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Simulation Task 3

RESULTS

Input parameters:
Mean inter-arrival time of non-RT messages have not been taken as input as my simulation generates for a list of times ranging from 10 to 40.

```
Mean inter-arrival time of RT messages 7
Mean service time of an RT message 2
Mean service time of a nonRT message 4
Number of batches, m 51
Batch size, b 1000
```

Explanation of plots
For each iteration, I have generated 4 plots.

1. Mean for RT batch (blue plot)
   The mean for each RT batch is taken and we have 50 such values. This is plotted along with vertical lines for mean and confidence interval
2. Mean for non-RT batch (pink plot)
   The mean for each non-RT batch is taken and we have 50 such values. This is plotted along with vertical lines for mean and confidence interval
3. 95th percentile for RT batch (green plot)
   The 95th percentile for each batch is taken and we have 50 such values. This is plotted along with vertical lines for 95th percentile and confidence interval
4. 95th percentile for non-RT batch (orange plot)
   The mean for each batch is taken and we have 50 such values. This is plotted along with vertical lines for 95th percentile and confidence interval

Note:
Plot 2 (a): Just to get some visualization for the non-RT batch, I decided to just depict a plot where I range the values to be in the range of the actual mean service time for non-RT. This shows a distribution of service time of most of the non-RT signals.
A few non-RT messages may get paused in the middle due to the processing of RT-messages making the values very large and skewing the service time from the actual mean service times. This is seen in the next plot where the mean is an arbitrary large value.
Plot 2 (b): Mean for non-RT batch usually tends to be large. This makes the confidence interval to be generated at places where there are no values when the inter-arrival time is low.

Depicted in the following pages are a list of graphs generated for each case ranging from an inter-arrival time of non-RT from 10 to 40 with an increase of 5. Rest of the parameters being constant.

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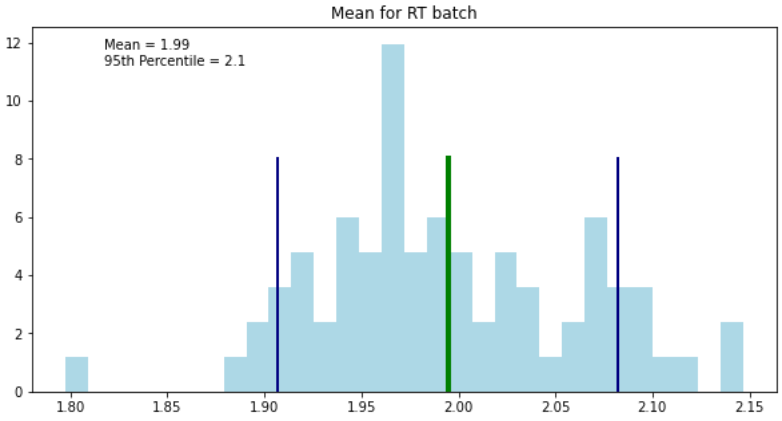
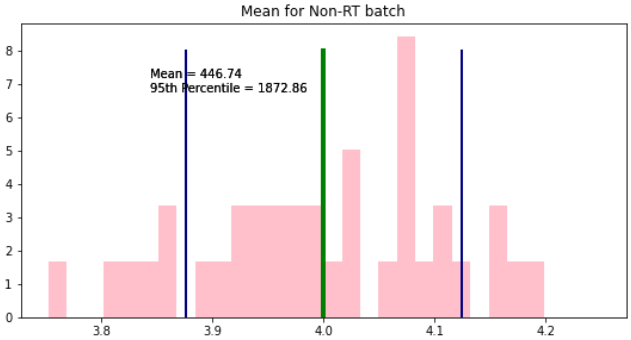
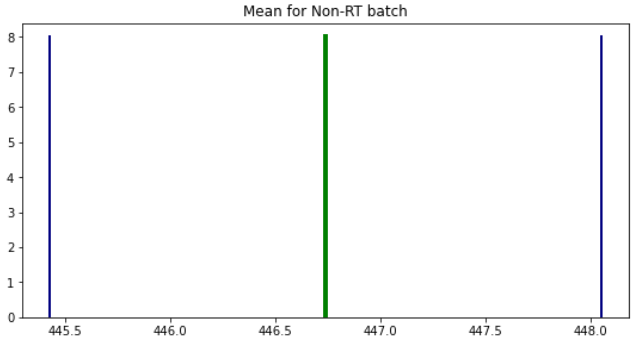
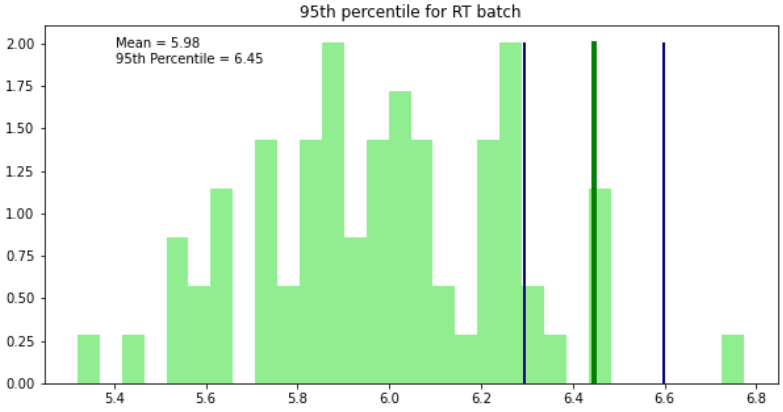
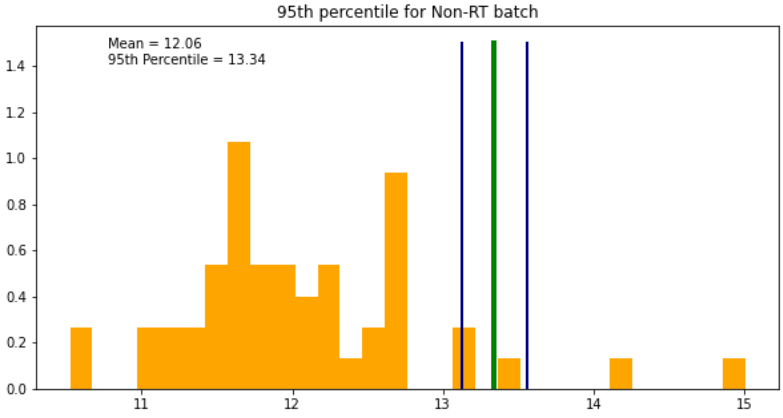
Inter-arrival time of Non-RT message = 10











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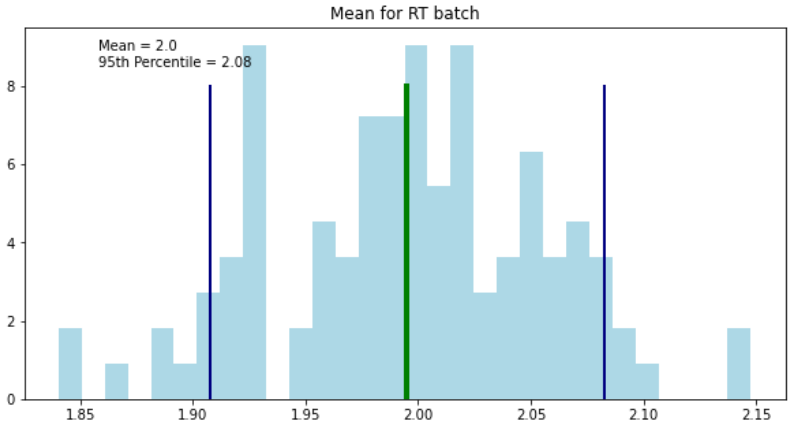
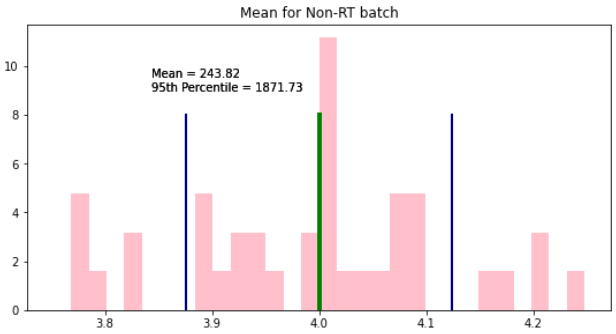
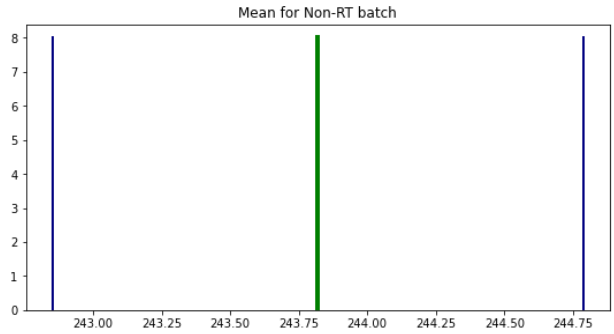
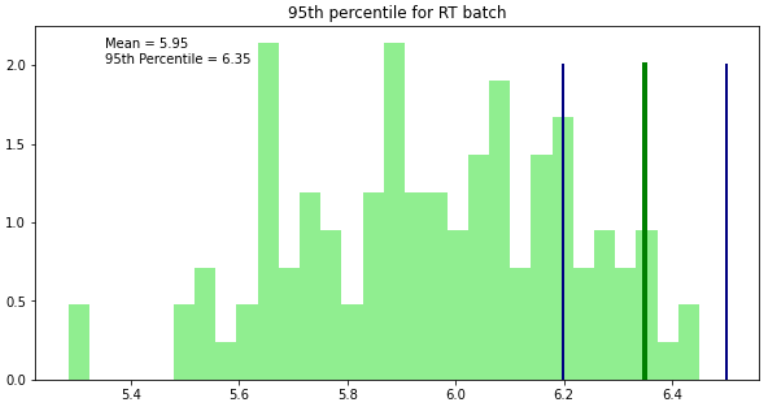
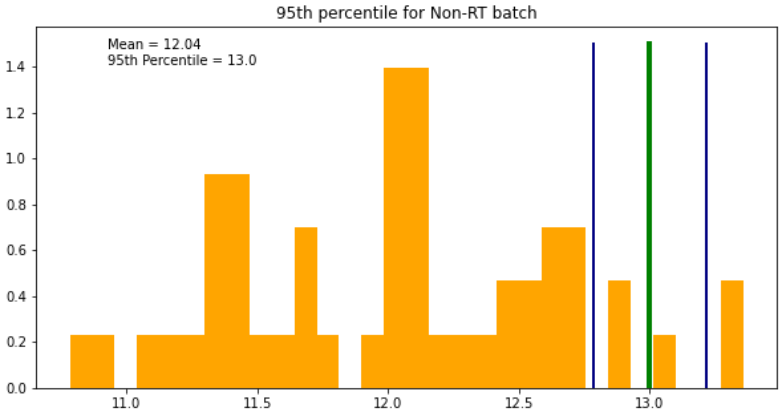
Inter-arrival time of Non-RT message = 15











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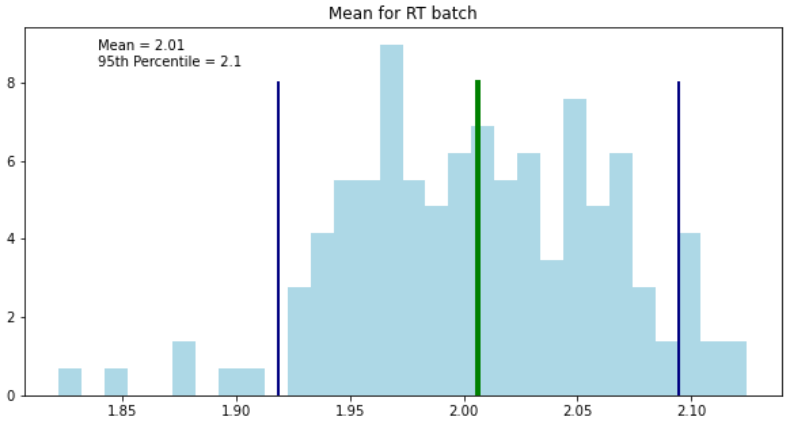
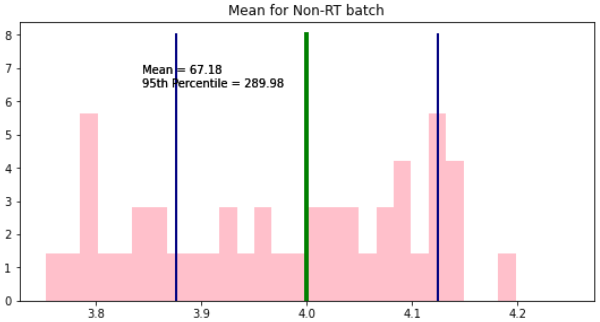
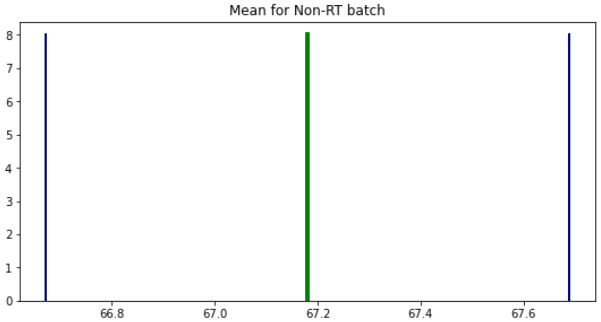
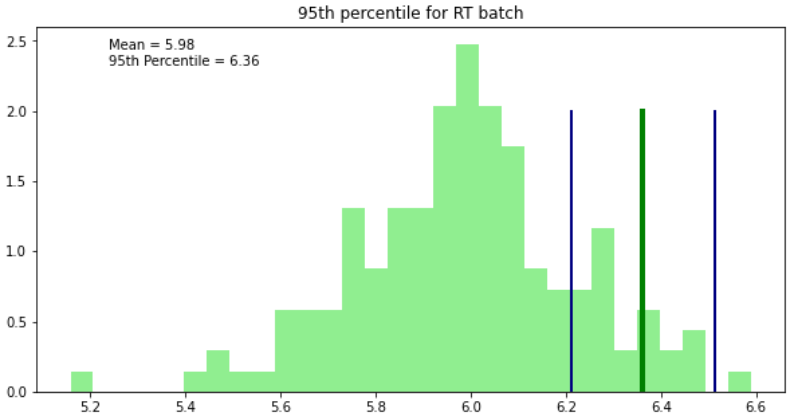
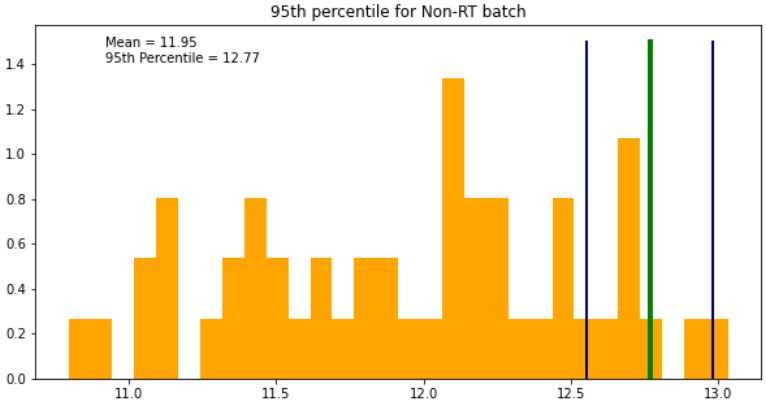
Inter-arrival time of Non-RT message = 20











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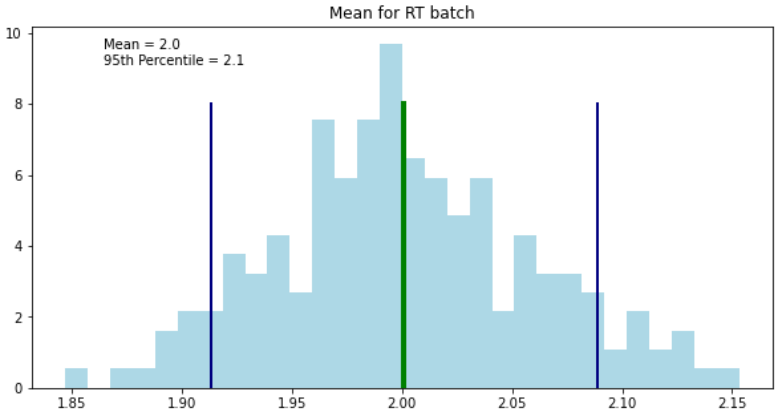
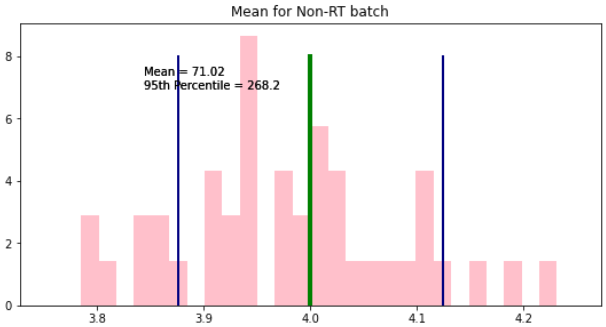
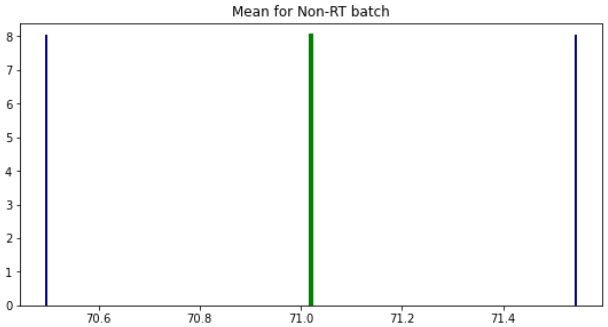
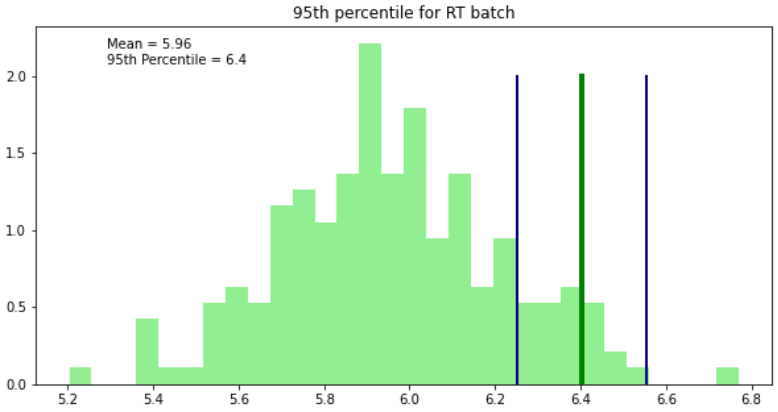
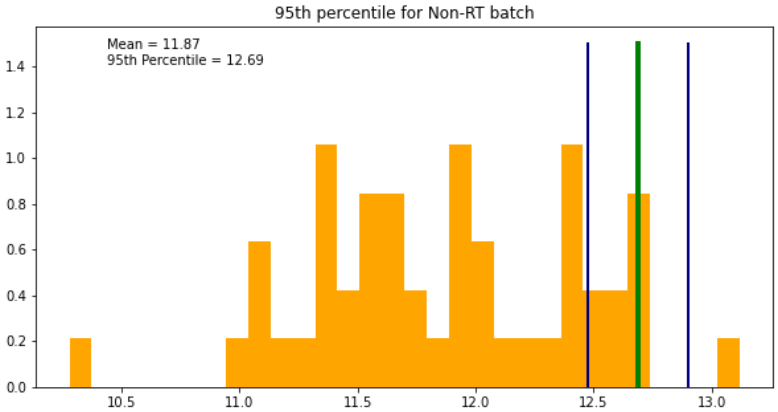
Inter-arrival time of Non-RT message = 25











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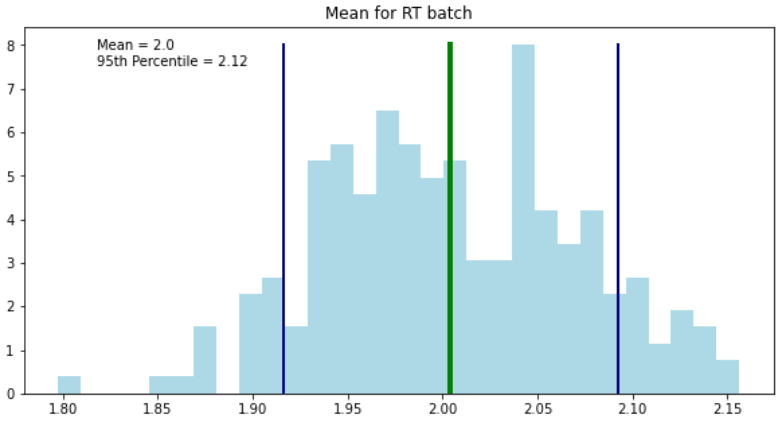
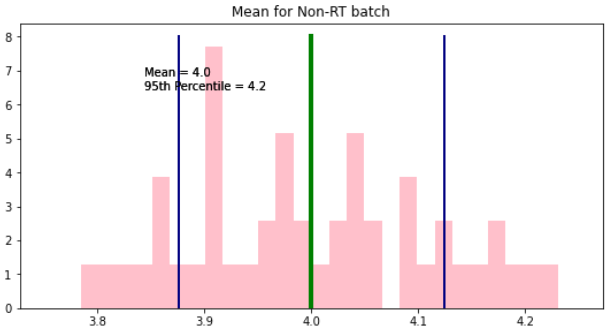
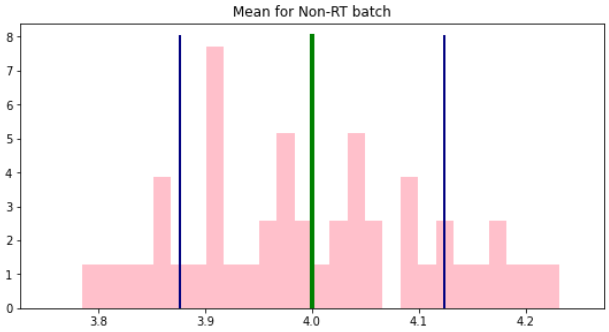
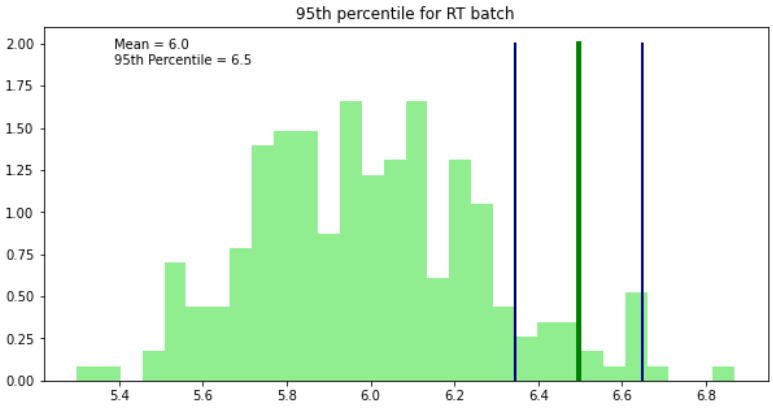
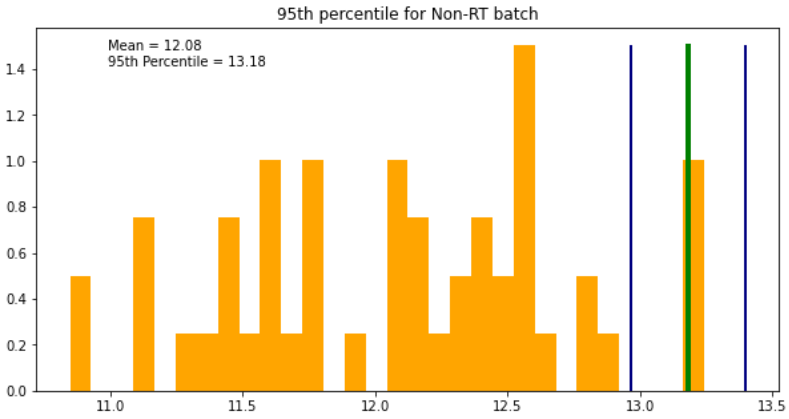
Inter-arrival time of Non-RT message = 30











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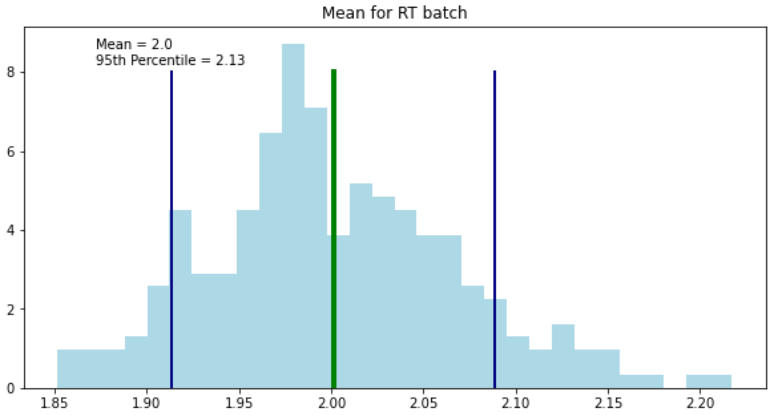
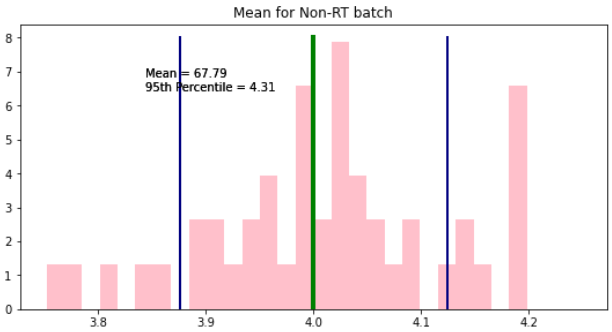
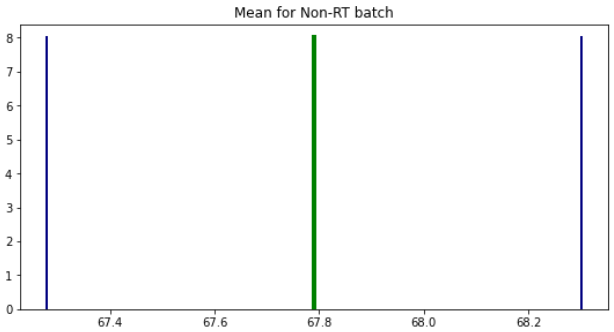
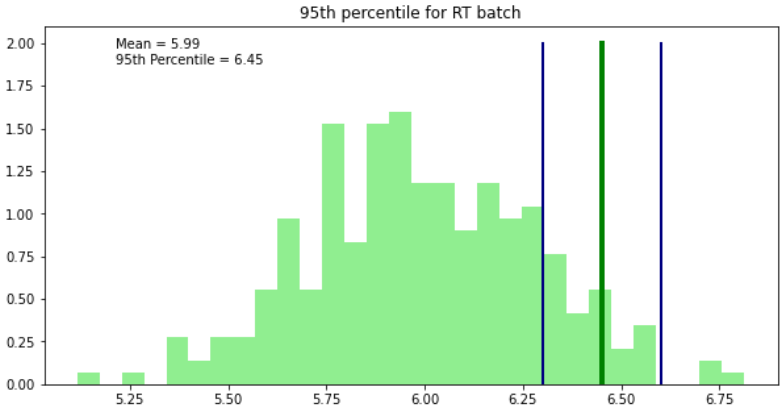
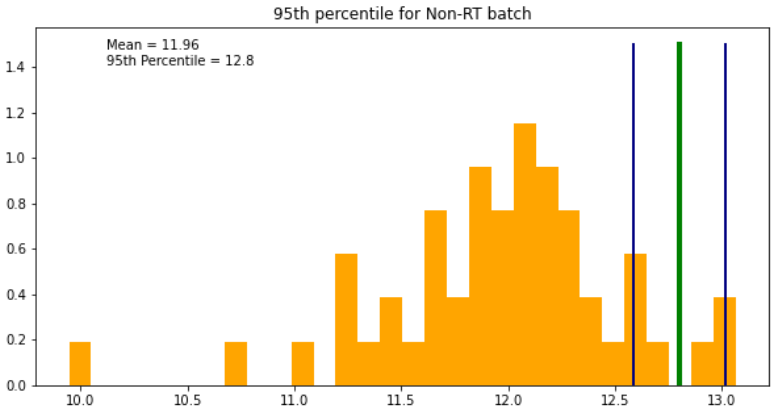
Inter-arrival time of Non-RT message = 35











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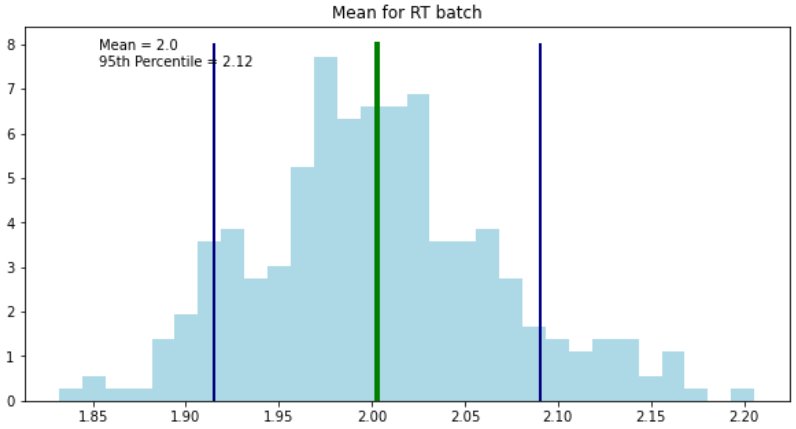
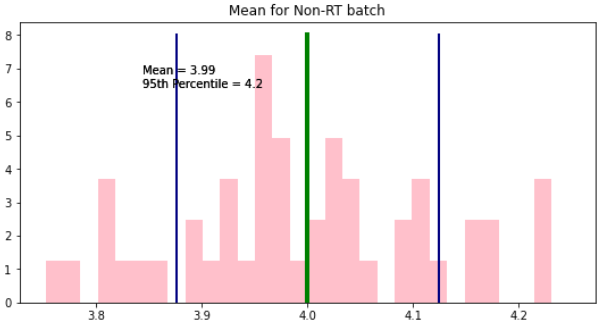
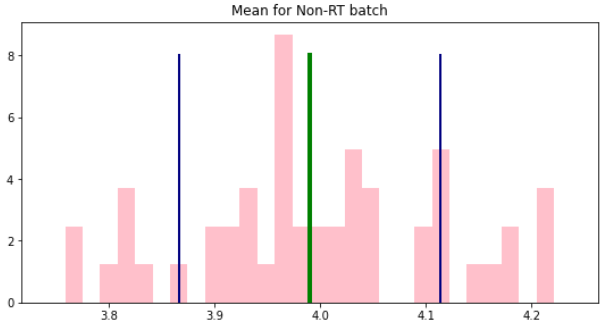
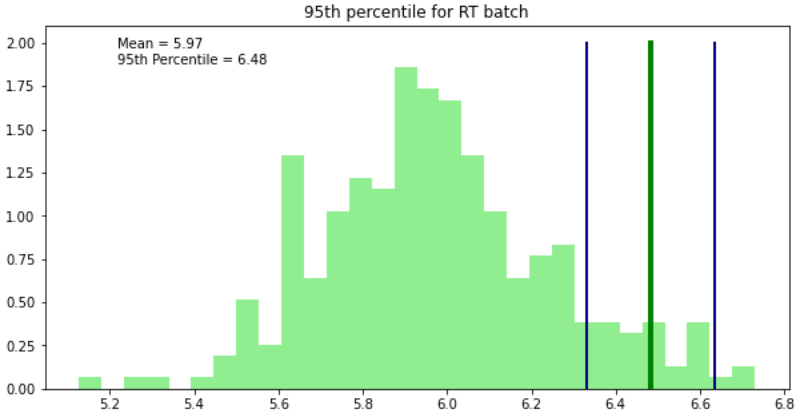
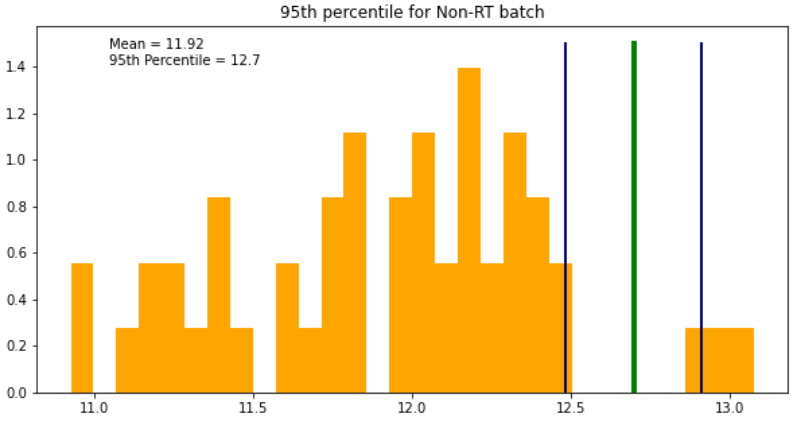
Inter-arrival time of Non-RT message = 40











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Analysis of generated graphs

3.1 summary of Mean service times for RT and non-RT

As for RT messages, they have a very small service time and tend to get immediately processed as and when a new RT-message arrives. Even after randomizing the mean service time, we notice that due to its prompt processing the mean value of the batches seemed to lie at 2.0 or very close to 2.0 depicting that the Real time messages are immediately being processed.

As for non-RT messages, we notice a trend. Initially when the non RT messages had a mean inter-arrival time of 10, there were a lot of messages put into the queue when a RT message arrived. However, when we increase the inter-arrival time of non-real time messages, lesser and lesser messages get added back to the queue making the mean service time lesser.
Initially the mean service time was about 446.74 seconds. With increase in the inter-arrival time we notice the trend of the mean value becoming 243.82 and finally almost 4.0

3.1 summary of 95th percentile for RT and non-RT

There is a different trend we notice when it comes to the 95th percentile value.

For both RT messages and non-RT messages, the value for 95th percentile does not vary too much. It remains around 6.5 for RT messages and 12.9 for non-RT messages when the mean service times are 2 and 4 respectively. We could say this could be a value to base our outcomes for different simulations because this tends to vary less from one simulation to another.

Furthermore, we also notice that most of the graphs generated follow a normal distribution where most of the service times for both RT and non-RT closer to the value input by the user.

Finally, we also can conclude that such simulations are better understood when graphing the data points to understand trends and patterns in them.

References:

CI: https://towardsdatascience.com/illustration-with-python-confidence-interval-ee4736cc3dc2