SIE 431 - Simulation Modeling and Analysis
Fall 2018
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Homework 4

4-10 Models

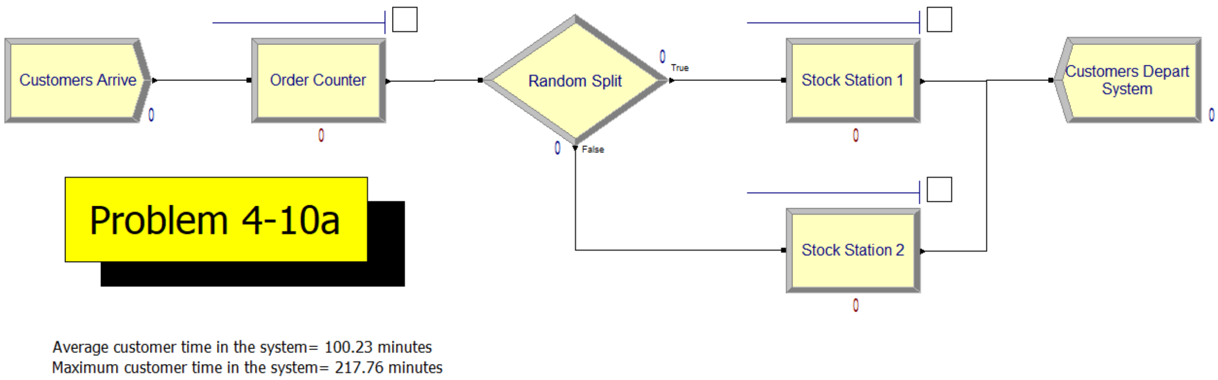

Figure 1. Model with assigned servers for the Stock Stations

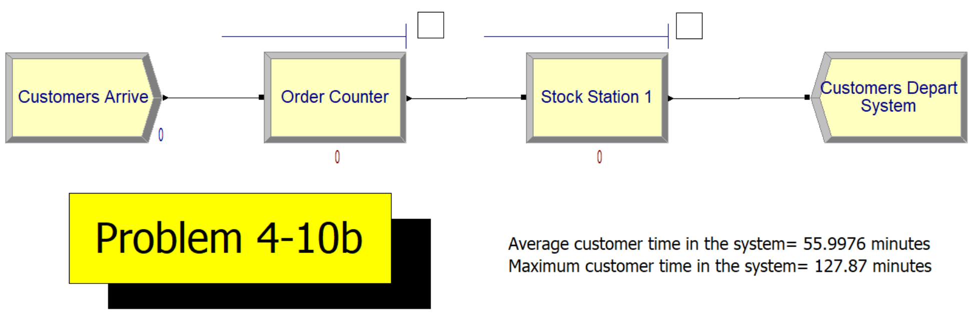

Figure 2. Model with a single FIFO queue for the Stock Station

4-10 Summary

The two models (Figures 1 and 2) show the difference between a customer waiting for a specific server and a customer waiting for the next available server. The results from the simulations show that switching to the single queue for both servers significantly reduces the time. The average time in the system goes from 100.23 minutes to 55.9976 minutes and the maximum time that a customer had to wait was from 217.76 minutes to 127.87 minutes.

4-17 Models

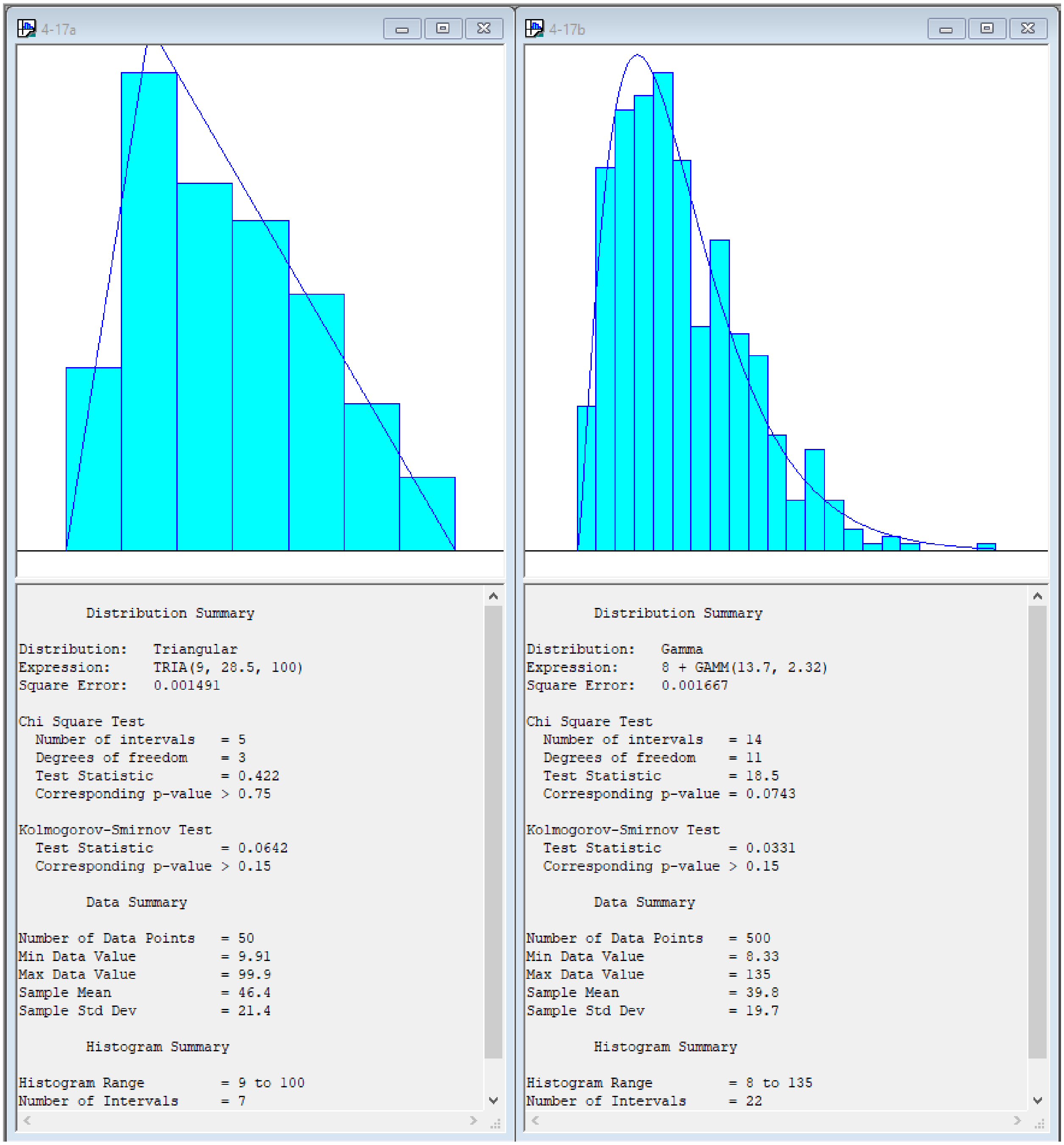

Figure 3. Best fit for Erlang distributed data with 50 and 500 data points

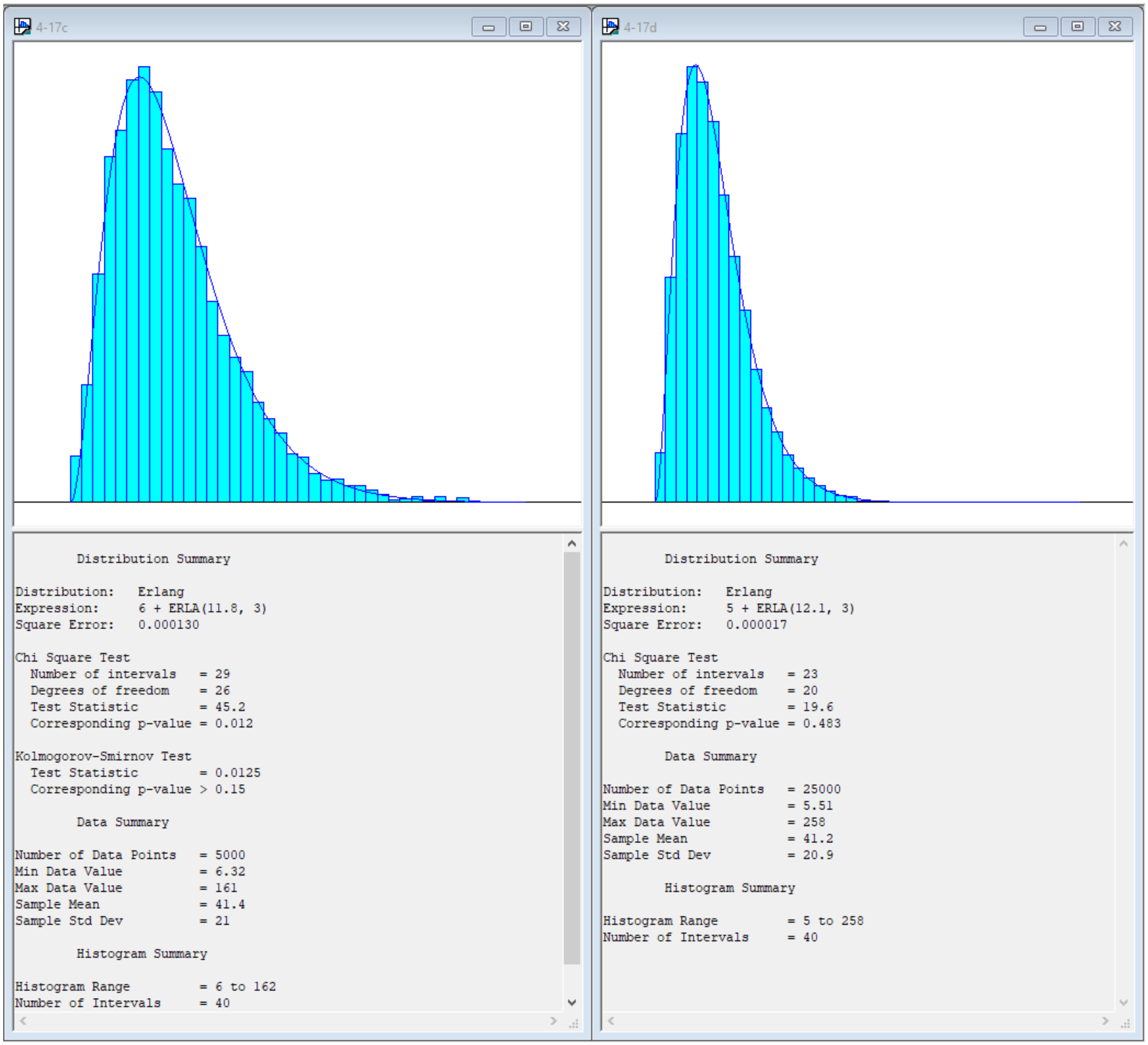

Figure 4. Best fit for Erlang distributed data with 5,000 and 25,000 data points

<u>4-17 Summary</u>

Each chart represents data sampled from a 5 + Erlang(12, 3) distribution. The charts vary in the number of data points pulled from that distribution (50, 500, 5000 and 25000). From there, the best fit distribution was applied to each data sample to describe the data. The results from this experiment was that the best fit distribution got closer to the true distribution as more data points were used. The results were: TRIA(9, 28.5, 100) for 50 data points, 8 + GAMM(13.7, 2.32) for 500 data points, 6 + ERLA(11.8, 3) for 5,000 data points and 5 + ERLA(12.1, 3) for 25,000 data points. The results also show that the best fit lines are getting closer to the true distribution from looking at the square error. As the number of data points increases, there is less error between the data and the best fit line. The results were: 0.001491 for 50 data points, 0.001667 for 500 data points, 0.00013 for 5,000 data points and 0.000017 for 25,000 data points.

4-18 Model

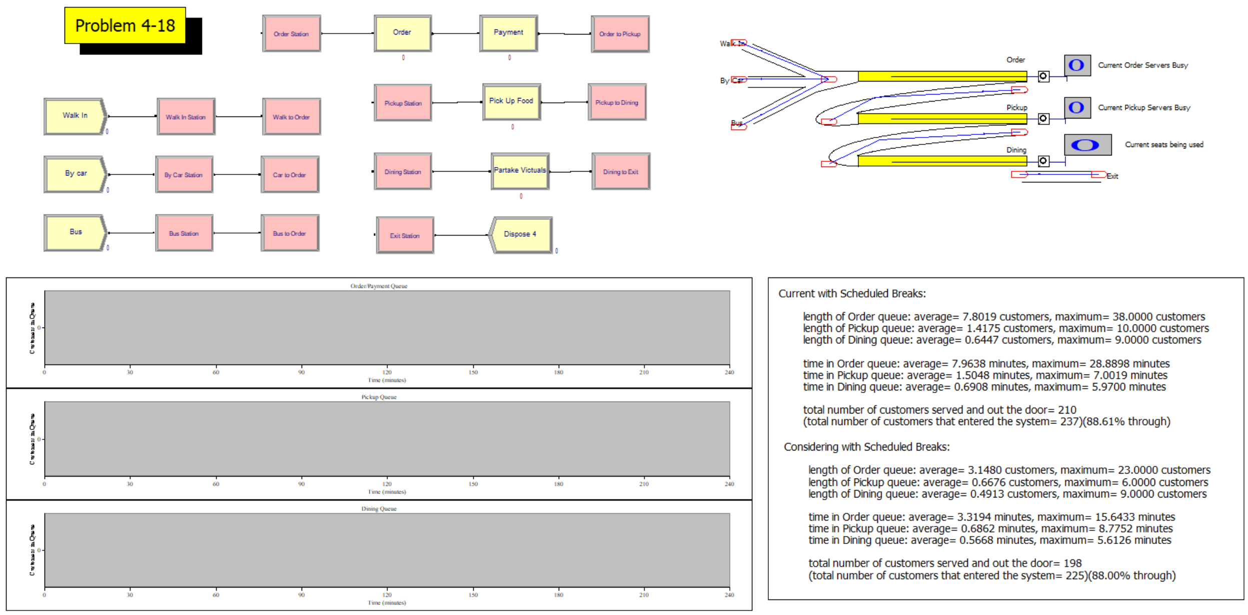

Figure 5. Final model for the restaurant from 10 am to 2 pm

4-18 Summary

This simulation models a restaurant from 10 am to 2 pm. It takes into account three different methods of customer arrival (walk-ins, by car, by bus). After arriving, the customers go through the order/payment station, then the food pickup station, then they sit and eat and finally exit the restaurant. Two different sets of schedules were run to test how changing the capacity would affect the system. The results show that there is a decrease in each of the queue lengths and times when the schedule was shifted to be more concentrated during the peak hours (see Figure 5). Although the customers waited less in each queue with this change, the total number of customers that was served did not show a significant change. Also, with the current schedule there only needs to be a total of 8 servers at any time during that period, but the new schedule requires a total of 4 for the first hour, then 12 for the next two hours, then 4 for the last hour. My advice is to remain with the current schedule. Even though there is a significant improvement for the average queues, this can be misleading because it does not take into account the variance or the shape of the distribution. What I think matters more is the overall efficiency of the system and these results show that there is not much of a difference in the total number of people that exit the system. Also, because of the difference in the number of servers, it would probably be harder to convince some people to only work during the 2 peak hours.