Problem 11
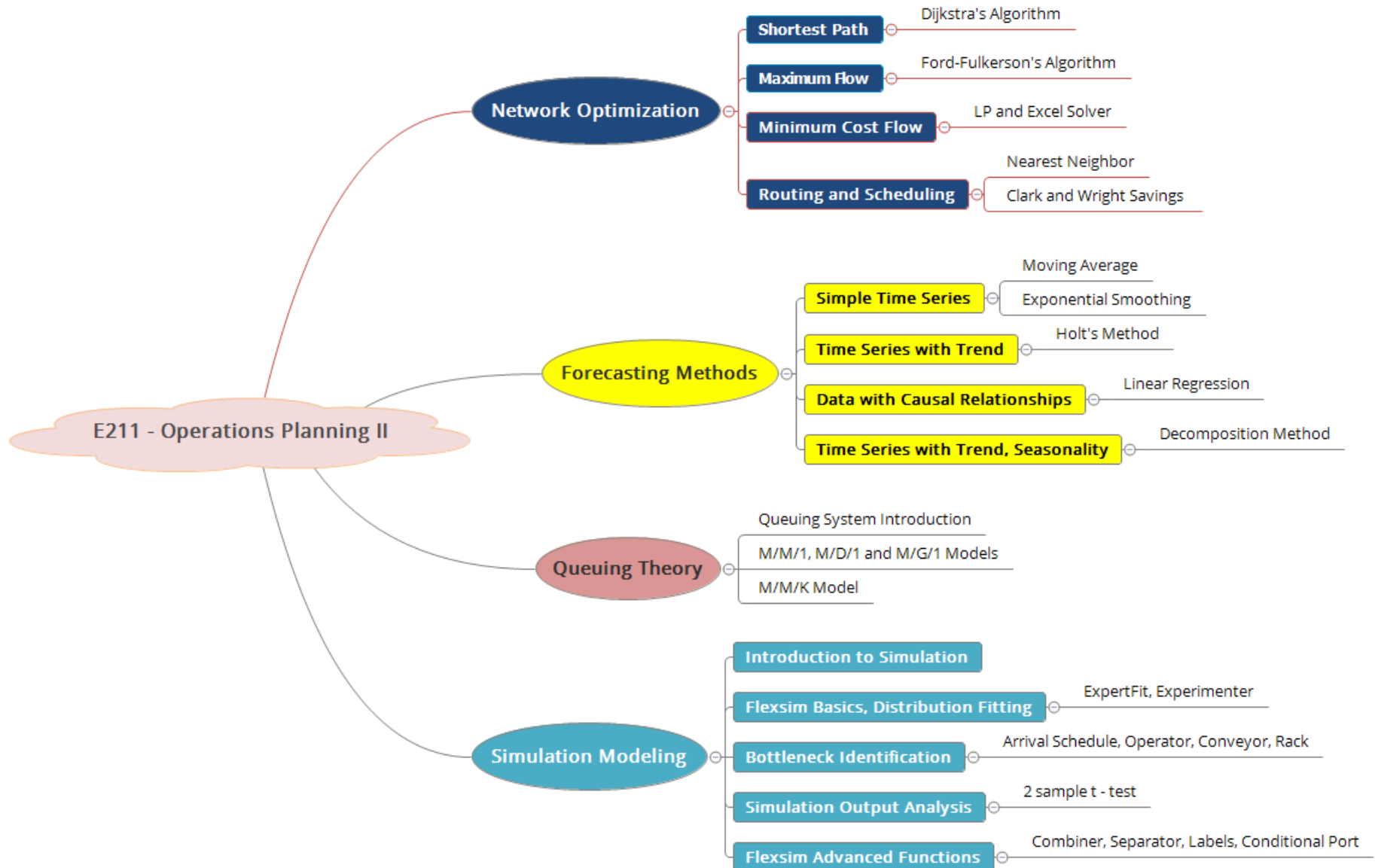## Is the Service Good?
E211 – Operations Planning II

Module Coverage: E211 Topic Tree

# Recap on Flexsim Basics: Keys for Connecting Ports

- ## "A" key
  - ➢ Connects object 1 output port to object 2 input port

- ## "Q" key
  - ➢ Disconnects object 1 output port to object 2 input port

- ## "S" key
  - ➢ Connects object 1 center port to object 2 center port

- ## "W" key
  - ➢ Disconnects object 1 center port to object 2 center port
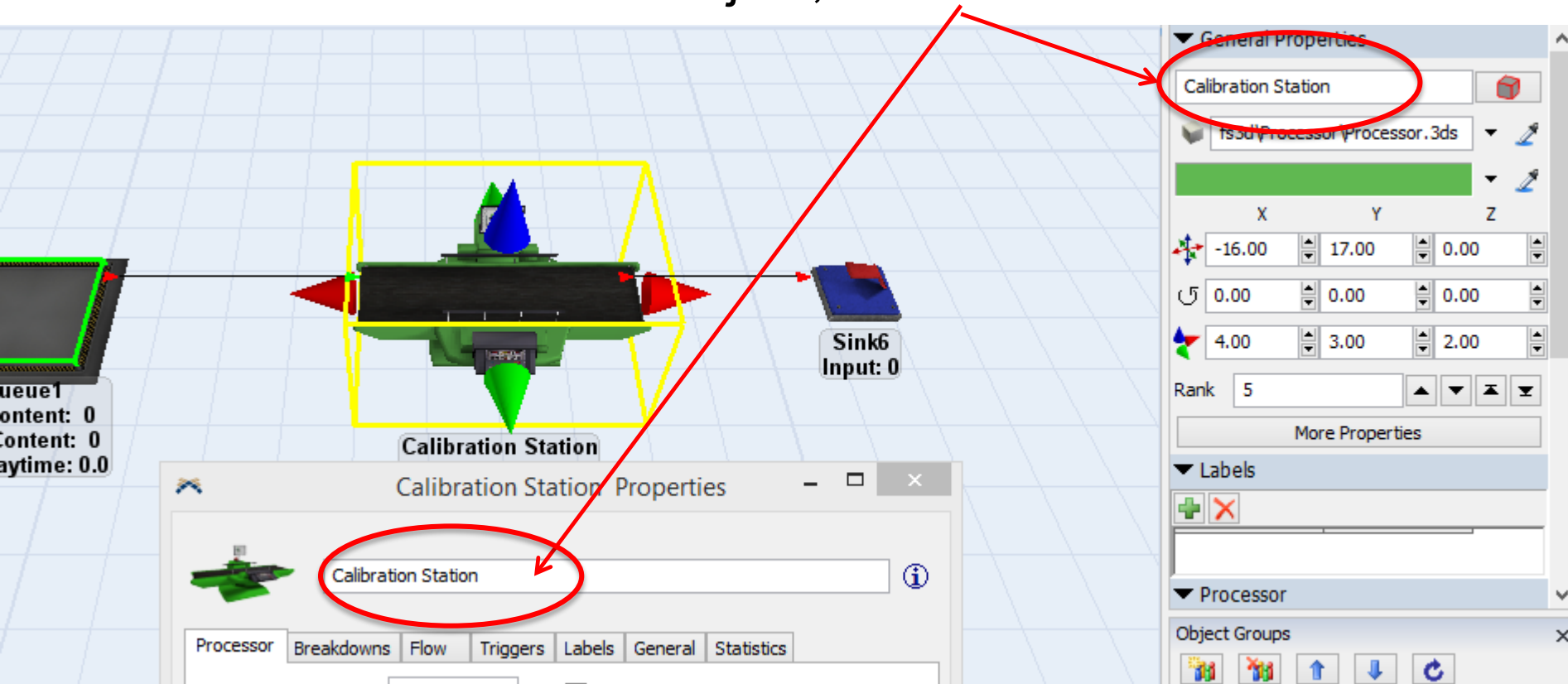
Recap on Flexsim Basics: Port Connections

- Output ports are shown on the upper right of the object

- Input ports are shown on the upper left of the object

- Center ports are shown on the bottom center of the object
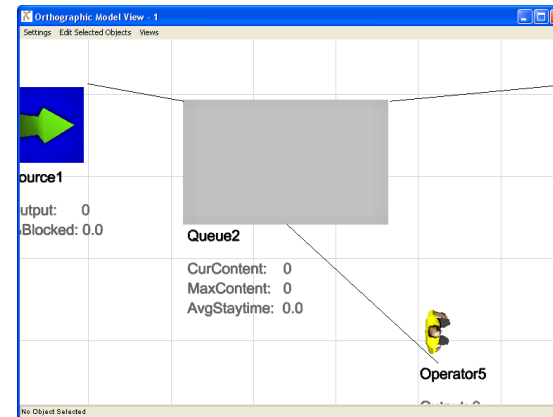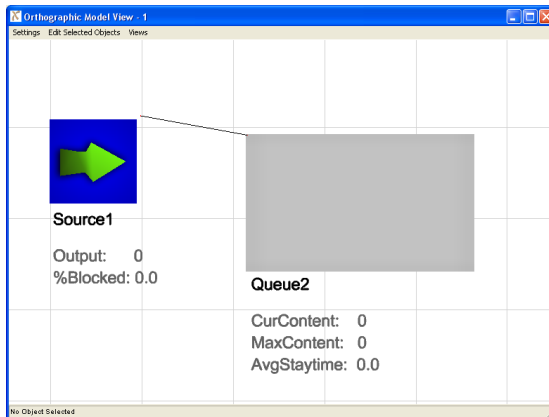
- Double click on the object, and edit in the field.

- or click on the object to edit using "Quick Properties" window.

- Double click on the object

- Double click on the object

Recap on Using ExpertFit to Fit Distributions to Given Data Sets

- Copy the data in Excel (make sure it is in "copy mode" with dashed line)
- Go to 'Flexsim>Statistics>ExpertFit';
- Click new>OK>Analyse>Enter Data
- Click "Enter/Edit Data values">"Apply"
- "Paste at end from Clipboard"(Make sure step a) is completed); "Done"
- Click "Models">"Automated Fitting" function to find the most appropriate distribution.
- Click "Comparisons", Conduct "Goodness-of-Fit Test (select the Anderson-Darling Test)" to see how well the distribution fits your data.
- Note down (or do a printscreen of) the distribution type and the parameters for your setup time distribution.

# A Two-stage Service System (Scenario for Exercises 1 to 6)

Customers dine at the food stall need to go through a two-stage queuing system.

- Stage 1: Order taking (including simple food preparation)
- Stage 2: Payment

During peak hours, from 11:30am to 2:00pm, on average, 100 customers will patronize the stall. Customers would generally turn away if the queue at order taking is already very long (8 people). Evaluate the service level at the food stall through simulation modeling and analysis.

Exercise 1: Process Map
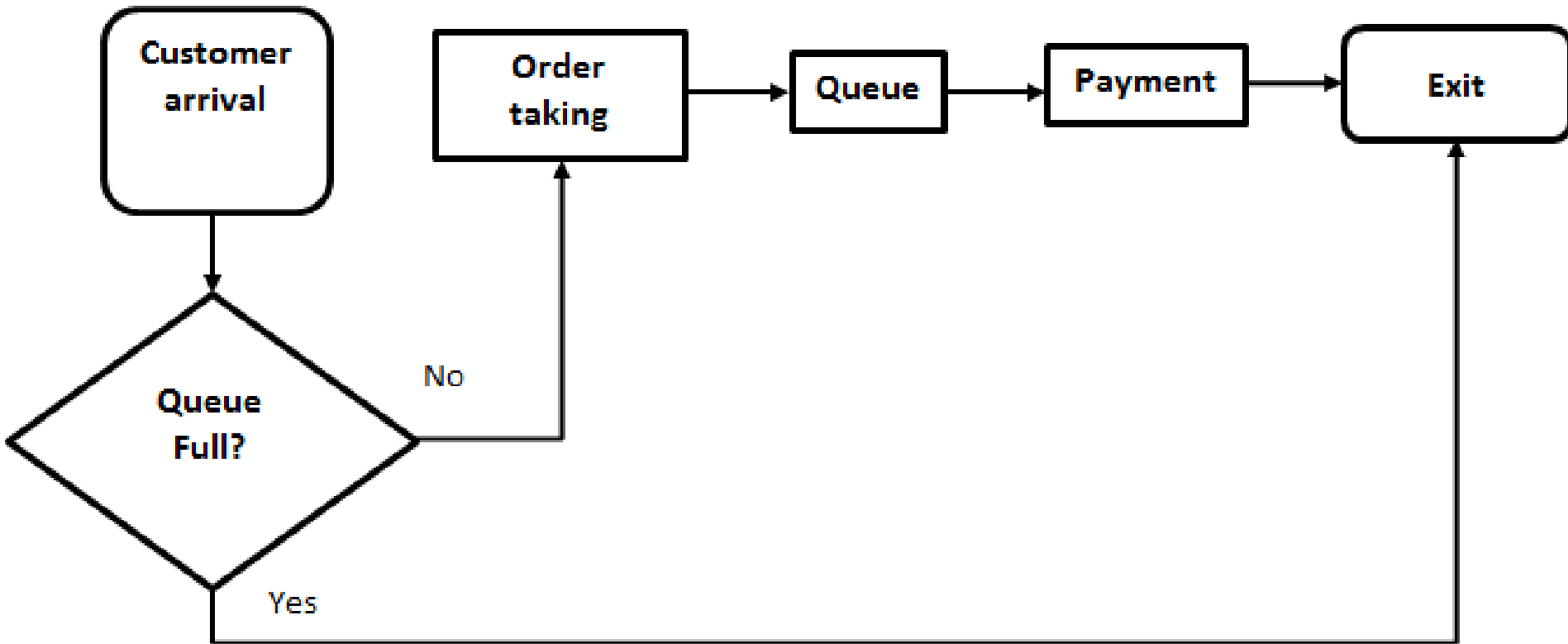
Exercise 2: Construct the Simulation Model

- Source (to generate arrival of customers)
- Queue (holding area for customers; one for each processor)
- Processor (order taking and payment)
- Sink (linking to payment processor) for normal customers to 'exit
- Sink (linking to source) for customers who turn away from the stall to exit.
- Use 'A' key to link objects (in direction of item flow).
- 1 Queue for each process step. This is to ensure that upstream activities are not 'blocked' by slower downstream activities.
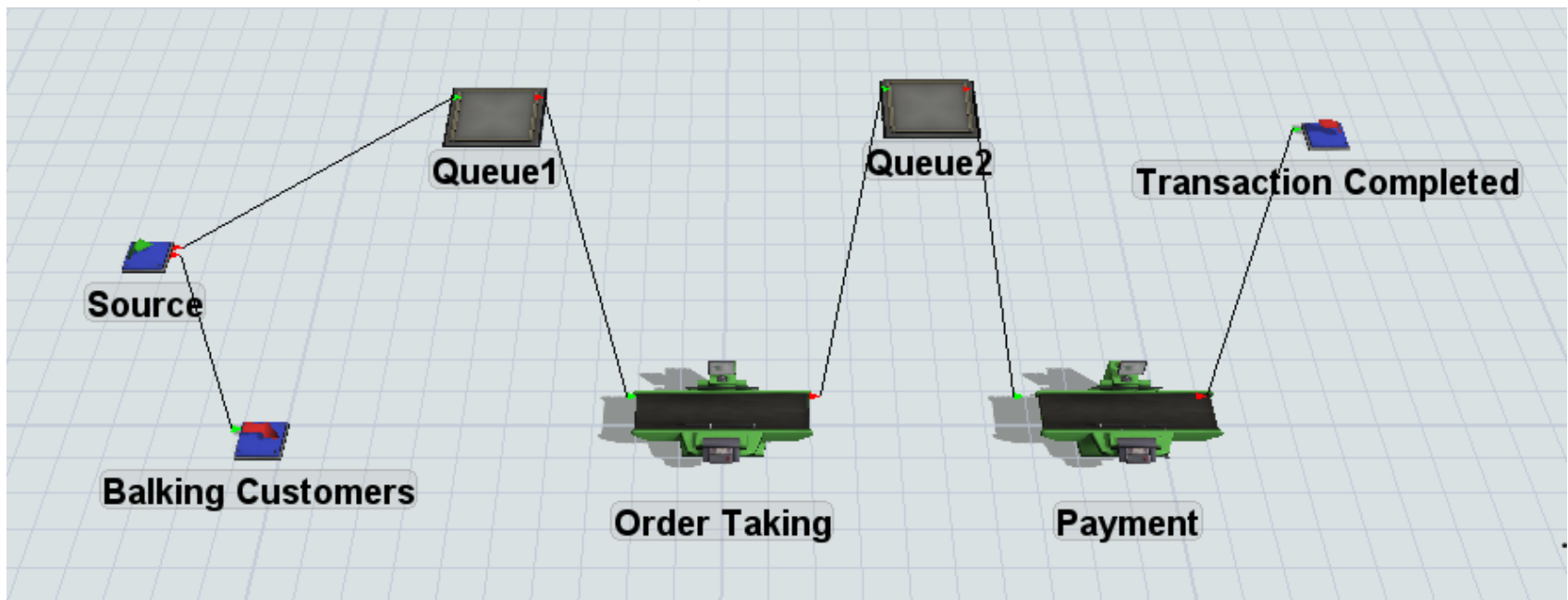
Exercise 2: Construct the Simulation Model
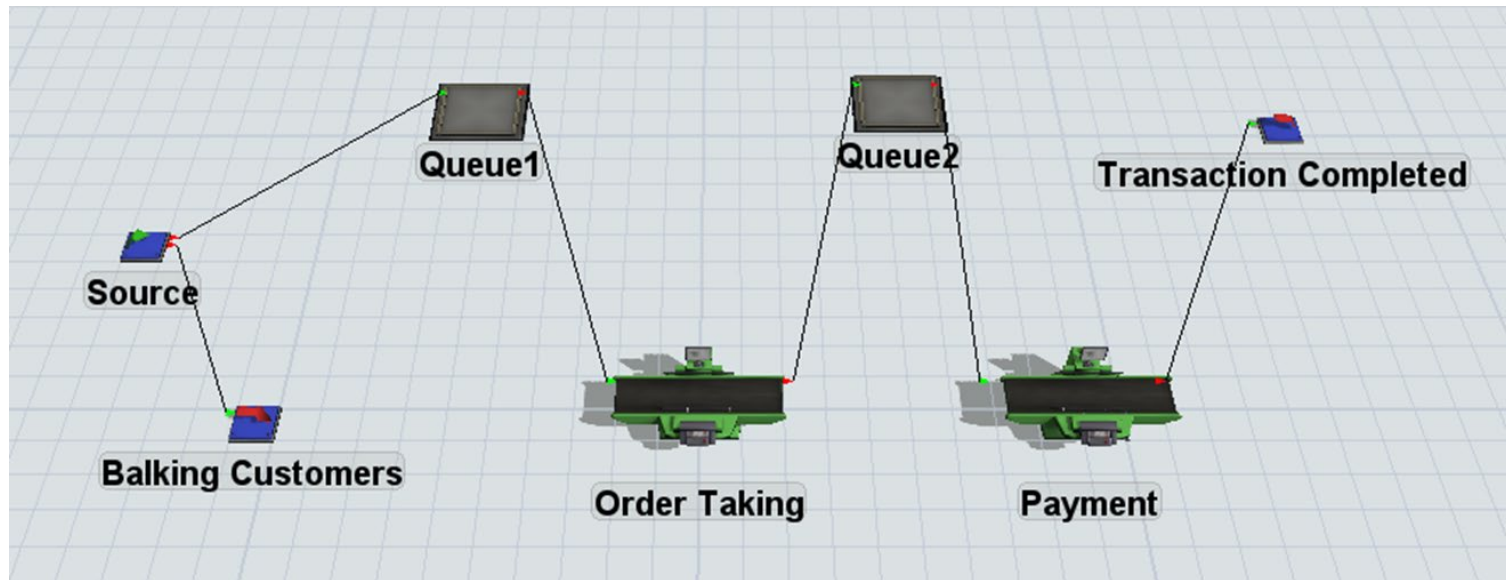
- **<u>Source:</u>** The inter-arrival time of customers is assumed to follow exponential distribution with mean inter-arrival time of 150/100 minute.
- **<u>Queu1:</u>** Customers would leave if the queue before Order Taking is too long.
  - ✓ **<u>Balking behavior</u>** – assume customer would leave if there are already 8 customers in the queue before Order Taking.
- **<u>Order Taking and Payment:</u>** The entire process is modeled as a multi-stage single server service system.
  - ✓ 2 stages each with different service timings.
- The **<u>queue buffer</u>** between stages (activities).
  - ✓ Maximum queue size for Queue1: 8
  - ✓ Maximum queue size for Queue 2: default value (1000)

Exercise 3: Set the Parameters

Using ExpertFit to determine the distribution for Order Taking data

Gamma distribution best represents Order Taking timings.

Parameters of the recommended distribution.

Goodness-of-fit test indicates that there is no strong evidence to reject the null hypothesis. The data set follows Gamma Distribution with the given parameters.

Exercise 3: Set the Parameters

Adopt Triangular Distribution for the Payment data. Parameters required are: Min, Max and Mode
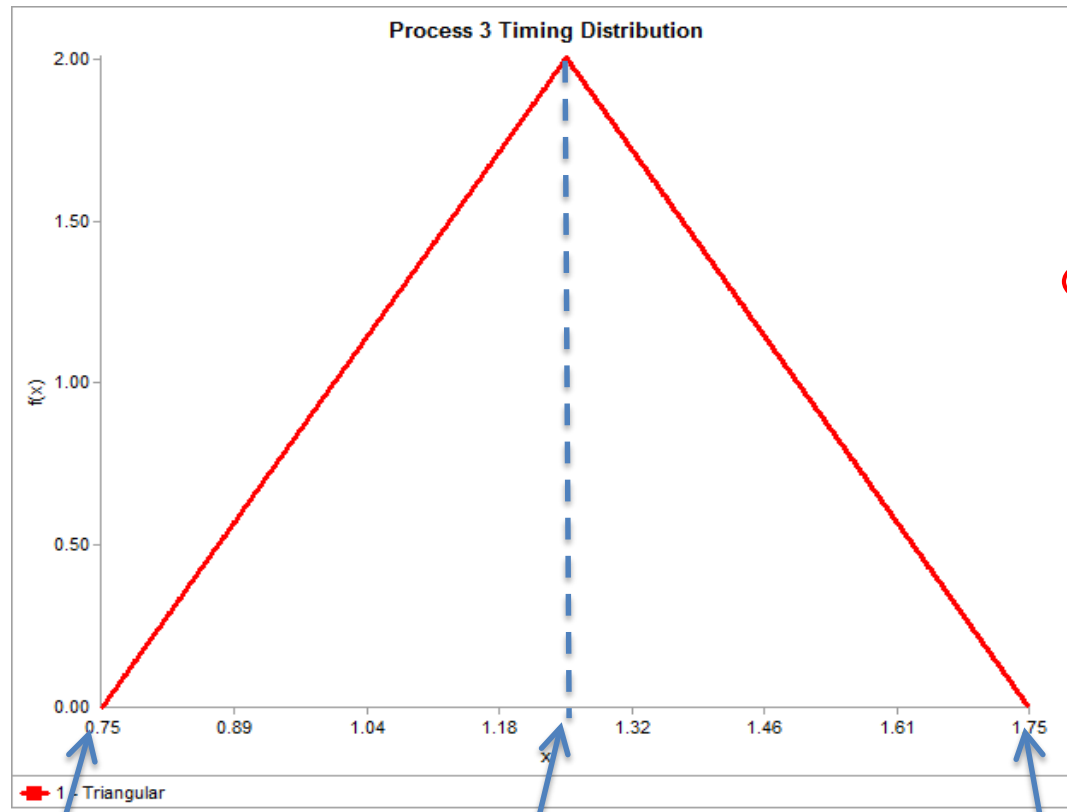
Minimum value

Most-likely (mode)

Maximum value

In our case, the Payment data follows a triangular distribution with:
minimum = 1.0 minute, most-likely = 1.5 minutes and maximum = 2.5 minutes