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CSC/ECE 576 - Simulation Project:

OUTPUTS AND OBSERVATIONS

Objectives

In this project, you will develop a simulation model of the flow of SIP messages as they go through a P-CSCF, an S-CSCF, and an application server (AS), with a view to estimating the 95th percentile of the end-to-end delay.

Operating System

Windows 8.1

Language used:

Python 2.7

Version: Anaconda Python

(A full Python distribution for data management, analysis and visualization of large data sets)

Download reference:

https://www.python.org/download/

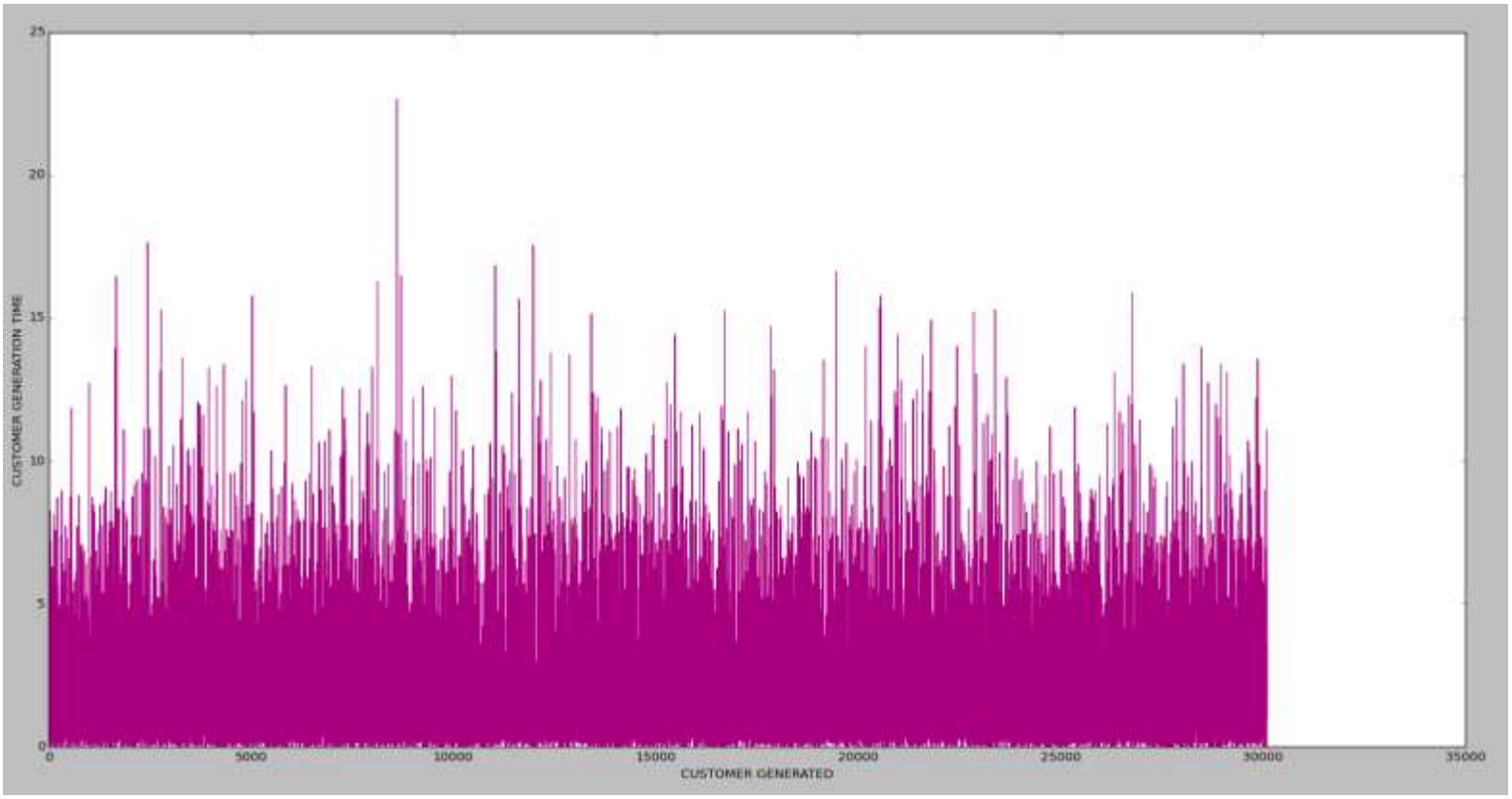
OBSERVATION TABLE

	INPUT		OUTPUT
RUN 1 for Lambda 0.5	Arrival rate (Lambda),0.5		Mean of end-to-end delay without using batch means : 1.26739767442
	Mean service time 1/μP (sec),0.1		95th percentile without using batch means : 2.72
	Mean service time 1/μS (sec),0.2		Mean of end-to-end delay using batch means : 2.7106
	Mean service time 1/μAS (sec),0.5		95th percentile using batch means : 3.13055
	Total number of departures,30100		Standard deviation of the percentiles 0.231956321319
	The number of batches,100		My confidence interval using batch means : [2.6843516712672262, 2.7368483287323624]
RUN 2 for Lambda 1	Arrival rate (Lambda),1		Mean of end-to-end delay without using batch means : 1.80940498339
	Mean service time 1/μP (sec),0.1		95th percentile without using batch means : 4.02
	Mean service time 1/μS (sec),0.2		Mean of end-to-end delay using batch means : 4.046705
	Mean service time 1/μAS (sec),0.5		95th percentile using batch means : 5.614
	Total number of departures,30100		Standard deviation of the percentiles 0.820365400584
	The number of batches,100		My confidence interval using batch means : [3.9538719157673343, 4.1395380842328651]
RUN 3 for Lambda 1.5	Arrival rate (Lambda),1.5		Mean of end-to-end delay without using batch means: 3.2309282392
	Mean service time 1/μP (sec),0.1		95th percentile without using batch means: 7.64
	Mean service time 1/μS (sec),0.2		Mean of end-to-end delay using batch means 7.02607
	Mean service time 1/μAS (sec),0.5		95th percentile using batch means 12.3424
	Total number of departures,30100		Standard deviation of the percentiles 2.56766953288
	The number of batches,100		My confidence interval using batch means [6.7355108395838474, 7.316629160416074]
RUN 4 for Lambda 2	Arrival rate (Lambda),2		Mean of end-to-end delay without using batch means : 116.609015165
	Mean service time 1/μP (sec),0.1		95th percentile without using batch means : 189.48
	Mean service time 1/μS (sec),0.2		Mean of end-to-end delay using batch means : 130.31198
	Mean service time 1/μAS (sec),0.5		95th percentile using batch means : 201.93895
	Total number of departures,91000		Standard deviation of the percentiles 41.5958162325
	The number of batches,100		My confidence interval using batch means : [127.5943866728085, 133.02957332719117]

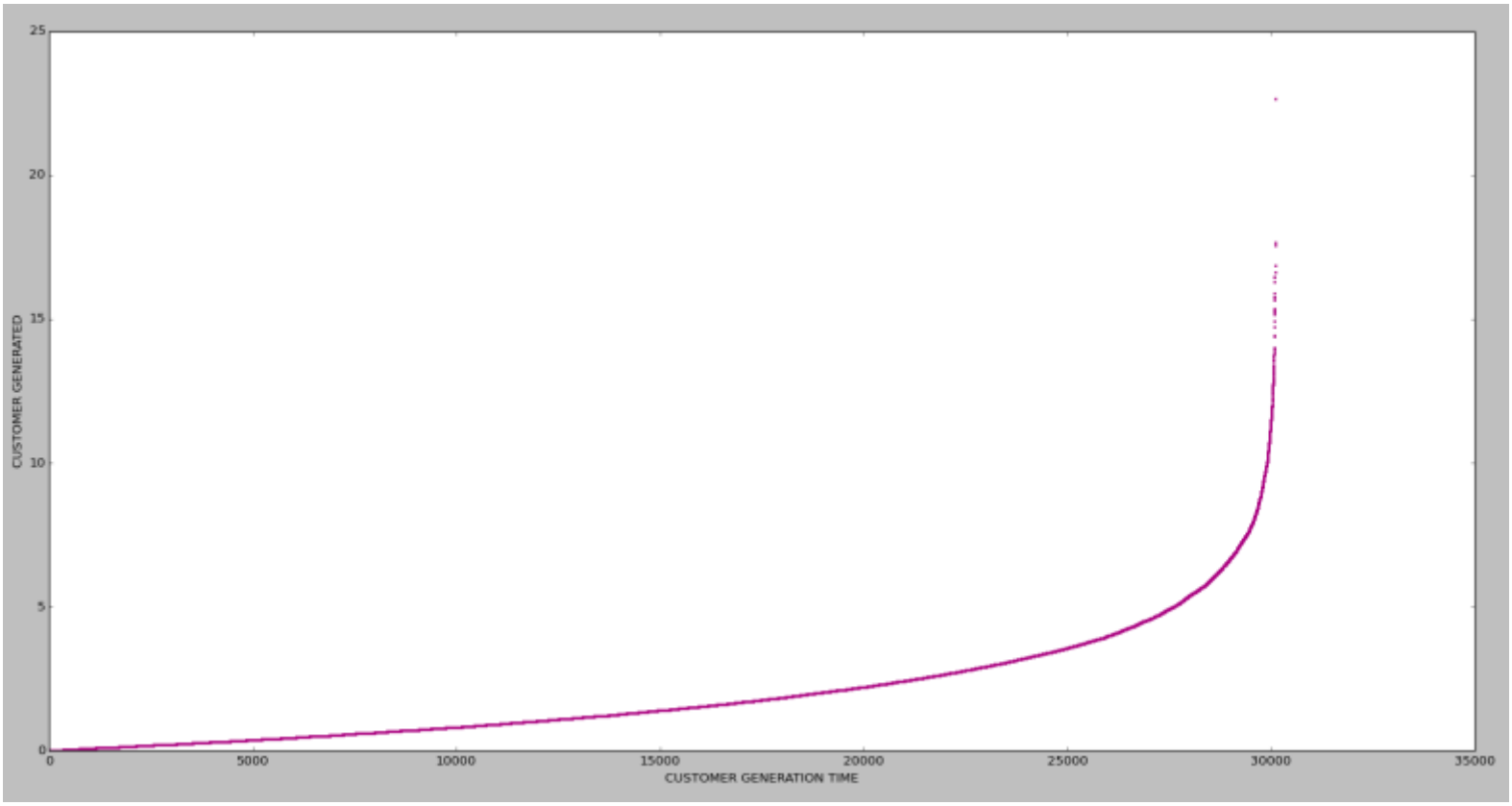
OBSERVED GRAPHICAL DISTRIBUTION

The following observations are for the first case of observation table (**RUN 1 for Lambda 0.5**)

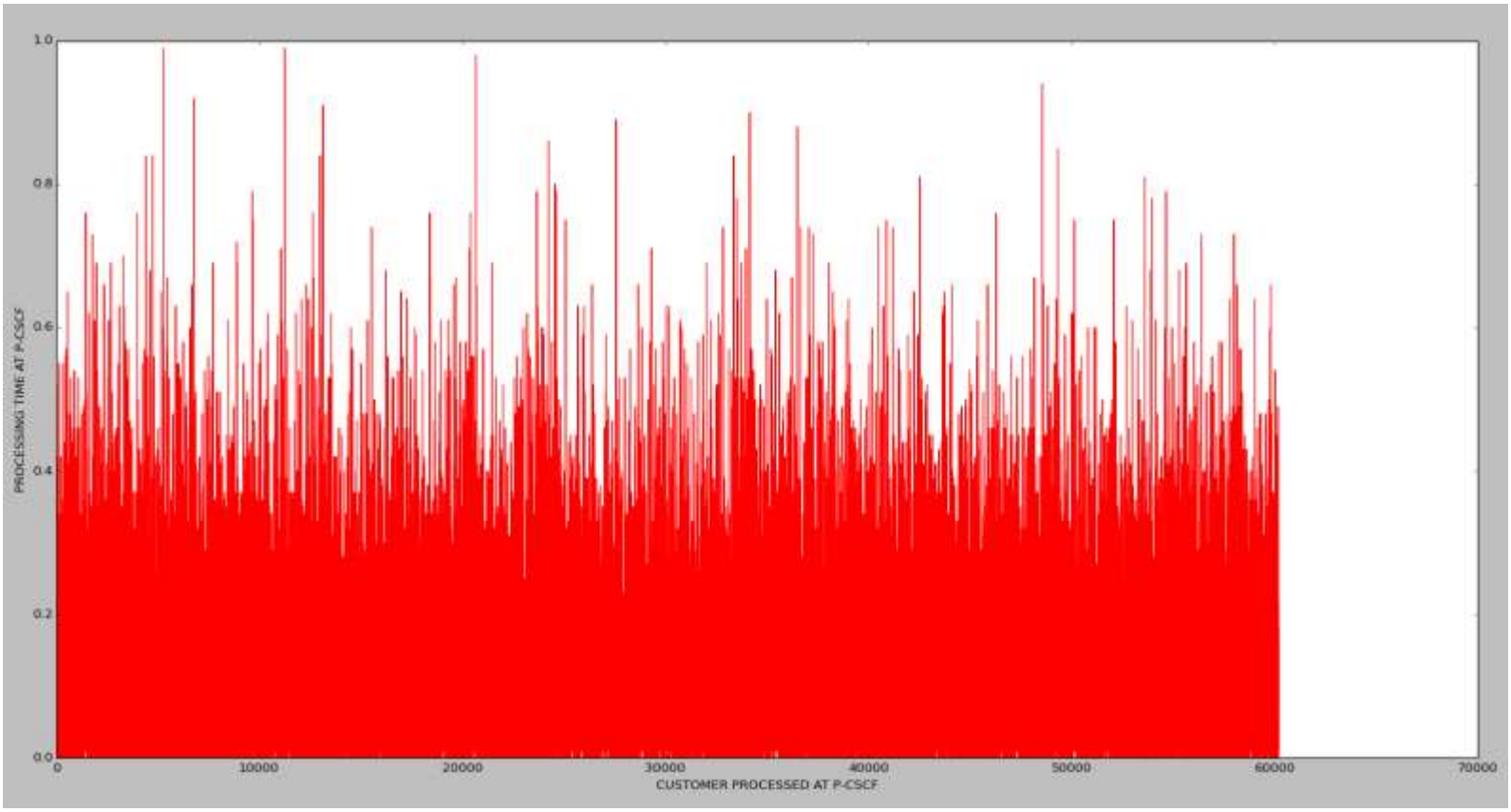
CUSTOMER GENERATION (Real Time Distribution)



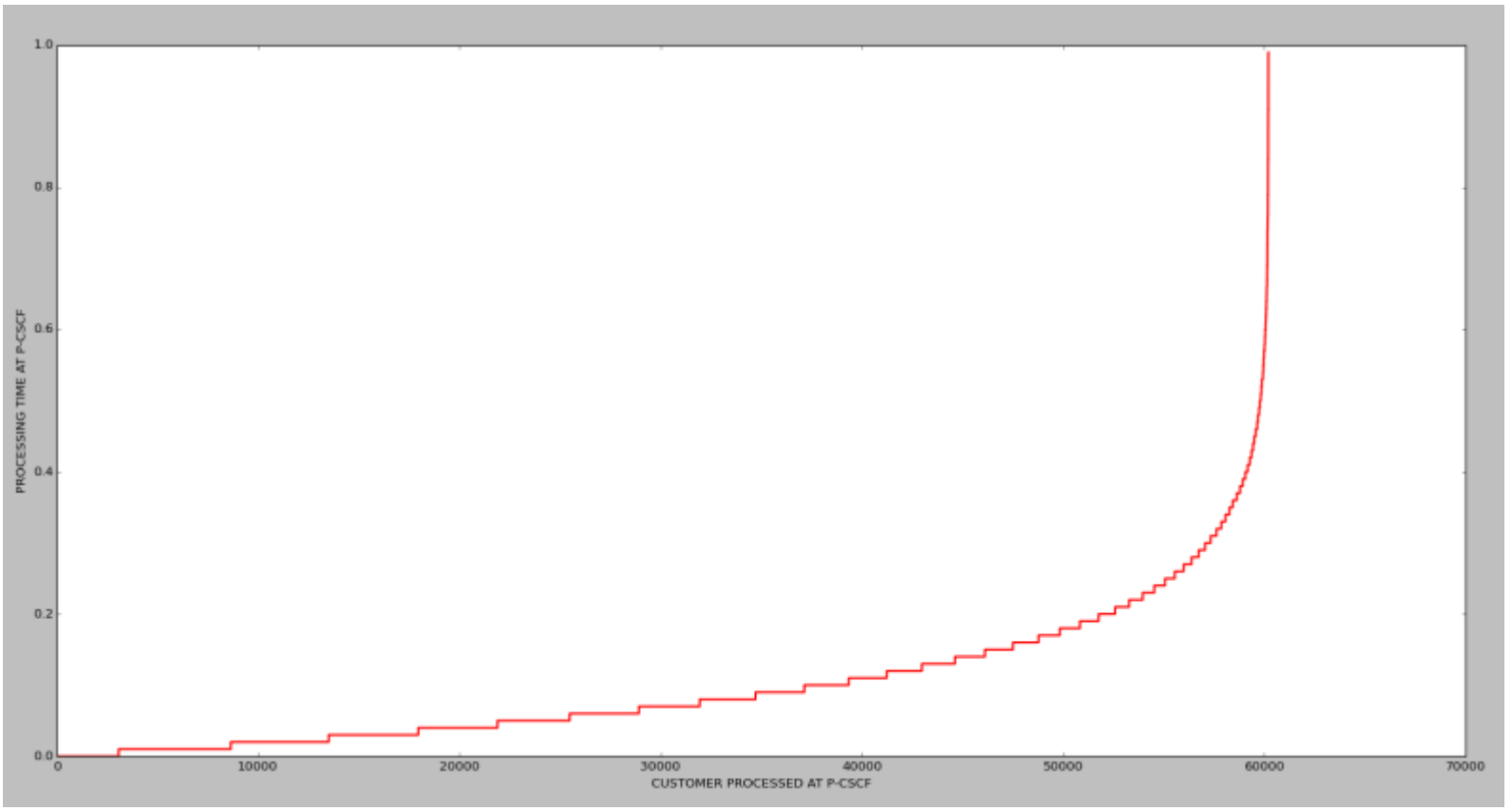
CUSTOMER GENERATION (Sorted Distribution)



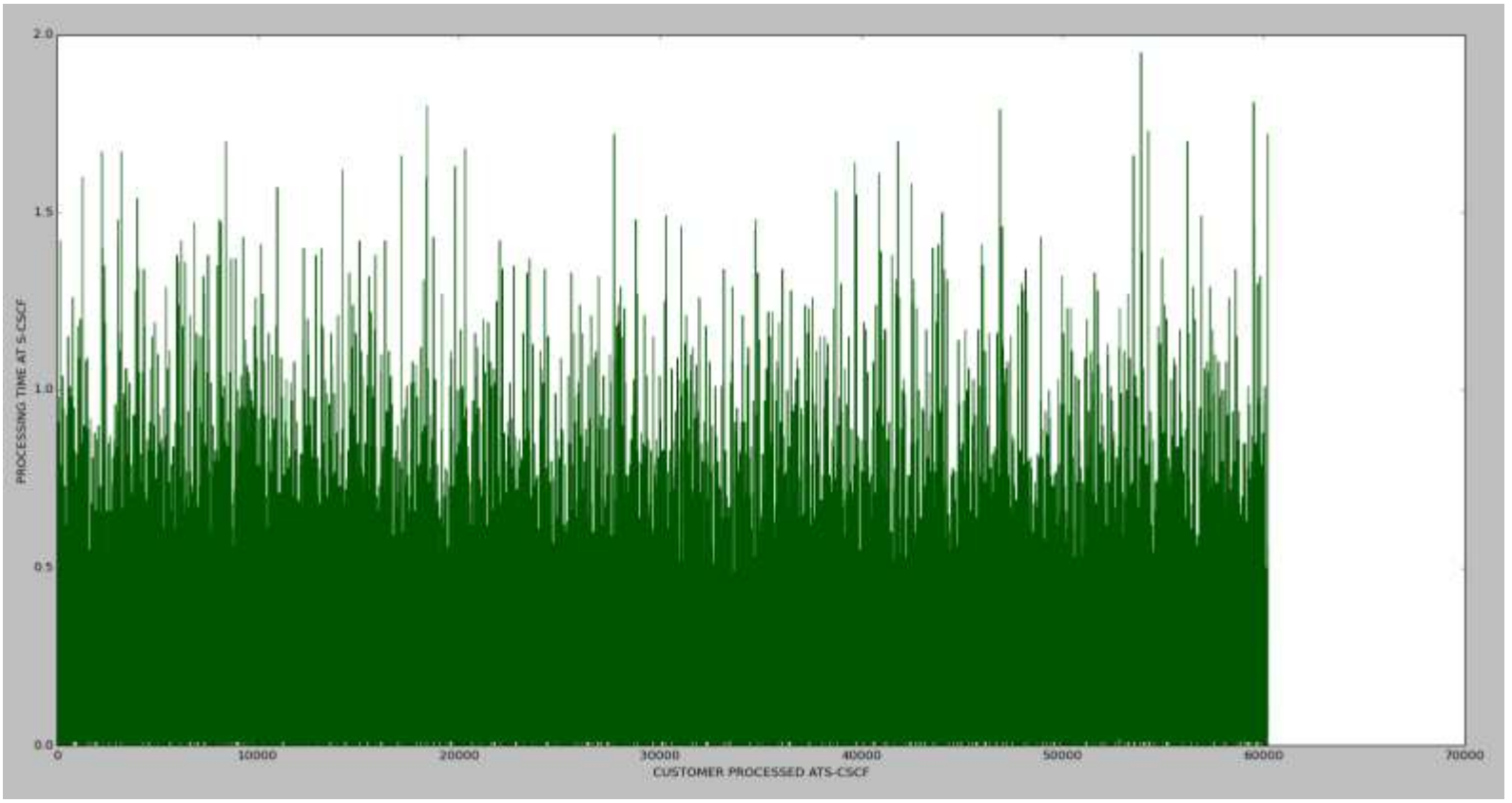
PROCESSING TIME AT P-CSCF (Real Time Distribution)



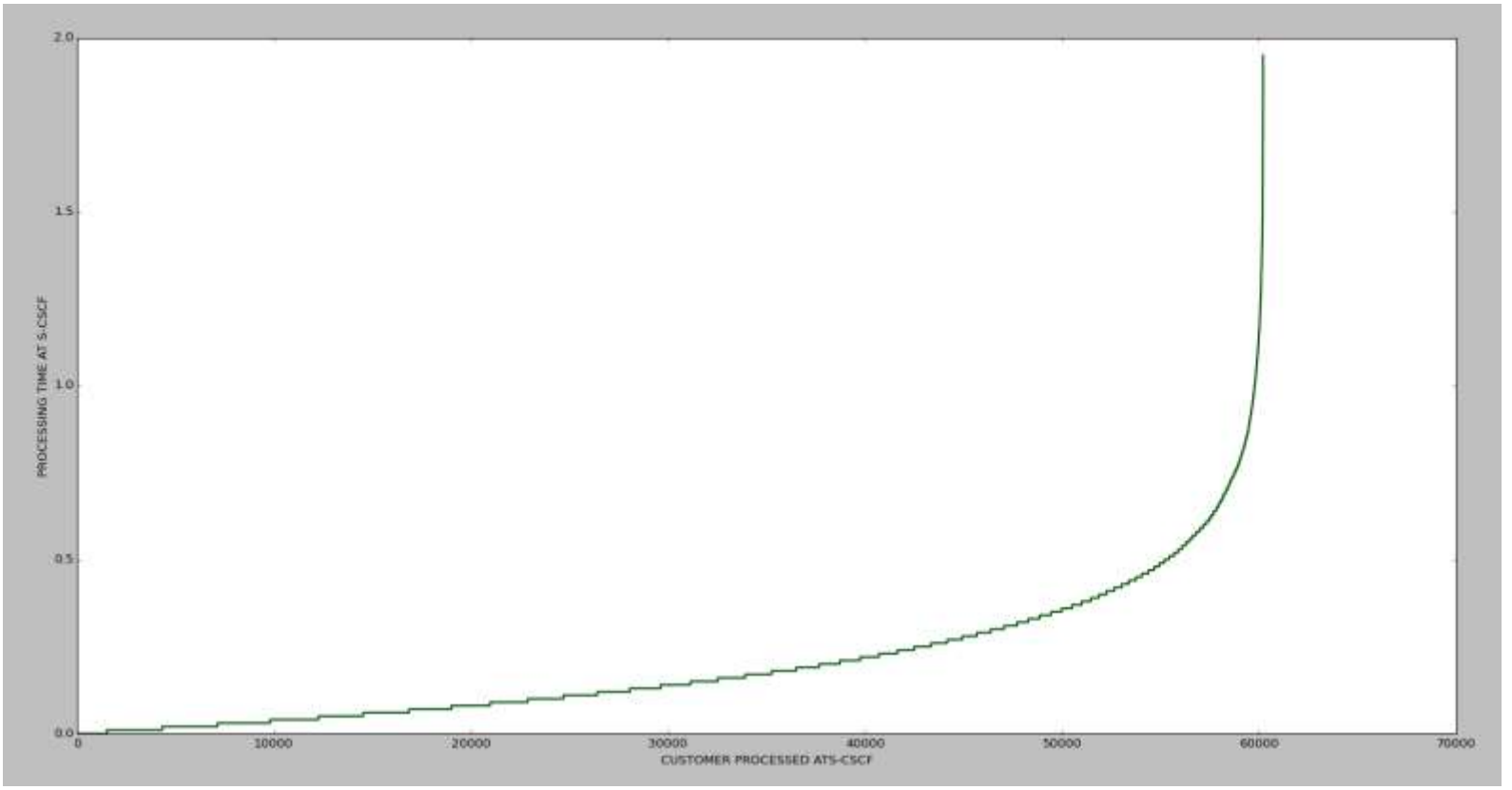
PROCESSING TIME AT P-CSCF (Sorted Distribution)



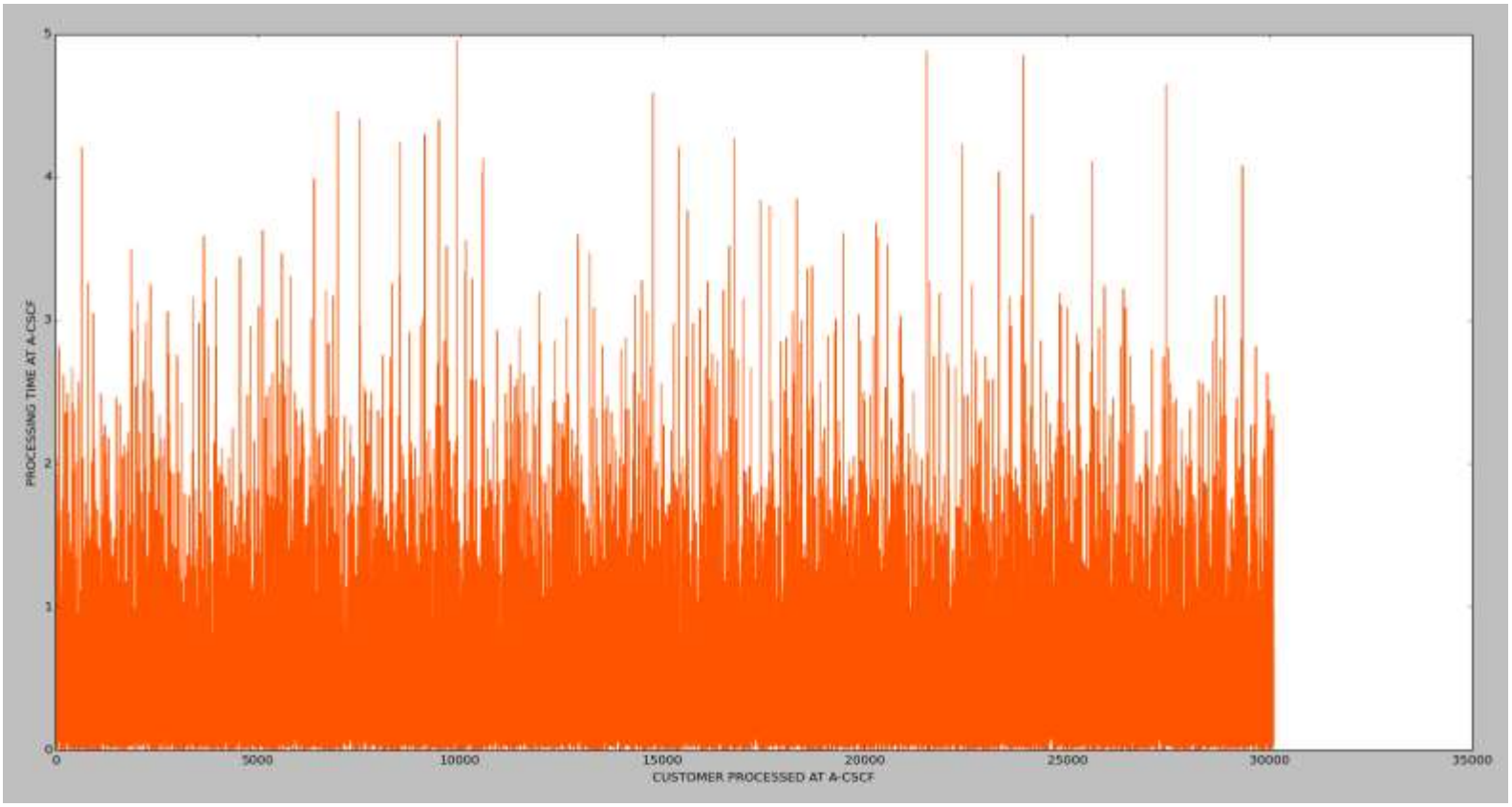
PROCESSING TIME AT S-CSCF (Real Time Distribution)



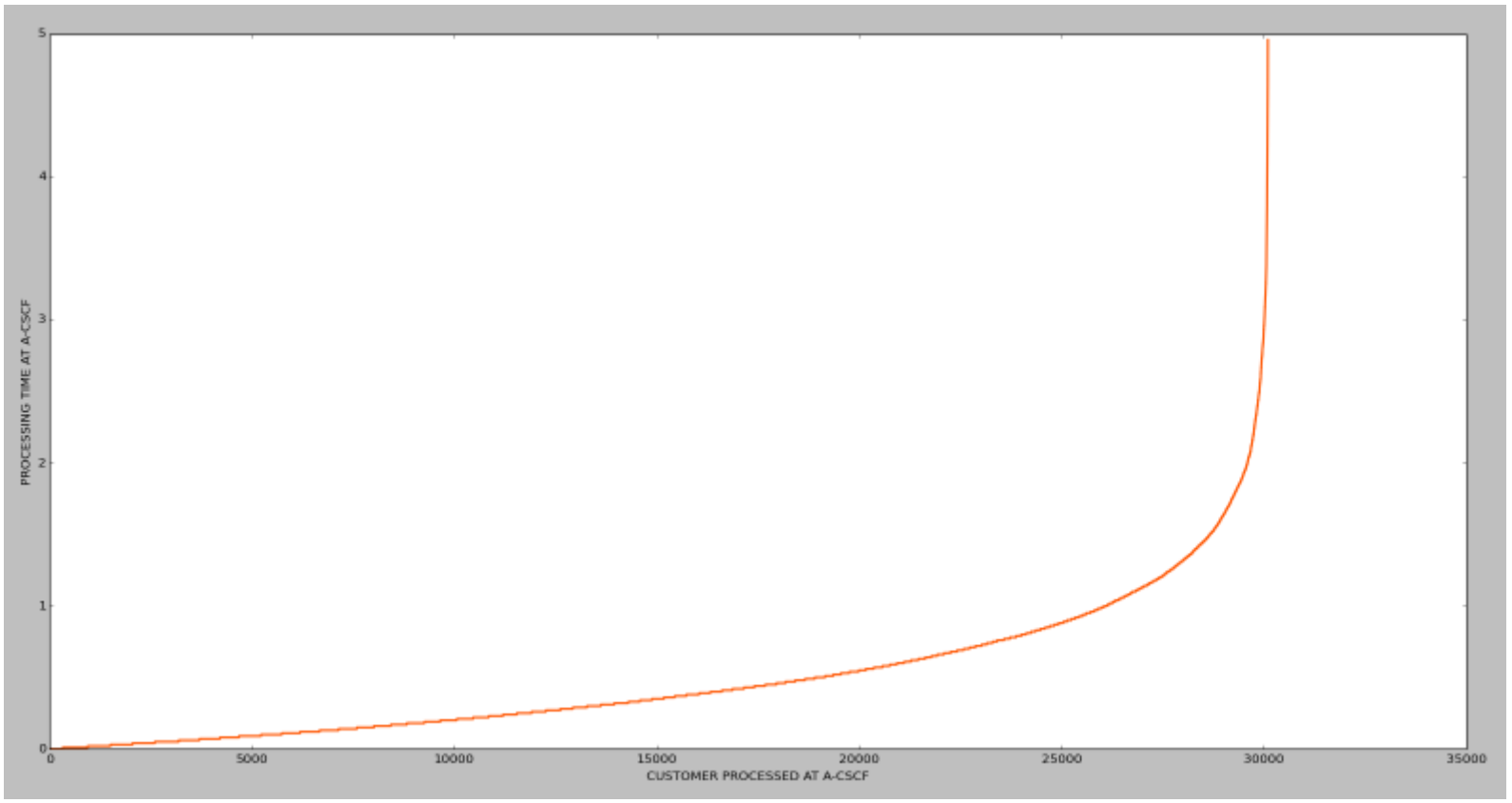
PROCESSING TIME AT S-CSCF (Sorted Distribution)



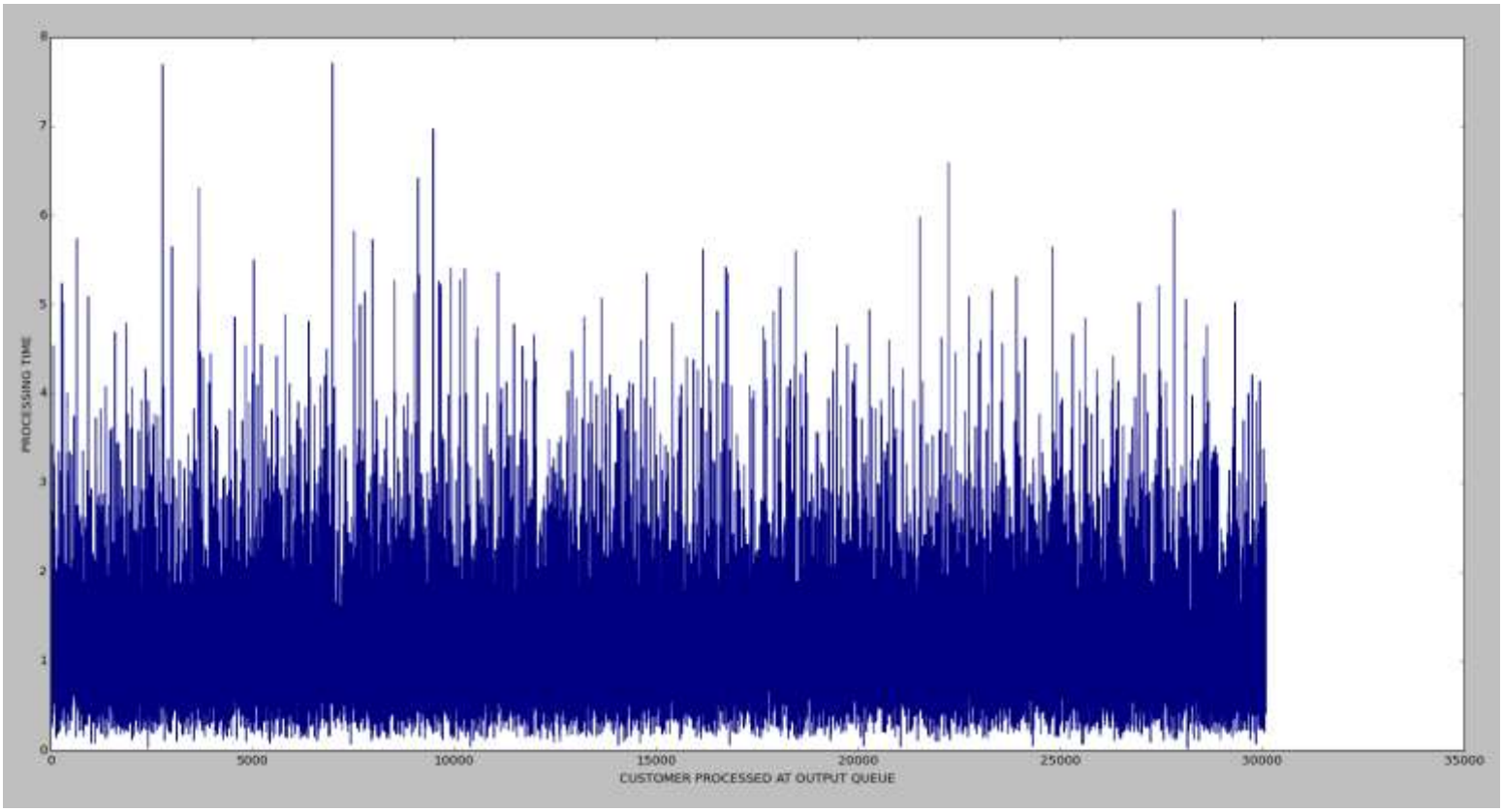
PROCESSING TIME AT A-CSCF (Real Time Distribution)



PROCESSING TIME AT A-CSCF (Real Time Distribution)

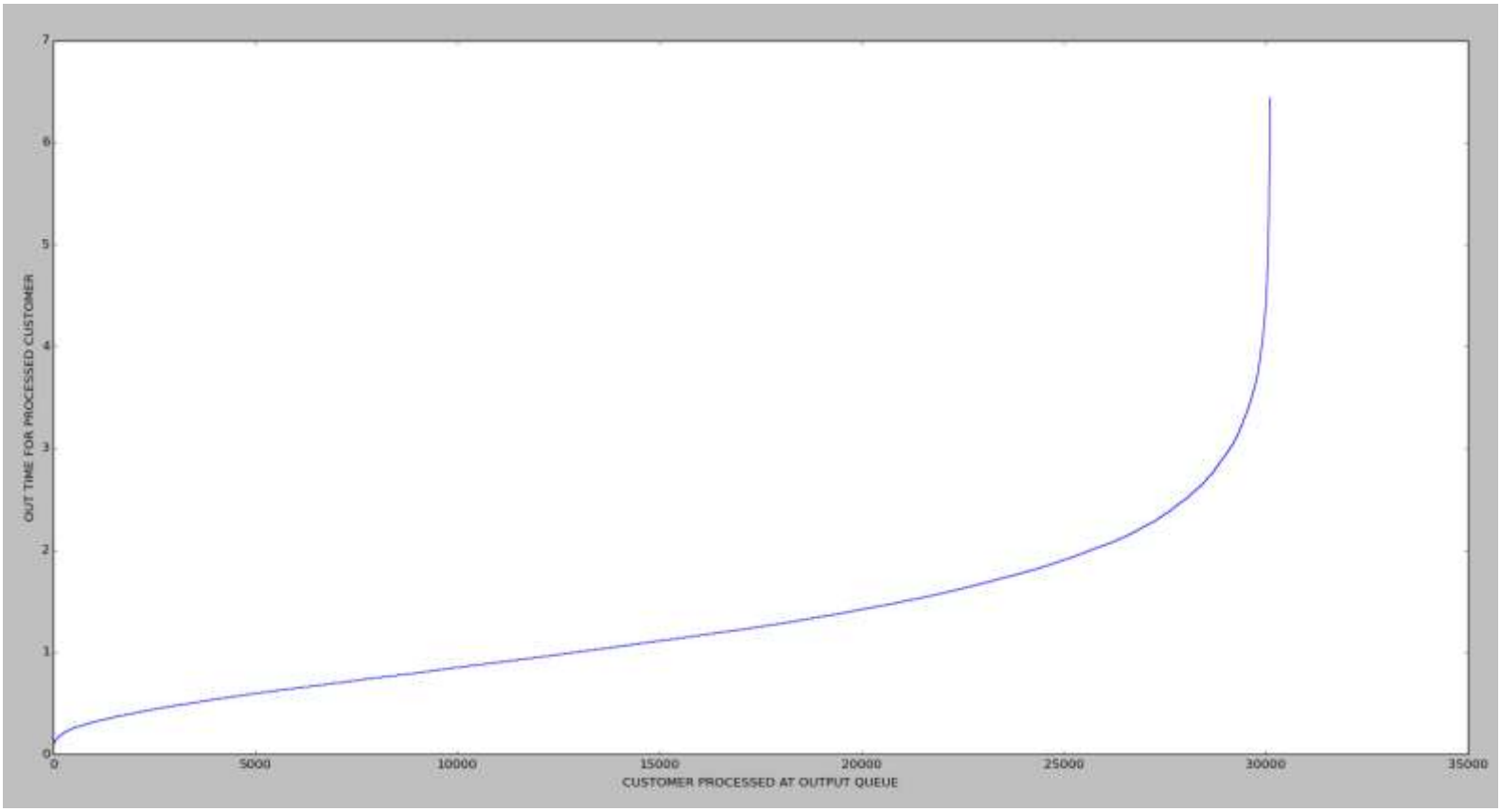


PROCESSING TIME FOR CUSTOMER AT OUTPUT (Real Time Distribution)



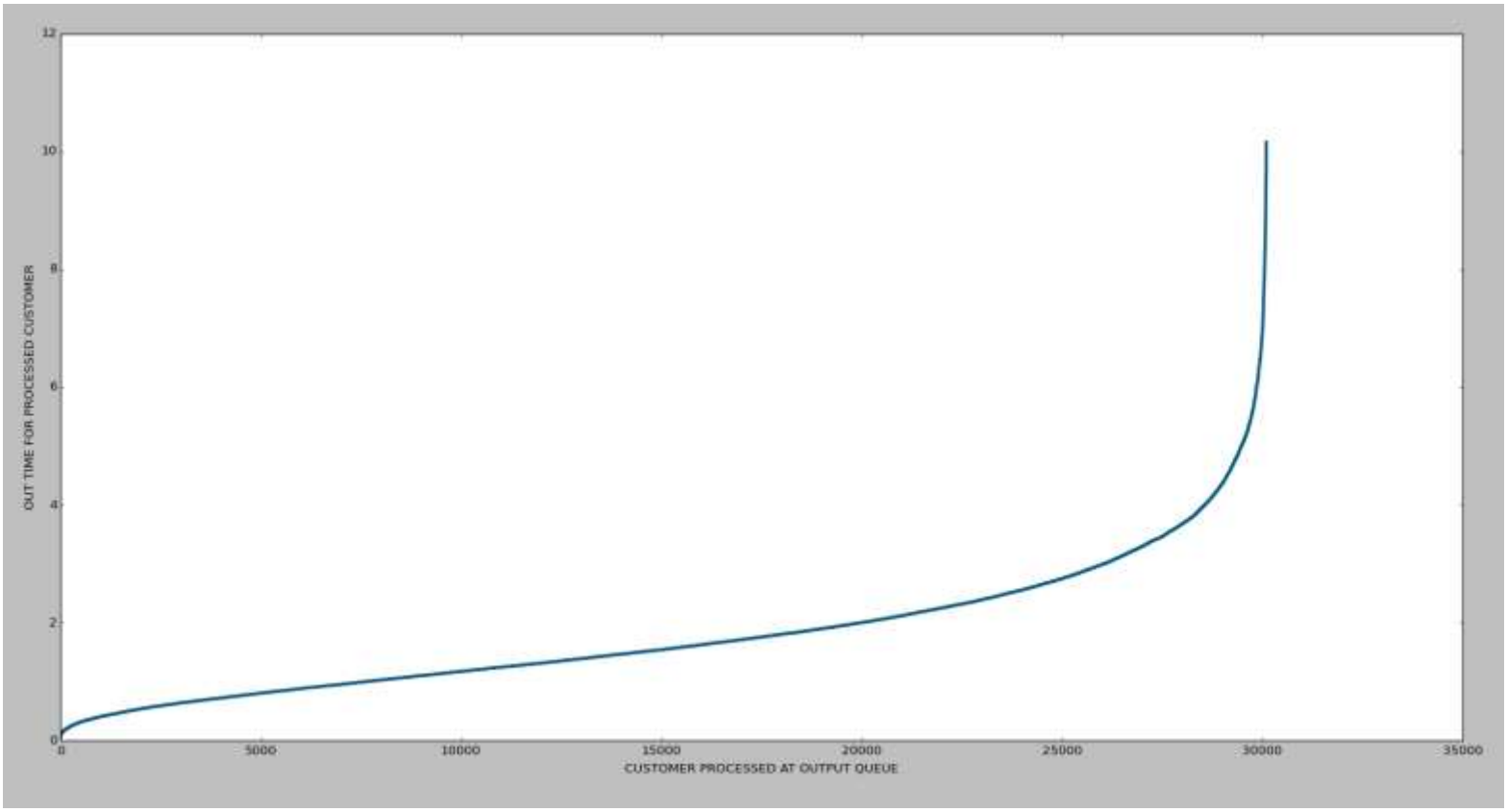
PROCESSING TIME FOR CUSTOMER AT OUTPUT (Sorted Distribution)

Output is a Poisson distribution

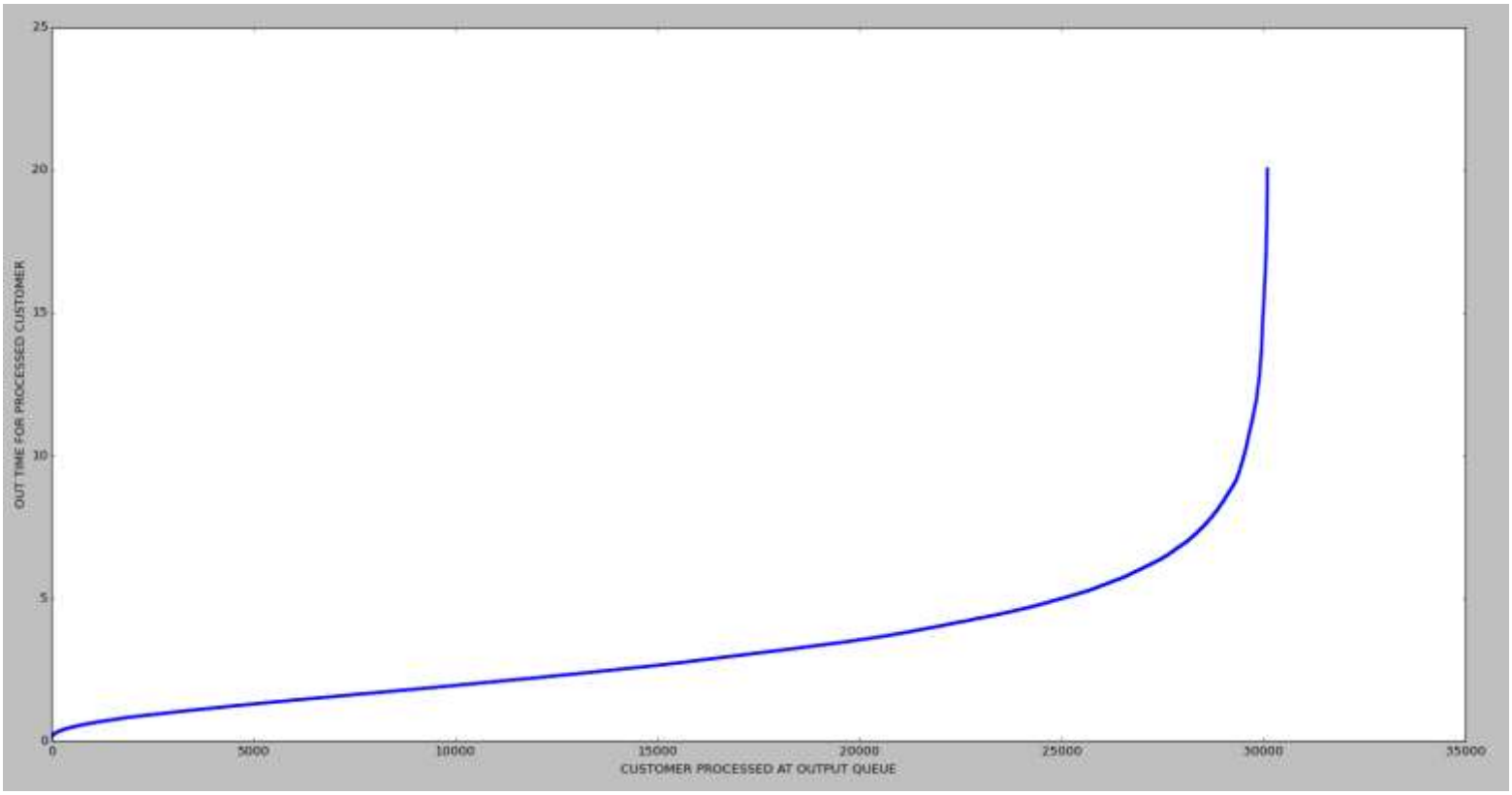


ADDITIONAL OUTPUTS FOR OTHER VALUES OF *lambda* KEEPING ALL OTHER PARAMETERS CONSTANT

Lambda = 1



Lambda =1.5



Lambda = 2

Here we can see some particular distortions in the output due to queueing problems at different processing parts of the simulation.