Animation, Simio Tables, and External Data Sources

In this lab we will discuss some of the basic animation features in Simio using a simple single-server model developed in the first module of the video lab series. We will also discuss Simio *Data Table*, *Sequence Table*, *Rate Table*, *Work Schedules*, and *Arrival Table* in the context of the Subway® restaurant example that we have seen in previous labs. The system operates similar to a serial production line with five stages as shown in the figure below (the highlighted stations involve a human worker).

Customers enter and go to the first stage where they select the size and type of bread, meat, and cheese. The second stage is the oven where sandwiches get toasted (if ordered by the customer). The customer (and partially made sandwich) then go to the next stage to add veggies and condiments. Once the sandwich is made, the customer pays at the cash register, the cashier wraps the sandwich and puts it in a bag. Finally, customers go to the drink machine to get their drink and then they leave the system. Each stage has one server and we will assume infinite queues between stages.

The restaurant operates from 7:00 a.m. to 1:00 a.m. (18 operating hours) and serves 576 customers per day on average resulting in an average arrival rate of 32 customers per hour. However, the arrival rate is not constant during the day with peaks during lunch rush and dinner rush (the arrival data are provided in the lab material). We do not consider balking in this model.

There are four types of customers based on what they purchase with the following distribution: toasted/hot sandwiches (60%), cold sandwiches (25%), drink only (10%), and cookies only (5%). Processing time and routing information are provided by the restaurant in an Excel file that can be found in the lab material. Moreover, "passing" is allowed, e.g., a customer that gets a cold sandwich can pass a customer that is waiting for his/her sandwich to be toasted at the oven. Similarly "Drink" and "Cookies" customers are allowed to pass those customers that are waiting at the Bread, Oven, and Veggies stations.

The videos will guide you through:

1. Basic Simio animation features

2. Creating related tables (a *Data Table* and a *Sequence Table*) to handle different routings and type-dependent processing times

3. Using a *Rate Table* to implement a non-stationary (time-varying) arrival process

4. Using *Work Schedules* to change the capacity of servers during the simulation run

5. Using an *Arrival Table* to specify customer arrival times to simulate a given arrival scenario

6. Binding Simio tables to external data sources, namely CSV and Excel files

Assignments

1. In this lab, you are assigned to watch and follow the steps that are performed in Module 4 of the Learning Simio Lab Series (developed by Dr. Jeffrey Smith) that is available at: http://jsmith.co/node/62. The lab involves different topics related to Simio animation. For the assignment portion of the lab, you should make a short video (1 minute maximum) of your animated model as it is running in 2D and 3D modes. *Be creative! Move around the model, rotate, zoom in, zoom out, etc. to show different animation features of your model.* You can either provide the video file in your submission or provide the link to the video in your report document. Your work will be evaluated based on both the quality of the video and the animation features used in the model.

2. Use the model of the Subway restaurant developed in Video 3 of this lab (the model with the *Rate Table* and *Work Schedules*) to find several "good" schedules that would result in the <u>maximum number in system</u> to be less than 16. Note that we would like to achieve this objective using "reasonable" allocations while finding the least costly allocation is not the goal in this assignment. Use 50 replications for each scenario. *Hint:* You will need to evaluate different possible work schedules for your servers (not just Bread and Veggies stations) and perform experiments to estimate maximum number in system for each work schedule. Use what you learned in *Lab 5* of this lab series and use *Referenced Properties* to define different work schedules in your Experiment table. Define a *Response* for the maximum number in system to be able to compare different scenarios.
    You should provide screenshots of the work schedules with referenced properties and also your experiment table in your report document.

Submission Requirements

The deliverables for the lab include the following:

1. A single word document that includes the "solutions" to the assignment problems, i.e., screenshots of your simulation models and their different components, tables/figures of simulation results (such as SMORE plots), analysis of simulation outputs/recommendations, description of your verification analysis (if applicable), and specific deliverables specified in the for the above problems. The report is the primary component of your submission that is graded and all other files (such as Excel or Simio models) are just supporting material so make sure your report document is complete by itself and do not simply refer the reader to other files in your submission.

2. All related Simio models developed as part of the assignments.

All of the files should be zipped together and submitted via Canvas. Make sure you do not submit any other file types such as ".rar".

If you work in a team of 2, make sure that you both submit the exact same zip file and indicate the name of your partner as a comment.