Performance Evaluation Homework 3

Ferhat Elmas

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Problem 1 - Simulate

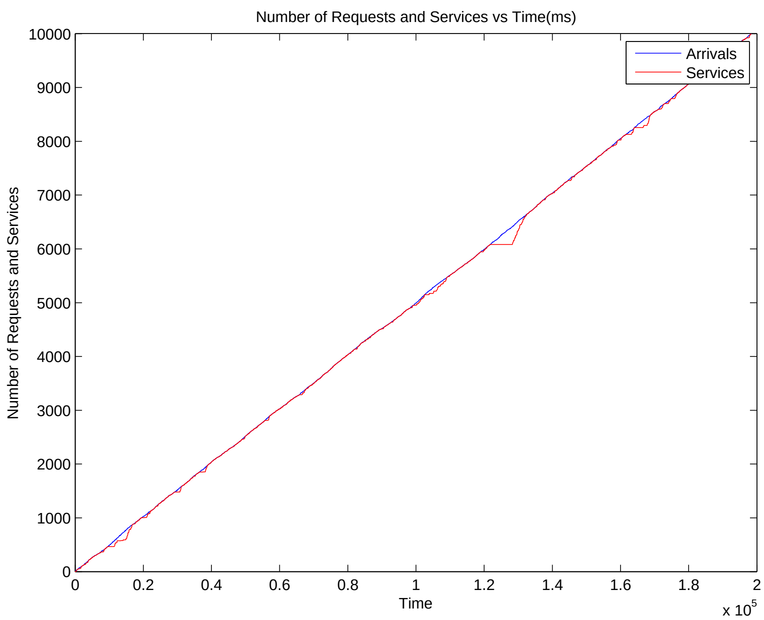

Table 1: Number of requests arrived and serviced vs Time (intensity $\lambda = 50$)

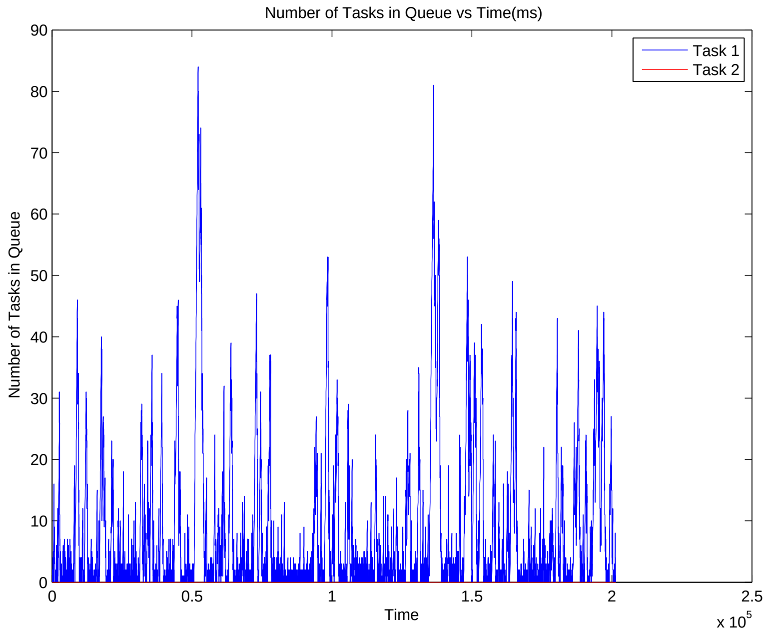

Table 2: Number of tasks in processor queue vs Time (intensity $\lambda = 50$)

	Task1 Response Time	Task2 Response Time	Task1 Service Rate	Task2 Service Rate
Run1	190.82	127.04	50.04	49.94
Run2	224.22	164.64	50.53	50.52
Run3	590.51	360.32	49.85	49.86
Run4	233.45	147.05	49.46	49.38
Run5	233.02	161.71	50.61	50.61
Run6	863.01	284.67	48.82	46.24
Run7	183.17	108.48	49.87	49.87
Run8	843.36	539.47	50.48	50.49
Run9	552.09	416.24	49.82	49.80
Run10	376.34	218.09	49.85	49.81
Avg	429.00	252.77	49.93	49.65

Table 3: Mean response time and service rate for task 1 and 2

Problem 2 - Stationarity

If we have the ratio of mean of service distribution and arrival time lower than 1, we have stationary system. For service time mean, task 2 has 1.75 ms mean since it is uniform between 1.5 and 2, $mean = (1.5 + 2)/2$. Task 1 has a mean of around 12 ms. Therefore, when we sum these two means, we get 14 ms service time. These means requests must come at least in $1000/14 = 71$ per second. And we see this numerical result in the plot because around 65 request per second, the length of the queue starts to increase rapidly.

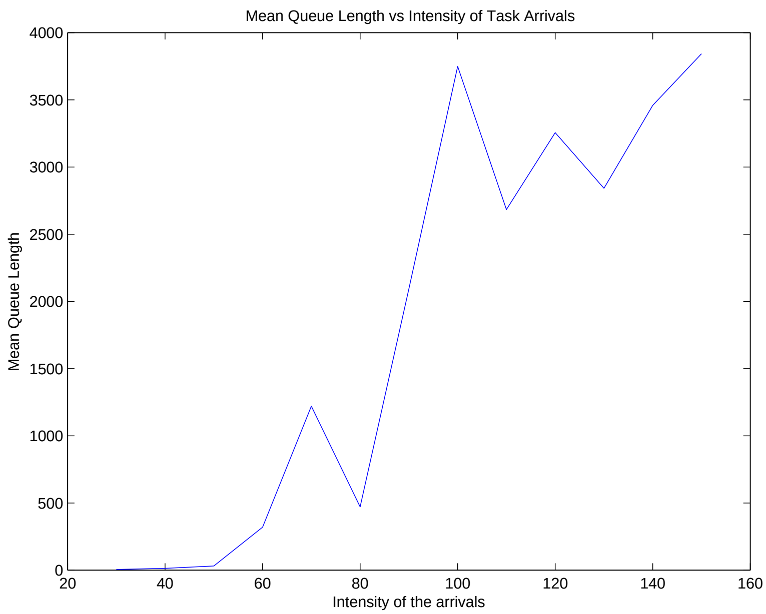

Table 4: Intensity vs Mean Queue Length

Problem 3 - Remove Trasients

Parameter	Lower Bound	Upper Bound
Median Task 1 with intensity 50	11.82	17.92
Median Task 2 with intensity 50	12.37	18.92
Median Task 1 with intensity 70	84.21	206.55
Median Task 2 with intensity 70	84.77	124.38
Mean Task 1 with intensity 50	14.01	21.50
Mean Task 2 with intensity 50	14.95	22.81
Mean Task 1 with intensity 70	123.49	206.57
Mean Task 2 with intensity 70	116.76	195.24

Table 5: Confidence Intervals for the median and mean of average number of tasks in the system

The bigger Lorenz curve gap, the less stationary the system is because this means system behaves similar at start but thensignificantly differs.

Parameter	Lorenz Gap
Task 1 with intensity 50	0.2055
Task 2 with intensity 50	0.2025
Task 1 with intensity 70	0.3340
Task 2 with intensity 70	0.3216

Table 6: Lorenz Curve Gaps of average number of tasks in the system

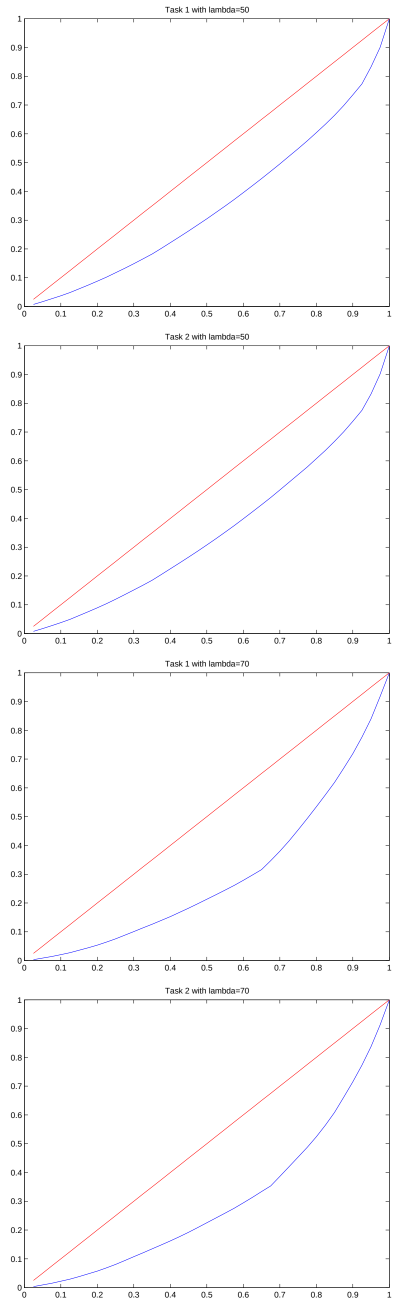

Table 7: Lorenz Curves of average number of tasks in the system

For redo calculation, we will remove the trasients but this is quite difficult task. The best way is to visually determine, plot for the various values and choose when output doesn't seem to exhibit a clear trend behaviour. In intensity 50 case, arrivals are less than services so we can start from very start and there is no need to remove. For intensity 70 case, I got below table.

Parameter	Lower Bound	Upper Bound
Median Task 1 with intensity 70	43.97	237.35
Median Task 2 with intensity 70	48.00	266.11
Mean Task 1 with intensity 70	163.64	384.02
Mean Task 2 with intensity 70	155.26	346.85

Table 8: Confidence Intervals for the median and mean of average number of tasks in the system

Problem 4 - Little's Law

If we multiply customer arriving rate by expected response time, we get the average queue length. We have parameters 50 per second for arrival rate, 0.43 s for response time then we get 21.5 for queue length and from our analysis, we see it in the confidence intervals by task1=[10, 18] and task2=[11, 18].

Reference

- All code is here: http://goo.gl/5uZda