# EXERCISES

**EXERCISE 1**

Build in JMT a simple open queuing system with a single queue, a source, a sink and a single class.

Assign a deterministic service time distribution with a parameter you like.

Assign the arrival distribution as:

1) A deterministic distribution;
2) An exponentially distributed interarrival times distribution;
3) A hyperexponentially distributed interarrival times distribution;
4) A hypoexponentially distributed interarrival times distribution;
5) An Erlang distributed interarrival times distribution;
6) A Markov Modulated Poisson Process

with proper parameters so that the queue is stable in each case and parameters give the same average interarrival time.

Perform for each case a what-if analysis in the same parameter range, so that results may be compared, evaluating all metrics on the queue.

By using a spreadsheet, copy what-if results of all cases, one metric per spreadsheet, from the results screen (use the spreadsheet-like part of the dialog) and plot in a single diagram all the graphs to superpose and compare all the what-if results for all distributions.

What do you observe?

[hint 1: in order to have a readable and significant plot, omit the stability point, to exclude the effect of the explosion of the response time]

[hint 2: to have a reference case, check “A closer look to queues” from materials on the web site]

**EXERCISE 2**

Using JMT, given a parameter *a*, tell what system is faster between three alternative implementations that can be modeled as:

1) A M/M/1 queue with service rate 2a;
2) A M/M/2 queue with service rate a;
3) 2 M/M/1 queues with service rate a with a single source and random routing (use the *router* JMT element to connect the source to the queues or connect them directly with ).

Perform a what-if analysis on each case with significant parameters of your choice on the metrics and compare all the cases by plotting them together by using spreadsheets, as seen for the previous exercise.

In particular, consider stability ranges, throughputs, utilizations and response times.

What do you observe?

Consider the implementation with 2 queues and use a round robin routing instead of a random routing. What do you observe? Why?

Consider the implementation with 2 queues and use a join the shortest queue routing. What do you observe? Why?

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Build in JMT a simple open queuing system with a single queue, a source, a sink and a single class.

Assign a exponentially distributed interarrival times distribution with a parameter you like.

Assign the service times distribution as:

1) A deterministic distribution;
2) An exponentially distributed service times distribution;
3) A hyperexponentially distributed service times distribution;
4) A hypoexponentially distributed service times distribution;
5) An Erlang distributed service times distribution;
6) A Markov Modulated Poisson Process service distribution

with proper parameters so that the queue is stable in each case. Are all cases viable/significant?

Compare the results. Check the advanced index function of JMT: what do you observe for the different cases? Why?