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Compare the differences between the two queueing strategies, the biggest variation is the average waiting time customers spend in queues. When the average service time is comparatively short, the average waiting time of single queue simulation is smaller than multi-queue simulation. However, as the average service time increase, the average waiting time of single queue simulation goes up rapidly. When it surpass certain threshold value, the average waiting time of multi-queue system becomes smaller than single queue system. However, the threshold is not fixed. It also depends on the sequence of customers. So it is not practical to get a specific theoretic threshold value. I need more data sample to calculate the threshold value of average service time. All in all, if the average service time beyond the threshold, multi queue system is better. Otherwise, single queue system is better.

The simulation result is following :

Please input file name : ass2\_sample\_input

Single queue :

The number of customers : 1000

The finishing time : 30558.395

The average service time : 159.108

The average time a customer spends in queue : 0.154

The maximum time a customer spends in queue : 39.693

The average length of queue : 0.005

The maximum length of queue : 2

Total idle time for server 1 : 14933.395

Total idle time for server 2 : 12873.889

Total idle time for server 3 : 18306.145

Total idle time for server 4 : 13461.205

Total idle time for server 5 : 16237.428

Total idle time for server 6 : 10322.134

Total idle time for server 7 : 13223.199

Total idle time for server 8 : 14810.663

Total idle time for server 9 : 12289.018

Total idle time for server 10 : 14631.493

Multi queue :

The number of customers : 1000

The finishing time : 30558.395

The average service time : 159.108

The average time a customer spends in all queue : 0.638

The maximum time a customer spends in all queue : 188.355

The average length of all queue : 0.002

The average length of queue 1 : 0.000

The average length of queue 2 : 0.000

The average length of queue 3 : 0.002  
 The average length of queue 4 : 0.000  
 The average length of queue 5 : 0.000  
 The average length of queue 6 : 0.005  
 The average length of queue 7 : 0.001  
 The average length of queue 8 : 0.002  
 The average length of queue 9 : 0.000  
 The average length of queue 10 : 0.011  
 The maximum length of all queue : 2  
 The maximum length of queue 1 : 0  
 The maximum length of queue 2 : 0  
 The maximum length of queue 3 : 1  
 The maximum length of queue 4 : 0  
 The maximum length of queue 5 : 0  
 The maximum length of queue 6 : 1  
 The maximum length of queue 7 : 1  
 The maximum length of queue 8 : 1  
 The maximum length of queue 9 : 0  
 The maximum length of queue 10 : 2  
 Total idle time for server 1 : 11473.695  
 Total idle time for server 2 : 14068.089  
 Total idle time for server 3 : 16111.145  
 Total idle time for server 4 : 13509.105  
 Total idle time for server 5 : 17669.728  
 Total idle time for server 6 : 14065.034  
 Total idle time for server 7 : 14812.499  
 Total idle time for server 8 : 13890.463  
 Total idle time for server 9 : 11114.518  
 Total idle time for server 10 : 14253.393  
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 Please input file name : longer\_queues  
 Single queue :  
 The number of customers : 1000  
 The finishing time : 30437.974  
 The average service time : 190.597  
 The average time a customer spends in queue : 1.685  
 The maximum time a customer spends in queue : 61.439  
 The average length of queue : 0.055  
 The maximum length of queue : 3  
 Total idle time for server 1 : 13470.274  
 Total idle time for server 2 : 9837.509  
 Total idle time for server 3 : 11046.251  
 Total idle time for server 4 : 9769.306  
 Total idle time for server 5 : 9414.232

Total idle time for server 6 : 9538.113  
Total idle time for server 7 : 9706.142  
Total idle time for server 8 : 12620.437  
Total idle time for server 9 : 11782.389  
Total idle time for server 10 : 10039.898

Multi queue :

The number of customers : 1000  
The finishing time : 30437.974  
The average service time : 190.597  
The average time a customer spends in all queue : 8.049  
The maximum time a customer spends in all queue : 701.938  
The average length of all queue : 0.026

The average length of queue 1 : 0.022  
The average length of queue 2 : 0.060  
The average length of queue 3 : 0.045  
The average length of queue 4 : 0.024  
The average length of queue 5 : 0.061  
The average length of queue 6 : 0.010  
The average length of queue 7 : 0.013  
The average length of queue 8 : 0.019  
The average length of queue 9 : 0.010  
The average length of queue 10 : 0.000

The maximum length of all queue : 3

The maximum length of queue 1 : 2  
The maximum length of queue 2 : 3  
The maximum length of queue 3 : 2  
The maximum length of queue 4 : 2  
The maximum length of queue 5 : 3  
The maximum length of queue 6 : 1  
The maximum length of queue 7 : 1  
The maximum length of queue 8 : 2  
The maximum length of queue 9 : 2  
The maximum length of queue 10 : 0

Total idle time for server 1 : 10194.174  
Total idle time for server 2 : 10163.009  
Total idle time for server 3 : 11945.651  
Total idle time for server 4 : 11027.206  
Total idle time for server 5 : 11591.832  
Total idle time for server 6 : 10644.213  
Total idle time for server 7 : 8445.142  
Total idle time for server 8 : 10809.237  
Total idle time for server 9 : 11942.189  
Total idle time for server 10 : 11638.242

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Please input file name : much\_longer

Single queue :

The number of customers : 1000

The finishing time : 37451.268

The average service time : 234.875

The average time a customer spends in queue : 2507.003

The maximum time a customer spends in queue : 7143.906

The average length of queue : 66.940

The maximum length of queue : 178

Total idle time for server 1 : 2593.068

Total idle time for server 2 : 2358.732

Total idle time for server 3 : 2367.081

Total idle time for server 4 : 1771.676

Total idle time for server 5 : 2674.539

Total idle time for server 6 : 3700.759

Total idle time for server 7 : 1828.527

Total idle time for server 8 : 1663.524

Total idle time for server 9 : 1679.190

Total idle time for server 10 : 1510.341

Multi queue :

The number of customers : 1000

The finishing time : 30457.590

The average service time : 234.875

The average time a customer spends in all queue : 62.780

The maximum time a customer spends in all queue : 1515.497

The average length of all queue : 0.206

The average length of queue 1 : 0.295

The average length of queue 2 : 0.398

The average length of queue 3 : 0.045

The average length of queue 4 : 0.120

The average length of queue 5 : 0.290

The average length of queue 6 : 0.061

The average length of queue 7 : 0.105

The average length of queue 8 : 0.368

The average length of queue 9 : 0.170

The average length of queue 10 : 0.209

The maximum length of all queue : 7

The maximum length of queue 1 : 5

The maximum length of queue 2 : 4

The maximum length of queue 3 : 2

The maximum length of queue 4 : 4

The maximum length of queue 5 : 6

The maximum length of queue 6 : 2

The maximum length of queue 7 : 4

The maximum length of queue 8 : 7

The maximum length of queue 9 : 3

The maximum length of queue 10 : 5

Total idle time for server 1 : 6717.690

Total idle time for server 2 : 6103.234

Total idle time for server 3 : 7433.598

Total idle time for server 4 : 8040.391

Total idle time for server 5 : 7389.163

Total idle time for server 6 : 8797.140

Total idle time for server 7 : 6764.352

Total idle time for server 8 : 4573.369

Total idle time for server 9 : 6839.585

Total idle time for server 10 : 5653.458