0.719185	0.737295	0.753247
5	0.003067	0.036697	0.110054	0.199067	0.284868	0.3604	0.424719	0.479008	0.524908	0.563952	0.597423	0.626352	0.651554	0.673675	0.693227
6	0.000511	0.012085	0.052157	0.117162	0.191847	0.264922	0.33133	0.389752	0.440516	0.484515	0.522736	0.556089	0.585355	0.611183	0.634111
7	7.3E-05	0.003441	0.021864	0.062749	0.120519	0.185055	0.248871	0.308165	0.361585	0.409041	0.450984	0.488045	0.520863	0.550029	0.576057

8	9.12E-06	0.000859	0.008132	0.03042	0.070048	0.121876	0.178822	0.23557	0.289158	0.338318	0.382756	0.422655	0.458406	0.490459	0.519256
9	1.01E-06	0.000191	0.002703	0.01334	0.037458	0.075145	0.122101	0.173141	0.2243	0.273208	0.318714	0.360426	0.398367	0.432765	0.463929
10	1.01E-07	3.82E-05	0.00081	0.005308	0.018385	0.043142	0.078741	0.121661	0.167963	0.214582	0.25958	0.301925	0.341185	0.377285	0.410341
11	9.22E-09	6.94E-06	0.000221	0.001926	0.008287	0.022991	0.047717	0.081288	0.120821	0.163232	0.206085	0.247766	0.287353	0.324407	0.358792
12	7.68E-10	1.16E-06	5.52E-05	0.000642	0.003441	0.011365	0.027081	0.051406	0.083087	0.119739	0.158894	0.198567	0.237397	0.27456	0.309626
13	5.91E-11	1.78E-07	1.27E-05	0.000197	0.001322	0.005218	0.014373	0.030665	0.054393	0.084339	0.118515	0.154901	0.191852	0.228205	0.263222
14	4.22E-12	2.54E-08	2.73E-06	5.64E-05	0.000472	0.002231	0.007135	0.017221	0.033785	0.056819	0.085186	0.11721	0.15121	0.185804	0.219983
15	2.81E-13	3.39E-09	5.46E-07	1.5E-05	0.000157	0.000892	0.003319	0.009101	0.019868	0.036497	0.058797	0.085729	0.115865	0.147788	0.180316
16	1.8E-14	4.24E-10	1.02E-07	3.76E-06	4.91E-05	0.000334	0.00145	0.00453	0.011052	0.022302	0.038852	0.060413	0.08604	0.114507	0.144602
17	1E-15	4.99E-11	1.81E-08	8.85E-07	1.45E-05	0.000118	0.000597	0.002127	0.005817	0.012949	0.024523	0.0409	0.061734	0.086174	0.113153
18	0	5.54E-12	3.01E-09	1.97E-07	4.01E-06	3.93E-05	0.000232	0.000945	0.0029	0.007142	0.014765	0.026543	0.042683	0.062814	0.086169
19	0	5.83E-13	4.76E-10	4.14E-08	1.06E-06	1.24E-05	8.55E-05	0.000398	0.001372	0.003745	0.008476	0.016488	0.028375	0.044236	0.063695
20	0	5.8E-14	7.14E-11	8.28E-09	2.64E-07	3.73E-06	2.99E-05	0.000159	0.000617	0.001869	0.00464	0.009796	0.01811	0.030035	0.045593

Multiplexing Gain (Pb=1%)

trunks	load	pb0.1	Marginal increase in Load	Utilization
1	0.0103	0.010195		0.010195
2	0.152796	0.010025	13.83492011	0.075632
3	0.455489	0.01	1.98102064	0.150311
4	0.86948	0.010002	0.908891282	0.215196
5	1.360868	0.010002	0.565152371	0.269451
6	1.909255	0.010005	0.402968617	0.315026
7	2.501142	0.010004	0.3100089	0.353732
8	3.127827	0.010004	0.250559729	0.387067
9	3.782712	0.010002	0.2093737	0.416097
10	4.461296	0.010001	0.179390926	0.441668
11	5.15998	0.010001	0.156610032	0.464398
12	5.876063	0.010001	0.13877638	0.484775
13	6.607446	0.010003	0.124468193	0.503181
14	7.351728	0.01	0.112643017	0.519872
15	8.108311	0.010002	0.102912172	0.535147
16	8.875093	0.010001	0.094567429	0.549146
17	9.651775	0.010001	0.087512535	0.562073
18	10.43716	0.010002	0.081371736	0.574042
19	11.23034	0.010002	0.075995938	0.585159
20	12.03072	0.010001	0.071269567	0.59552
21	12.838	0.010001	0.067101654	0.605219
22	13.65128	0.01	0.063349509	0.614308
23	14.47056	0.010001	0.060014943	0.622863
24	15.29524	0.010001	0.056990235	0.630928

25	16.12472	0.010001	0.054231282	0.638538
26	16.959	0.010001	0.051739214	0.645746
27	17.79748	0.01	0.049441608	0.652574
28	18.64047	0.010001	0.047365139	0.659073
29	19.48705	0.010001	0.045416262	0.665247
30	20.33753	0.010001	0.043643361	0.671138
31	21.19131	0.010001	0.041980529	0.676754
32	22.04839	0.01	0.040444889	0.682122
33	22.90877	0.010001	0.039022355	0.687263
34	23.77215	0.010001	0.037687751	0.692188
35	24.63823	0.01	0.036432547	0.69691
36	25.5073	0.010001	0.035273633	0.70145
37	26.37878	0.010001	0.034165886	0.70581
38	27.25266	0.010001	0.033128123	0.710003
39	28.12894	0.010001	0.032153904	0.714042
40	29.00762	0.010001	0.031237558	0.717938
41	29.8884	0.010001	0.030363723	0.721695

Probability of Hangup vs. Offered Load

Seed	Arrival Rate	(0.50,1)	(5.25,1)	(10.00,1)	(0.50,5)	(5.25,5)	(10.00,5)	(0.50,9)	(5.25,9)	(10.00,9)	(0.50,13)	(5.25,13)	(10.00,13)	(0.50,17)	(5.25,17)	(10.00,17)
4E+08	1	0.396454	0.48502	0.491833	0.000909	0.002456	0.002709	0	6E-07	6E-07	0	0	0	0	0	0
4E+08	2	0.586011	0.653476	0.659469	0.014237	0.030904	0.033229	4.12E-05	0.000139	0.000161	2E-07	2E-07	2E-07	0	0	0
4E+08	3	0.692711	0.73918	0.743998	0.053656	0.096745	0.102422	0.000675	0.002001	0.002278	2.2E-06	6.2E-06	8.4E-06	0	0	0
4E+08	4	0.759269	0.790986	0.794962	0.116973	0.180594	0.188332	0.003941	0.010252	0.011421	3.86E-05	0.000135	0.000155	0	8E-07	0.000001
4E+08	5	0.803363	0.825917	0.829105	0.192146	0.263734	0.272885	0.013525	0.030255	0.033056	0.000272	0.000865	0.001021	2.4E-06	8.8E-06	1E-05
4E+08	6	0.834643	0.850699	0.853492	0.269048	0.338897	0.348063	0.032626	0.063285	0.068077	0.001312	0.003765	0.004327	1.88E-05	7.54E-05	8.96E-05
4E+08	7	0.857762	0.869325	0.871784	0.340679	0.403502	0.412162	0.062113	0.105671	0.112325	0.004153	0.010694	0.012014	0.000103	0.000374	0.000445
4E+08	8	0.875363	0.883949	0.886053	0.404005	0.459424	0.467336	0.100448	0.154038	0.161993	0.010471	0.02398	0.026549	0.000435	0.001438	0.001633
4E+08	9	0.88905	0.895517	0.897335	0.460463	0.506924	0.514124	0.144371	0.203019	0.211447	0.021422	0.043901	0.047717	0.001401	0.004092	0.004707
4E+08	10	0.900062	0.905221	0.906734	0.508486	0.546971	0.553347	0.192079	0.251525	0.26036	0.038296	0.070228	0.075501	0.003642	0.009406	0.010679
4E+08	11	0.909085	0.913166	0.914569	0.550292	0.581454	0.587892	0.239903	0.296502	0.30506	0.060819	0.101498	0.107993	0.007868	0.018628	0.020682
4E+08	12	0.916712	0.919885	0.921112	0.586088	0.611503	0.617266	0.28641	0.338659	0.347205	0.089577	0.136246	0.14335	0.014837	0.032086	0.03556
4E+08	13	0.923067	0.925688	0.926756	0.6171	0.637786	0.642857	0.330454	0.377317	0.385461	0.121073	0.17132	0.179446	0.02568	0.049901	0.054184
4E+08	14	0.928526	0.930666	0.931644	0.643605	0.660965	0.665641	0.371558	0.413184	0.420484	0.1554	0.206848	0.215238	0.040231	0.071764	0.076718
4E+08	15	0.933304	0.93511	0.935954	0.666844	0.68162	0.685743	0.408464	0.445377	0.451961	0.191071	0.241984	0.249964	0.059206	0.096456	0.102371
4E+08	16	0.937444	0.938967	0.939723	0.68772	0.699666	0.703525	0.443066	0.474651	0.48082	0.226593	0.275067	0.283091	0.081018	0.12287	0.130025
4E+08	17	0.94119	0.942425	0.943135	0.706179	0.715807	0.719551	0.474238	0.501044	0.506956	0.261783	0.306673	0.314784	0.105591	0.151319	0.158439
4E+08	18	0.944468	0.94548	0.946078	0.72256	0.730646	0.733905	0.502073	0.525132	0.530764	0.295761	0.336877	0.343835	0.132661	0.178775	0.187268
4E+08	19	0.947372	0.948235	0.948816	0.73682	0.744038	0.747102	0.527952	0.547414	0.552906	0.327845	0.364496	0.372001	0.160771	0.206657	0.215267
4E+08	20	0.949982	0.950722	0.951271	0.750195	0.756066	0.758802	0.550736	0.567473	0.572968	0.357977	0.39096	0.397691	0.189918	0.234657	0.242148
4E+08	21	0.952357	0.952992	0.953478	0.762094	0.767014	0.769627	0.572109	0.586326	0.590998	0.386307	0.415629	0.421936	0.218792	0.261117	0.26861
4E+08	22	0.954526	0.955073	0.955583	0.772819	0.777172	0.779642	0.591408	0.603501	0.608084	0.412367	0.43809	0.444359	0.247819	0.28705	0.294082

4E+08	23	0.956509	0.956991	0.957417	0.782466	0.786309	0.788747	0.608863	0.619746	0.623801	0.437041	0.459777	0.466031	0.274686	0.310896	0.318622
4E+08	24	0.958344	0.95875	0.959104	0.79176	0.794731	0.797118	0.625402	0.634163	0.638106	0.459444	0.479717	0.485216	0.301728	0.334433	0.341792
4E+08	25	0.95998	0.960308	0.96063	0.800037	0.80274	0.80472	0.640029	0.648018	0.651487	0.481487	0.498254	0.503368	0.326938	0.356834	0.363084
4E+08	26	0.96153	0.961849	0.962174	0.807768	0.810192	0.811954	0.654002	0.660554	0.66422	0.500516	0.515582	0.520647	0.351068	0.37772	0.384487
4E+08	27	0.962973	0.963187	0.963547	0.814825	0.817044	0.818563	0.666648	0.672896	0.676218	0.519017	0.532089	0.537174	0.373925	0.397723	0.404202
4E+08	28	0.964284	0.964505	0.964795	0.821348	0.823247	0.824973	0.678599	0.683904	0.686768	0.536212	0.54754	0.552152	0.395507	0.417075	0.421891
4E+08	29	0.965528	0.96573	0.965968	0.827569	0.829284	0.83084	0.689789	0.694361	0.697288	0.551944	0.562141	0.566039	0.416	0.434142	0.439786
4E+08	30	0.966678	0.966837	0.96709	0.833301	0.834776	0.836127	0.700094	0.704091	0.706788	0.567061	0.575765	0.579732	0.4346	0.451068	0.456635

Mean Waiting Time vs. Offered Load (Hangup included)

Seed	Arrival Rate	(0.50,1)	(5.25,1)	(10.00,1)	(0.50,5)	(5.25,5)	(10.00,5)
400137271	1	0.432541	2.513186	3.71647	0.273998	0.612214	0.664184
400137271	2.8125	0.440585	3.522256	6.500271	0.293485	0.853104	1.009854
400137271	4.625	0.446756	4.126904	7.839841	0.305131	1.199313	1.634535
400137271	6.4375	0.452344	4.434954	8.451386	0.317285	1.668165	2.699274
400137271	8.25	0.457248	4.612863	8.790845	0.32876	2.183479	3.989996
400137271	10.0625	0.461504	4.72847	9.008089	0.33997	2.665122	5.023887
400137271	11.875	0.464881	4.809188	9.160069	0.350232	3.042522	5.786986
400137271	13.6875	0.46807	4.866978	9.270363	0.359574	3.340141	6.350637
400137271	15.5	0.470875	4.909358	9.351956	0.368925	3.559953	6.763991
400137271	17.3125	0.473093	4.945771	9.420024	0.376969	3.73504	7.107797
400137271	19.125	0.475223	4.974008	9.474302	0.384942	3.876179	7.381766
400137271	20.9375	0.47701	4.997856	9.519457	0.392034	3.995367	7.610212
400137271	22.75	0.478731	5.018081	9.557549	0.398438	4.094062	7.800806
400137271	24.5625	0.480113	5.035048	9.590589	0.403887	4.178897	7.961703
400137271	26.375	0.481256	5.049424	9.618047	0.409498	4.251963	8.09961
400137271	28.1875	0.482273	5.061938	9.641882	0.414285	4.315815	8.221663
400137271	30	0.483563	5.073084	9.662985	0.418631	4.371999	8.329315

Mean Waiting Time vs. Offered Load (Hangup excluded)

Seed	Arrival Rate	(0.50,1)	(5.25,1)	(10.00,1)	(0.50,5)	(5.25,5)	(10.00,5)
400137271	0.1	0.430035	1.966593	2.421104	0	0	0
400137271	5.357895	0.528005	7.482443	15.35921	0.332558	1.454913	2.115227
400137271	10.61579	0.632899	11.03972	22.20315	0.400437	3.706833	7.223741
400137271	15.87368	0.736947	13.14312	26.192	0.473285	5.780974	11.23556
400137271	21.13158	0.832971	14.64723	29.06318	0.549774	7.273492	14.11843
400137271	26.38947	0.923953	15.81426	31.29093	0.624645	8.434711	16.33392
400137271	31.64737	1.005073	16.76726	33.10579	0.696417	9.389281	18.15099
400137271	36.90526	1.076913	17.57178	34.63315	0.763859	10.19753	19.68637
400137271	42.16316	1.141418	18.26435	35.96934	0.824296	10.8981	21.02071

400137271	47.42105	1.200027	18.88441	37.14256	0.880113	11.50917	22.18474
400137271	52.67895	1.25122	19.43786	38.19131	0.93222	12.07218	23.25556
400137271	57.93684	1.297545	19.93376	39.14246	0.979214	12.56695	24.20796
400137271	63.19474	1.34256	20.39991	40.02047	1.02376	13.02525	25.07524
400137271	68.45263	1.381749	20.81456	40.81123	1.062071	13.44184	25.87079
400137271	73.71053	1.41945	21.20131	41.55289	1.100384	13.83366	26.60848
400137271	78.96842	1.452802	21.55361	42.23183	1.134648	14.19988	27.30842
400137271	84.22632	1.485098	21.89745	42.86953	1.165658	14.53971	27.95008
400137271	89.48421	1.515648	22.21099	43.46912	1.196892	14.85609	28.55822
400137271	94.74211	1.542728	22.50983	44.03233	1.225157	15.15547	29.1266
400137271	100	1.569718	22.78836	44.57668	1.252918	15.44426	29.67939

W(t) Experimental 1 trunk

Seed	t (min) (	t (sec)	(0.10,1)	(0.20,1)	(0.30,1)	(0.40,1)	(0.50,1)	(0.60,1)	(0.70,1)	(0.80,1)	(0.90,1)	(1.00,1)
400137271	0	0	0.899811	0.799886	0.700241	0.599988	0.500303	0.40007	0.299827	0.200989	0.100289	0.001185
400137271	0.102041	6.122449	0.960114	0.866762	0.76373	0.656507	0.54862	0.440267	0.329892	0.221251	0.110464	0.001309
400137271	0.204082	12.2449	0.984173	0.911597	0.81407	0.705173	0.592504	0.477163	0.358542	0.240857	0.120515	0.001448
400137271	0.306122	18.36735	0.993671	0.941162	0.853536	0.74706	0.632054	0.511786	0.386039	0.259962	0.1305	0.001573
400137271	0.408163	24.4898	0.997445	0.961046	0.884624	0.782784	0.667998	0.543877	0.412345	0.27786	0.140504	0.001692
400137271	0.510204	30.61224	0.998968	0.974242	0.909131	0.813567	0.700163	0.573914	0.43761	0.296811	0.150186	0.001811
400137271	0.612245	36.73469	0.999592	0.982832	0.928411	0.840059	0.729273	0.60217	0.461871	0.314599	0.159746	0.001942
400137271	0.714286	42.85714	0.999834	0.988586	0.943775	0.862733	0.755671	0.628439	0.484961	0.331969	0.169265	0.002069
400137271	0.816327	48.97959	0.999938	0.99243	0.955769	0.882229	0.779355	0.653062	0.507067	0.348966	0.178767	0.0022
400137271	0.918367	55.10204	0.999974	0.995001	0.965355	0.898846	0.800853	0.675659	0.528336	0.36539	0.188091	0.002334
400137271	1.020408	61.22449	0.99999	0.99668	0.972739	0.913123	0.820243	0.697039	0.548604	0.381454	0.197256	0.002459
400137271	1.122449	67.34694	0.999995	0.99781	0.978532	0.925545	0.837742	0.716956	0.567991	0.397079	0.206302	0.002569
400137271	1.22449	73.46939	0.999999	0.998535	0.983089	0.936221	0.853449	0.735651	0.586484	0.412462	0.21538	0.002691
400137271	1.326531	79.59184	1	0.999017	0.986668	0.945344	0.867591	0.7531	0.60431	0.42747	0.224294	0.00281

400137271	1.428571	85.71429	1	0.999342	0.989556	0.953191	0.880475	0.76937	0.621369	0.441988	0.233077	0.002922
400137271	1.530612	91.83673	1	0.999566	0.991807	0.959781	0.892134	0.784499	0.637697	0.456208	0.241845	0.003034
400137271	1.632653	97.95918	1	0.999712	0.993586	0.965379	0.902691	0.798549	0.653333	0.470065	0.250469	0.003158
400137271	1.734694	104.0816	1	0.999811	0.994954	0.970263	0.912238	0.811896	0.668085	0.48358	0.258936	0.003284
400137271	1.836735	110.2041	1	0.999884	0.99605	0.974461	0.920777	0.824258	0.682333	0.496615	0.267352	0.003403
400137271	1.938776	116.3265	1	0.999919	0.996907	0.978121	0.928368	0.835825	0.695855	0.509511	0.275616	0.003523
400137271	2.040816	122.449	1	0.999944	0.997553	0.981232	0.935299	0.846771	0.708743	0.521861	0.283807	0.003654
400137271	2.142857	128.5714	1	0.999963	0.998044	0.983913	0.941635	0.857007	0.721313	0.53393	0.291968	0.003766
400137271	2.244898	134.6939	1	0.999975	0.998444	0.986243	0.947208	0.866401	0.733223	0.545672	0.299877	0.003906
400137271	2.346939	140.8163	1	0.999981	0.998779	0.988136	0.952382	0.875256	0.744751	0.557048	0.307824	0.004023
400137271	2.44898	146.9388	1	0.999989	0.999032	0.989775	0.956993	0.883542	0.755674	0.568264	0.315637	0.00414
400137271	2.55102	153.0612	1	0.999993	0.999236	0.991252	0.961149	0.89112	0.766258	0.579225	0.323353	0.00428
400137271	2.653061	159.1837	1	0.999996	0.999399	0.992454	0.964888	0.898234	0.77631	0.589793	0.331045	0.004409
400137271	2.755102	165.3061	1	0.999998	0.999535	0.993536	0.968379	0.904979	0.786157	0.600099	0.338564	0.004535
400137271	2.857143	171.4286	1	0.999999	0.999633	0.994432	0.971425	0.91109	0.79533	0.610255	0.346024	0.004655
400137271	2.959184	177.551	1	1	0.999706	0.99952	0.974203	0.916934	0.804206	0.620051	0.353343	0.004762
400137271	3.061224	183.6735	1	1	0.999766	0.995872	0.976681	0.922339	0.812683	0.629638	0.360728	0.004885
400137271	3.163265	189.7959	1	1	0.999817	0.996461	0.978921	0.92743	0.820725	0.639076	0.36797	0.004994
400137271	3.265306	195.9184	1	1	0.999859	0.996942	0.980942	0.932217	0.82845	0.648113	0.374998	0.005121
400137271	3.367347	202.0408	1	1	0.999891	0.997387	0.982759	0.936623	0.835844	0.656979	0.381951	0.005256
400137271	3.469388	208.1633	1	1	0.999912	0.997745	0.984434	0.940786	0.842965	0.665591	0.388934	0.005392
400137271	3.571429	214.2857	1	1	0.999924	0.998071	0.985888	0.944839	0.849832	0.674043	0.395793	0.005512
400137271	3.673469	220.4082	1	1	0.999935	0.998354	0.987248	0.948493	0.856359	0.682324	0.402625	0.005637

400137271	3.77551	226.5306	1	1	0.999943	0.998589	0.988487	0.951862	0.862658	0.690331	0.409399	0.005768
400137271	3.877551	232.6531	1	1	0.999956	0.998766	0.98962	0.954968	0.868659	0.698189	0.416111	0.005898
400137271	3.979592	238.7755	1	1	0.999964	0.99893	0.990634	0.957969	0.874378	0.705836	0.422741	0.006031
400137271	4.081633	244.898	1	1	0.999975	0.999085	0.991527	0.960765	0.879804	0.713313	0.42929	0.006162
400137271	4.183673	251.0204	1	1	0.999981	0.999206	0.992346	0.963395	0.884969	0.720514	0.435716	0.006274
400137271	4.285714	257.1429	1	1	0.999987	0.999316	0.993093	0.965797	0.890002	0.727553	0.442097	0.006393
400137271	4.387755	263.2653	1	1	0.99999	0.999407	0.993738	0.968012	0.89483	0.734523	0.44844	0.006524
400137271	4.489796	269.3878	1	1	0.999993	0.999494	0.994322	0.970083	0.899447	0.74123	0.45472	0.006645
400137271	4.591837	275.5102	1	1	0.999994	0.999564	0.994863	0.972043	0.903799	0.747857	0.460883	0.006776
400137271	4.693878	281.6327	1	1	0.999995	0.999626	0.995355	0.973875	0.90797	0.754274	0.466879	0.006902
400137271	4.795918	287.7551	1	1	0.999997	0.999672	0.995783	0.975575	0.912006	0.76049	0.472893	0.007027
400137271	4.897959	293.8776	1	1	0.999999	0.999716	0.996169	0.977207	0.915821	0.766611	0.47884	0.007147
400137271	5	300	1	1	0.999999	0.999749	0.996516	0.978737	0.919547	0.772621	0.484604	0.00727

W(t) Theoretical 1 trunk

Seed	t (min) (	t (sec)	(0.10,1)	(0.20,1)	(0.30,1)	(0.40,1)	(0.50,1)	(0.60,1)	(0.70,1)	(0.80,1)	(0.90,1)	(1.00,1)
400137271	0	0	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0
400137271	0.102041	6.122449	0.960083	0.867026	0.763562	0.656769	0.548504	0.439459	0.329953	0.22015	0.110146	0
400137271	0.204082	12.2449	0.984066	0.911589	0.813656	0.705481	0.592302	0.476323	0.358623	0.239793	0.120179	0
400137271	0.306122	18.36735	0.99364	0.941218	0.853138	0.74728	0.631852	0.510763	0.386067	0.25894	0.130097	0
400137271	0.408163	24.4898	0.997461	0.960918	0.884254	0.783147	0.667565	0.542937	0.412337	0.277606	0.139905	0
400137271	0.510204	30.61224	0.998987	0.974015	0.908777	0.813923	0.699813	0.572996	0.437483	0.295801	0.149601	0
400137271	0.612245	36.73469	0.999595	0.982724	0.928105	0.840332	0.728934	0.601078	0.461553	0.313538	0.159188	0

400137271	0.714286	42.85714	0.999839	0.988513	0.943337	0.862992	0.755229	0.627313	0.484592	0.330829	0.168668	0
400137271	0.816327	48.97959	0.999936	0.992363	0.955343	0.882437	0.778974	0.651823	0.506646	0.347683	0.17804	0
400137271	0.918367	55.10204	0.999974	0.994922	0.964804	0.899122	0.800415	0.674721	0.527757	0.364114	0.187307	0
400137271	1.020408	61.22449	0.999999	0.996624	0.972261	0.913439	0.819776	0.696113	0.547964	0.38013	0.196469	0
400137271	1.122449	67.34694	0.999996	0.997755	0.978138	0.925724	0.837259	0.716098	0.567306	0.395743	0.205528	0
400137271	1.22449	73.46939	0.999998	0.998508	0.98277	0.936265	0.853046	0.734768	0.585821	0.410963	0.214484	0
400137271	1.326531	79.59184	0.999999	0.999008	0.986421	0.945311	0.867302	0.752211	0.603543	0.425799	0.22334	0
400137271	1.428571	85.71429	1	0.99934	0.989298	0.953072	0.880174	0.768507	0.620507	0.440262	0.232096	0
400137271	1.530612	91.83673	1	0.999561	0.991565	0.959732	0.891798	0.783731	0.636746	0.45436	0.240753	0
400137271	1.632653	97.95918	1	0.999708	0.993352	0.965447	0.902295	0.797954	0.652289	0.468104	0.249313	0
400137271	1.734694	104.0816	1	0.999806	0.994761	0.970351	0.911773	0.811242	0.667167	0.481501	0.257776	0
400137271	1.836735	110.2041	1	0.999871	0.995871	0.974559	0.920332	0.823655	0.681409	0.494561	0.266144	0
400137271	1.938776	116.3265	1	0.999914	0.996746	0.97817	0.92806	0.835253	0.695041	0.507291	0.274417	0
400137271	2.040816	122.449	1	0.999943	0.997435	0.981268	0.935039	0.846087	0.70809	0.519702	0.282597	0
400137271	2.142857	128.5714	1	0.999962	0.997979	0.983926	0.94134	0.856209	0.720581	0.531799	0.290685	0
400137271	2.244898	134.6939	1	0.999975	0.998407	0.986208	0.947031	0.865666	0.732537	0.543592	0.298682	0
400137271	2.346939	140.8163	1	0.999983	0.998744	0.988165	0.952169	0.87445	0.743982	0.555088	0.306588	0
400137271	2.44898	146.9388	1	0.999989	0.99901	0.989845	0.956809	0.882754	0.754936	0.566294	0.314406	0
400137271	2.55102	153.0612	1	0.999993	0.99922	0.991286	0.960999	0.890464	0.765423	0.577218	0.322135	0
400137271	2.653061	159.1837	1	0.999995	0.999385	0.992523	0.964782	0.897668	0.77546	0.587867	0.329777	0
400137271	2.755102	165.3061	1	0.999997	0.999516	0.993584	0.968199	0.904398	0.785068	0.598248	0.337333	0
400137271	2.857143	171.4286	1	0.999998	0.999618	0.994494	0.971284	0.910685	0.794265	0.608367	0.344804	0
400137271	2.959184	177.551	1	0.999999	0.999699	0.995276	0.974069	0.916559	0.803068	0.618231	0.352191	0

400137271	3.061224	183.6735	1	0.999999	0.999763	0.995946	0.976585	0.922046	0.811495	0.627847	0.359494	0
400137271	3.163265	189.7959	1	0.999999	0.999813	0.996522	0.978856	0.927173	0.819561	0.63722	0.366715	0
400137271	3.265306	195.9184	1	1	0.999853	0.997015	0.980907	0.931963	0.827281	0.646358	0.373854	0
400137271	3.367347	202.0408	1	1	0.999884	0.997439	0.98276	0.936437	0.834672	0.655265	0.380913	0
400137271	3.469388	208.1633	1	1	0.999909	0.997802	0.984432	0.940617	0.841746	0.663948	0.387893	0
400137271	3.571429	214.2857	1	1	0.999928	0.998114	0.985942	0.944523	0.848518	0.672413	0.394794	0
400137271	3.673469	220.4082	1	1	0.999943	0.998382	0.987306	0.948171	0.855	0.680664	0.401617	0
400137271	3.77551	226.5306	1	1	0.999955	0.998612	0.988537	0.95158	0.861204	0.688707	0.408363	0
400137271	3.877551	232.6531	1	1	0.999965	0.998809	0.989649	0.954764	0.867143	0.696548	0.415033	0
400137271	3.979592	238.7755	1	1	0.999972	0.998978	0.990653	0.957739	0.872828	0.704191	0.421628	0
400137271	4.081633	244.898	1	1	0.999978	0.999123	0.99156	0.960518	0.87827	0.711642	0.428148	0
400137271	4.183673	251.0204	1	1	0.999983	0.999247	0.992379	0.963115	0.883478	0.718905	0.434595	0
400137271	4.285714	257.1429	1	1	0.999986	0.999354	0.993118	0.96554	0.888464	0.725985	0.440969	0
400137271	4.387755	263.2653	1	1	0.999989	0.999446	0.993786	0.967807	0.893237	0.732887	0.447272	0
400137271	4.489796	269.3878	1	1	0.999992	0.999524	0.994389	0.969924	0.897805	0.739615	0.453503	0
400137271	4.591837	275.5102	1	1	0.999993	0.999592	0.994933	0.971902	0.902178	0.746173	0.459664	0
400137271	4.693878	281.6327	1	1	0.999995	0.99965	0.995424	0.97375	0.906364	0.752566	0.465756	0
400137271	4.795918	287.7551	1	1	0.999996	0.9997	0.995868	0.975476	0.91037	0.758799	0.471779	0
400137271	4.897959	293.8776	1	1	0.999997	0.999742	0.996269	0.977089	0.914205	0.764874	0.477734	0
400137271	5	300	1	1	0.999997	0.999779	0.996631	0.978596	0.917877	0.770796	0.483622	0

W(t) Experimental 2 trunks

Seed	t (min) (	t (sec)	(0.10,2)	(0.20,2)	(0.30,2)	(0.40,2)	(0.50,2)	(0.60,2)	(0.70,2)	(0.80,2)	(0.90,2)	(1.00,2)

400137271	0	0	0.995252	0.981752	0.96049	0.933485	0.89954	0.861341	0.81853	0.7716	0.721682	0.668276
400137271	0.102041	6.122449	0.999297	0.992756	0.977819	0.955889	0.926143	0.890724	0.850034	0.804118	0.754444	0.700545
400137271	0.204082	12.2449	0.999905	0.997106	0.987549	0.970647	0.945663	0.913854	0.875884	0.832111	0.783382	0.72979
400137271	0.306122	18.36735	0.999985	0.998893	0.992997	0.980468	0.960082	0.932023	0.89744	0.856048	0.809008	0.756257
400137271	0.408163	24.4898	0.999998	0.999563	0.996086	0.98702	0.970642	0.946579	0.915053	0.876504	0.831388	0.780121
400137271	0.510204	30.61224	1	0.99983	0.997806	0.991416	0.978351	0.957886	0.929675	0.894062	0.851123	0.801524
400137271	0.612245	36.73469	1	0.999935	0.998792	0.994287	0.984083	0.966753	0.94198	0.909118	0.868598	0.820833
400137271	0.714286	42.85714	1	0.999974	0.999336	0.996234	0.988293	0.973759	0.951955	0.92212	0.884025	0.838282
400137271	0.816327	48.97959	1	0.999989	0.999635	0.99755	0.99134	0.97923	0.960149	0.933283	0.897774	0.853923
400137271	0.918367	55.10204	1	0.999997	0.999806	0.99838	0.993651	0.983664	0.967087	0.942713	0.909806	0.868045
400137271	1.020408	61.22449	1	0.999999	0.999895	0.998928	0.99534	0.987183	0.972715	0.950878	0.920393	0.880939
400137271	1.122449	67.34694	1	0.999999	0.999937	0.999302	0.996635	0.989906	0.977473	0.957827	0.929688	0.892516
400137271	1.22449	73.46939	1	1	0.999962	0.999552	0.997536	0.991998	0.981409	0.963787	0.937976	0.902992
400137271	1.326531	79.59184	1	1	0.999978	0.999709	0.998197	0.993694	0.984645	0.968937	0.945225	0.912368
400137271	1.428571	85.71429	1	1	0.999988	0.999813	0.99869	0.99504	0.987295	0.973376	0.951512	0.921006
400137271	1.530612	91.83673	1	1	0.999991	0.999874	0.999037	0.996109	0.98947	0.977198	0.957295	0.928766
400137271	1.632653	97.95918	1	1	0.999995	0.999919	0.999299	0.996944	0.991248	0.9804	0.962348	0.935707
400137271	1.734694	104.0816	1	1	0.999998	0.999957	0.999487	0.997617	0.992756	0.983238	0.966823	0.941898
400137271	1.836735	110.2041	1	1	0.999999	0.999975	0.999624	0.99814	0.993981	0.985649	0.97071	0.947556
400137271	1.938776	116.3265	1	1	1	0.999983	0.999726	0.998547	0.995053	0.987661	0.974132	0.952664
400137271	2.040816	122.449	1	1	1	0.999989	0.999803	0.99886	0.995923	0.989394	0.977129	0.95731
400137271	2.142857	128.5714	1	1	1	0.999994	0.999856	0.999096	0.996623	0.990924	0.979794	0.961536
400137271	2.244898	134.6939	1	1	1	0.999994	0.999898	0.999295	0.997208	0.992233	0.982125	0.965306

400137271	2.346939	140.8163	1	1	1	0.999998	0.999928	0.99944	0.997695	0.993354	0.984172	0.968715
400137271	2.44898	146.9388	1	1	1	1	0.999947	0.999566	0.99809	0.994313	0.986053	0.971789
400137271	2.55102	153.0612	1	1	1	1	0.999965	0.999657	0.99842	0.995134	0.987712	0.974587
400137271	2.653061	159.1837	1	1	1	1	0.999978	0.999738	0.998701	0.995827	0.98912	0.977093
400137271	2.755102	165.3061	1	1	1	1	0.999982	0.999793	0.998934	0.996427	0.990402	0.97935
400137271	2.857143	171.4286	1	1	1	1	0.999988	0.999845	0.999112	0.996912	0.991583	0.981364
400137271	2.959184	177.551	1	1	1	1	0.999993	0.999885	0.999268	0.997363	0.992614	0.983188
400137271	3.061224	183.6735	1	1	1	1	0.999995	0.999911	0.99994	0.997733	0.993529	0.984795
400137271	3.163265	189.7959	1	1	1	1	0.999997	0.999927	0.999488	0.998059	0.994303	0.986268
400137271	3.265306	195.9184	1	1	1	1	0.999998	0.999943	0.999571	0.998343	0.994988	0.987619
400137271	3.367347	202.0408	1	1	1	1	0.999999	0.999956	0.999648	0.998594	0.995565	0.988844
400137271	3.469388	208.1633	1	1	1	1	1	0.999967	0.999707	0.998788	0.996082	0.989931
400137271	3.571429	214.2857	1	1	1	1	1	0.999977	0.999771	0.998958	0.996552	0.990894
400137271	3.673469	220.4082	1	1	1	1	1	0.999982	0.999807	0.999112	0.996953	0.991816
400137271	3.77551	226.5306	1	1	1	1	1	0.999985	0.999849	0.999245	0.997316	0.992604
400137271	3.877551	232.6531	1	1	1	1	1	0.999987	0.999875	0.999357	0.997639	0.993327
400137271	3.979592	238.7755	1	1	1	1	1	0.999991	0.999899	0.999449	0.997928	0.994024
400137271	4.081633	244.898	1	1	1	1	1	0.999995	0.999915	0.999526	0.998173	0.994628
400137271	4.183673	251.0204	1	1	1	1	1	0.999997	0.999934	0.99959	0.998378	0.995167
400137271	4.285714	257.1429	1	1	1	1	1	0.999998	0.999947	0.999636	0.998579	0.995675
400137271	4.387755	263.2653	1	1	1	1	1	0.999999	0.999958	0.999689	0.998748	0.996109
400137271	4.489796	269.3878	1	1	1	1	1	0.999999	0.999968	0.999729	0.998901	0.996485
400137271	4.591837	275.5102	1	1	1	1	1	1	0.999973	0.999773	0.999045	0.996834

400137271	4.693878	281.6327	1	1	1	1	1	1	0.999978	0.999805	0.999162	0.997153
400137271	4.795918	287.7551	1	1	1	1	1	1	0.99998	0.999837	0.999258	0.997441
400137271	4.897959	293.8776	1	1	1	1	1	1	0.999985	0.999862	0.999357	0.99769
400137271	5	300	1	1	1	1	1	1	0.999988	0.999881	0.99944	0.997916

W(t) Theoretical 2 trunks

Seed	t (min) (	t (sec)	(0.10,2)	(0.20,2)	(0.30,2)	(0.40,2)	(0.50,2)	(0.60,2)	(0.70,2)	(0.80,2)	(0.90,2)	(1.00,2)
400137271	0	0	0.995238	0.981818	0.96087	0.933333	0.9	0.861538	0.818519	0.771429	0.72069	0.666667
400137271	0.102041	6.122449	0.999315	0.992742	0.978052	0.955675	0.92637	0.890875	0.849848	0.803868	0.75344	0.699002
400137271	0.204082	12.2449	0.999901	0.997103	0.98769	0.97053	0.945787	0.913995	0.875769	0.831704	0.78235	0.728201
400137271	0.306122	18.36735	0.999986	0.998844	0.993095	0.980406	0.960083	0.932217	0.897215	0.855589	0.80787	0.754568
400137271	0.408163	24.4898	0.999998	0.999538	0.996127	0.986973	0.970609	0.946579	0.914959	0.876084	0.830398	0.778377
400137271	0.510204	30.61224	1	0.999816	0.997828	0.991338	0.97836	0.957897	0.92964	0.893671	0.850284	0.799876
400137271	0.612245	36.73469	1	0.999926	0.998782	0.994241	0.984066	0.966818	0.941786	0.908761	0.867839	0.819289
400137271	0.714286	42.85714	1	0.999971	0.999317	0.996171	0.988268	0.973848	0.951835	0.92171	0.883335	0.836819
400137271	0.816327	48.97959	1	0.999988	0.999617	0.997454	0.991362	0.979389	0.96015	0.932821	0.897014	0.852649
400137271	0.918367	55.10204	1	0.999995	0.999785	0.998307	0.99364	0.983756	0.967029	0.942355	0.90909	0.866943
400137271	1.020408	61.22449	1	0.999998	0.999879	0.998875	0.995317	0.987198	0.972721	0.950536	0.919749	0.879851
400137271	1.122449	67.34694	1	0.999999	0.999932	0.999252	0.996552	0.98991	0.97743	0.957556	0.929159	0.891506
400137271	1.22449	73.46939	1	1	0.999962	0.999503	0.997461	0.992048	0.981327	0.96358	0.937465	0.902031
400137271	1.326531	79.59184	1	1	0.999979	0.999669	0.998131	0.993733	0.98455	0.968749	0.944797	0.911535
400137271	1.428571	85.71429	1	1	0.999988	0.99978	0.998624	0.995061	0.987217	0.973184	0.95127	0.920116
400137271	1.530612	91.83673	1	1	0.999993	0.999854	0.998987	0.996107	0.989424	0.97699	0.956984	0.927866

400137271	1.632653	97.95918	1	1	0.999996	0.999903	0.999254	0.996932	0.99125	0.980256	0.962028	0.934863
400137271	1.734694	104.0816	1	1	0.999998	0.999935	0.999451	0.997582	0.99276	0.983058	0.96648	0.941182
400137271	1.836735	110.2041	1	1	0.999999	0.999957	0.999595	0.998094	0.99401	0.985462	0.97041	0.946888
400137271	1.938776	116.3265	1	1	0.999999	0.999971	0.999702	0.998498	0.995044	0.987526	0.97388	0.95204
400137271	2.040816	122.449	1	1	1	0.999981	0.999781	0.998816	0.9959	0.989296	0.976942	0.956692
400137271	2.142857	128.5714	1	1	1	0.999987	0.999839	0.999067	0.996608	0.990815	0.979646	0.960894
400137271	2.244898	134.6939	1	1	1	0.999992	0.999881	0.999265	0.997193	0.992119	0.982033	0.964687
400137271	2.346939	140.8163	1	1	1	0.999994	0.999912	0.999421	0.997678	0.993237	0.984139	0.968113
400137271	2.44898	146.9388	1	1	1	0.999996	0.999936	0.999543	0.998079	0.994197	0.985999	0.971206
400137271	2.55102	153.0612	1	1	1	0.999998	0.999953	0.99964	0.99841	0.995021	0.987641	0.973999
400137271	2.653061	159.1837	1	1	1	0.999998	0.999965	0.999716	0.998685	0.995727	0.98909	0.976522
400137271	2.755102	165.3061	1	1	1	0.999999	0.999974	0.999776	0.998912	0.996334	0.990369	0.978799
400137271	2.857143	171.4286	1	1	1	0.999999	0.999981	0.999824	0.9991	0.996854	0.991498	0.980856
400137271	2.959184	177.551	1	1	1	1	0.999986	0.999861	0.999255	0.9973	0.992495	0.982713
400137271	3.061224	183.6735	1	1	1	1	0.99999	0.999891	0.999384	0.997684	0.993375	0.98439
400137271	3.163265	189.7959	1	1	1	1	0.999992	0.999914	0.99949	0.998012	0.994152	0.985904
400137271	3.265306	195.9184	1	1	1	1	0.999994	0.999932	0.999578	0.998294	0.994838	0.987272
400137271	3.367347	202.0408	1	1	1	1	0.999996	0.999946	0.999651	0.998537	0.995443	0.988506
400137271	3.469388	208.1633	1	1	1	1	0.999997	0.999958	0.999711	0.998744	0.995977	0.989621
400137271	3.571429	214.2857	1	1	1	1	0.999998	0.999967	0.999761	0.998922	0.996449	0.990628
400137271	3.673469	220.4082	1	1	1	1	0.999998	0.999974	0.999802	0.999075	0.996865	0.991537
400137271	3.77551	226.5306	1	1	1	1	0.999999	0.999979	0.999836	0.999207	0.997233	0.992358
400137271	3.877551	232.6531	1	1	1	1	0.999999	0.999984	0.999865	0.999319	0.997557	0.9931

400137271	3.979592	238.7755	1	1	1	1	0.999999	0.999987	0.999888	0.999416	0.997844	0.993769
400137271	4.081633	244.898	1	1	1	1	1	0.99999	0.999907	0.999499	0.998097	0.994373
400137271	4.183673	251.0204	1	1	1	1	1	0.999992	0.999923	0.99957	0.99832	0.994919
400137271	4.285714	257.1429	1	1	1	1	1	0.999994	0.999937	0.999631	0.998517	0.995412
400137271	4.387755	263.2653	1	1	1	1	1	0.999995	0.999948	0.999683	0.998691	0.995857
400137271	4.489796	269.3878	1	1	1	1	1	0.999996	0.999957	0.999728	0.998844	0.996259
400137271	4.591837	275.5102	1	1	1	1	1	0.999997	0.999964	0.999767	0.99898	0.996622
400137271	4.693878	281.6327	1	1	1	1	1	0.999998	0.99997	0.9998	0.999099	0.99695
400137271	4.795918	287.7551	1	1	1	1	1	0.999998	0.999975	0.999828	0.999205	0.997246
400137271	4.897959	293.8776	1	1	1	1	1	0.999998	0.99998	0.999853	0.999298	0.997513
400137271	5	300	1	1	1	1	1	0.999999	0.999983	0.999874	0.99938	0.997754