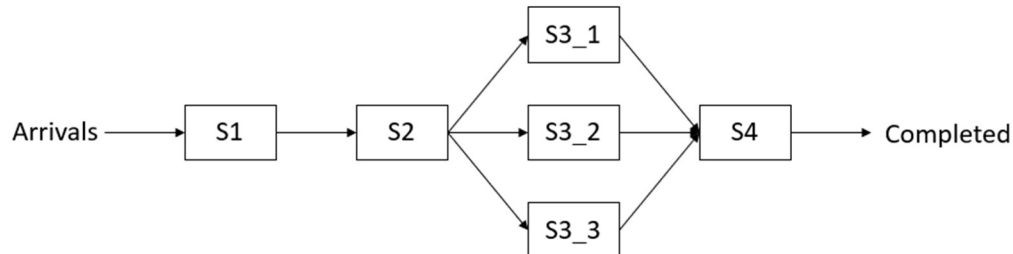# Case Study 01:
Simio Refresher – 4-station Serial Production Line

Consider the 4-station serial production line illustrated below.

Assume parts arrive randomly at the rate of 21 per hour and that the mean processing times for S1, S2, S3, and S4 are 2.47 minutes, 2.53 minutes, 8.09 minutes, and 2.38 minutes, respectively. Assume that the interarrival and processing times are exponentially distributed unless otherwise specified.

1. Baseline Model – Create a Simio model of this system using Server objects for the processing stations. For the parallel stations (S3), use a single Server object with capacity 3. Create an experiment assuming that we are interested in the steady-state performance of the system. Create experimental responses for the average number of parts in the system (L), the average time (in minutes) that a part spends in the system (W) and the utilizations of the four servers (ρ_1, ρ_2, ρ_3, and ρ_4).

2. Create a queueing network model and use this model to verify the baseline Simio model (as with the baseline Simio model, use a single $M/M/3$ server station 3). You can create this model by hand or using any software that you would like. Using the queueing network results, explain how you determined the experimental conditions for question 1 (replication length, warm-up period, number of replications).

3. ParallelA – Create a second Simio model (in the same Simio project) where the parallel stations (S3) are implemented using three Server objects. Note that the easiest way to start this model is to duplicate the baseline model (right-click on the baseline model in the Navigation window and select "Duplicate Model" – as illustrated in Video Module 01) and then make the necessary changes. The selection of individual Servers for the S3 station should be done randomly. Compare the queueing results with those of the baseline model and discuss any differences.

4. ParallelB – Create a third Simio model based on ParallelA except in this model, use AssociatedStation.Overload function with a node list to select the "best" server based on the current model state (as illustrated in Model 5-3 of the *Simio and Simulation* book). Compare the queueing results with those of the baseline and ParallelA models and discuss any differences.

5. ArrivalTable – Create a fourth Simio model based on ParallelB except in this model, part arrivals should be created using an Arrival Table. The table should include columns for the arrival time and the four station processing times (see below) for each arriving part.

The table should be bound to csv file "arrivals.csv" (provided as part of the assignment) and the import options should be set to "Manual." Using this model, generate the Resource Plan and Entity Workflow Gantt charts in the Planning tab (remember that you will need to turn interactive logging on from the Advanced Options button of the Run Ribbon and set the Log Resource Usage property to True for all the Server object instances). Set the run length to Indefinite so that the run will terminate when the last part in the arrival table is completed.

The deliverables for this case study include:

1. The Simio project file containing the four Simio models.
2. A Word/pdf file including the queueing network model results, the verification and experimental conditions explanation, and the model comparison discussions.
3. The queueing network model if you used Excel or another software tool.

All the deliverables should be zipped together and submitted on Canvas.