

Simio Referenced Properties and Scenario Comparison

In this lab we will revisit the Simio model of the Subway® restaurant that was developed in *Labs 2 and 4* and learn how to use *Referenced Properties* to facilitate comparison of multiple system configurations (scenarios) using a single *Experiment*. 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.

During lunch rush, customers arrive according to a Poisson distribution with a rate of 32/hr. However, customers will balk if there are 6 people in the system (all stages). Processing times are all triangularly distributed with the following parameters (minutes):

Station	Bread & Meat	Oven	Veggies	Cashier	Drink
(Min, Mode, Max)	(1, 1.5, 2)	(0.5, 1, 1.5)	(1, 1.5, 2)	(0.5, 1, 1.5)	(0.5, 1, 1.5)

Based on the data collected from the restaurant, 70% of the customers want their sandwich toasted while the remaining 30% get cold subs. The current operating policy requires that FIFO (First In First Out) must be maintained throughout the system. Therefore, cold sandwiches should also wait in the queue for the oven (if there is one). In other words, the current policy does not allow a customer that wants a cold sandwich to pass a customer that is waiting for his/her sandwich to be toasted.

The manager of this restaurant would like to reduce lost sales (i.e., balks) by investing in two additional “resources” (i.e., worker, oven, cash register, or drink machine) and has hired you to evaluate the performance of different capacity allocations under the current “No Passing” and the alternative policy that allows passing. Moreover, since the “balking process” is not deterministically known, your task is to also consider different balking thresholds. The performance measures of interest are the utilization of the servers, expected number of customers in the system, the time that customers spend in the system on average, percentage of customers that balk, and the average TIS per customer type.

The videos will guide you through:

1. Defining *Referenced Properties* (two methods)
2. Using *Controls* to define different scenarios for an experiment
3. Simultaneous comparison of scenarios using the resulting side-by-side SMORE plots

Assignments

In this lab, you are assigned to watch and follow the steps that are performed in the third module in the Learning Simio Lab Series (developed by Dr. Jeffrey Smith) that is available at: <http://jsmith.co/node/56>. The lab consists of developing a model of a serial manufacturing line in Simio. The topics covered in the lab include On-Event arrival mode, capacitated/finite buffers, Referenced Properties for conducting experiments, and different types of dynamic plots.

Your task is to build the Simio model of the original serial manufacturing line discussed in the first three videos. Your model should use symbols and implement the logic to change them. Your model should also use On-Event arrival mode, capacitated buffers, responses, referenced properties, the dynamic plots discussed in video 3, and parts 1 and 2 of the assignment (*note that you do not need to perform parts 3-5 of the assignment*).

In your report document, you should provide the SMORE plots for the responses defined in part 1 and screenshots of the model (the facility view as the model is running) showing the status plots discussed in part 2 of the assignment.

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), etc. 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.