Exercise 2:

There is a multiplexer that is capable of handling message service in bulk. Assume that the inter-arrival times are exponentially distributed with mean 5 min, and that service times are exponentially distributed with mean 4 min. The multiplexer has 2 stations for service.
Find the average number of messages in the multiplexer.

Solution:

The model for this bulk-service problem is of the type $M/M^{[K]}/1$. The parameters are $\lambda = 1/(5\text{min}) = 12/\text{hour}$, $\mu = 1/(4\text{ min}) = 15/\text{hour}$, and $K = 2$. The operator equation for the multiplexer is therefore,

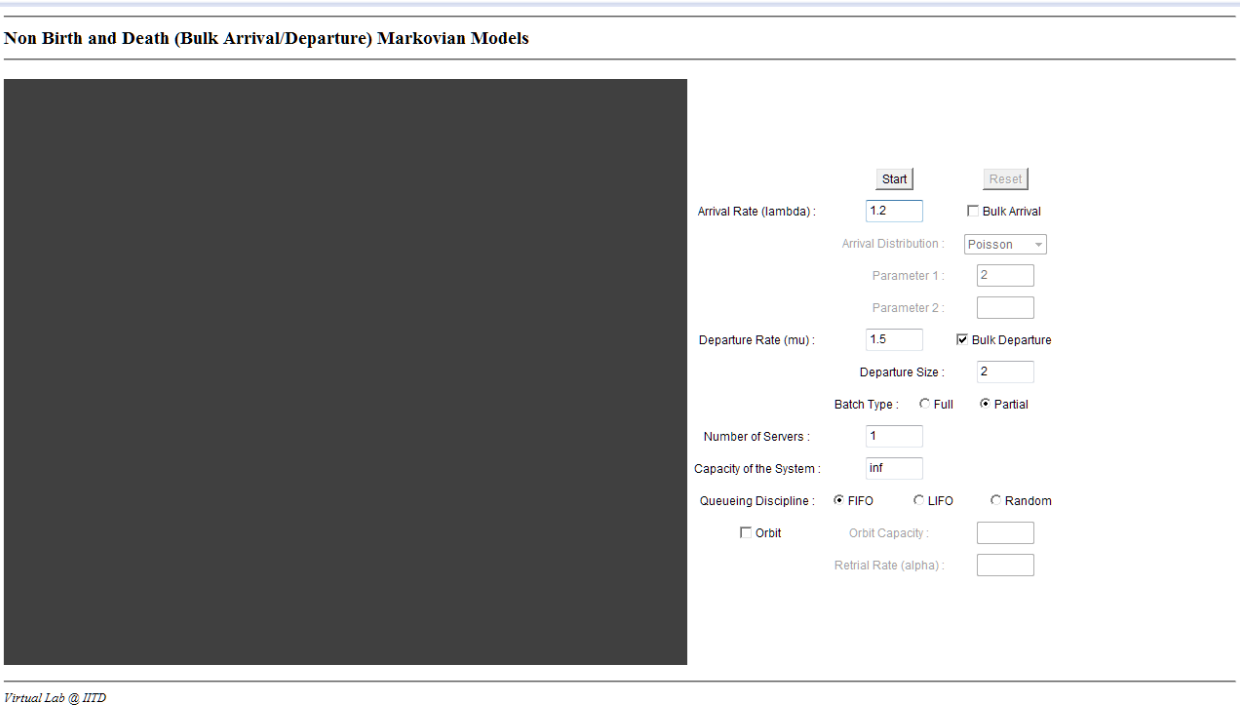
$$15r^3 - 27r + 12 = 0$$

The roots are 1, .525, and -1.525.
We select the positive root with absolute value less than 1, i.e. the second one. Thus, $r = 0.525$. Therefore,

$L = 0.525/(1-0.219) = 1.105$ messages.

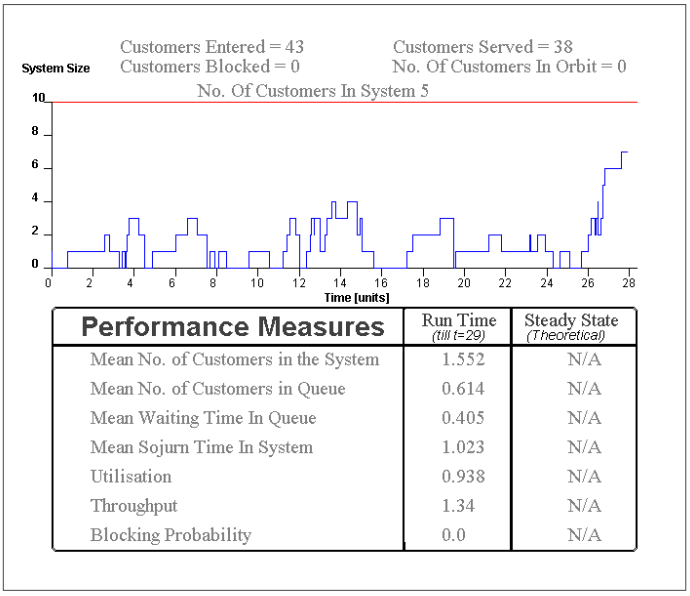
For a simulation of the multiplexer, perform the following steps:

→ Open the page where the simulation is to be performed.
→ Next feed the data as shown.



→ Click Start. The applet will now generate a sample path for the queue.

Non Birth and Death (Bulk Arrival/Departure) Markovian Models



Performance Measures	Run Time (till t=29)	Steady State (Theoretical)
Mean No. of Customers in the System	1.552	N/A
Mean No. of Customers in Queue	0.614	N/A
Mean Waiting Time In Queue	0.405	N/A
Mean Sojurn Time In System	1.023	N/A
Utilisation	0.938	N/A
Throughput	1.34	N/A
Blocking Probability	0.0	N/A