Assignment #2

Analytical results:

Mean interarrival time (minutes)	1.000	1.000	1.000	1.000	1.000
Mean service time minutes	0.300	0.400	0.500	0.600	0.700
Mean time an item spends in the system	0.3/1-0.3 = 0.429	0.4/1-0.4=0.667	0.5/1-0.5=1	1.5	2.333
Mean no of items waiting to be served	0.3*0.3/1-0.3=0.129	0.4*0.4/1-0.4=0.267	0.5*0.5/1-0.5=0.5	0.9	1.633
Mean waiting time (includes items that have to wait and items with waiting time=0)	0.3*0.3/1-0.3=0.129	0.267	0.5*0.5/1-0.5=0.5	0.9	1.633
Average delay in queue	0.129	0.267	0.500	0.900	1.633
Average number in queue	0.129	0.267	0.500	0.900	1.633

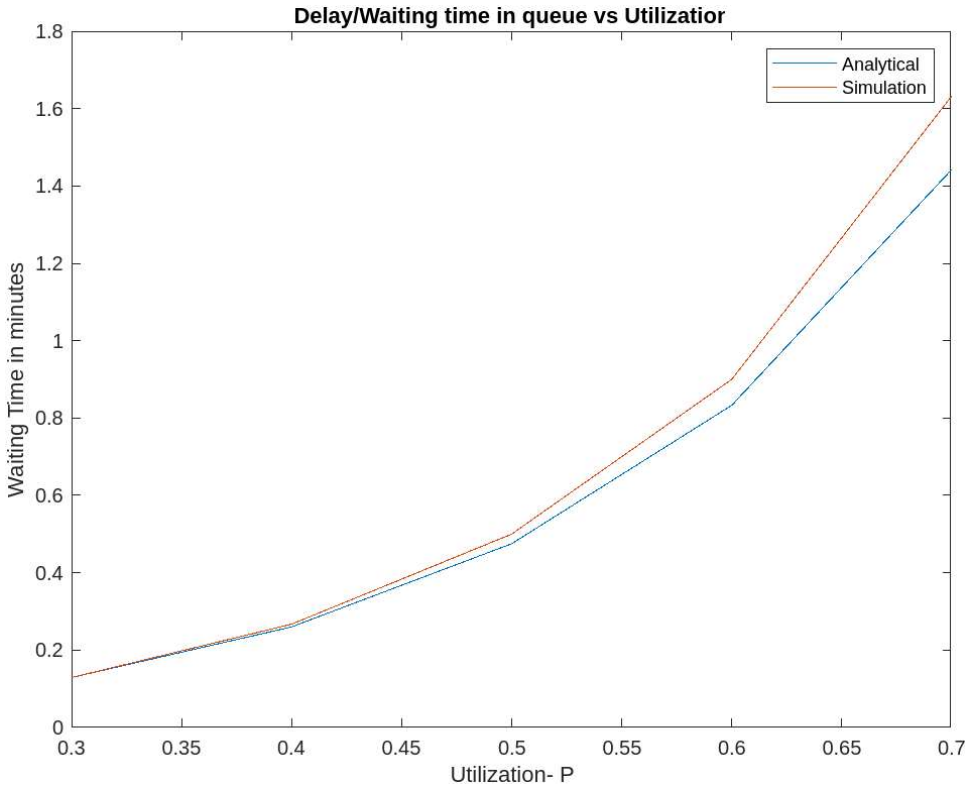
Simulation results:

Mean interarrival time (minutes)	1.000	1.000	1.000	1.000	1.000
Mean service time minutes	0.300	0.400	0.500	0.600	0.700
Mean time an item spends in the system	0.3/1-0.3 = 0.429	0.4/1-0.4=0.667	0.5/1-0.5=1	1.5	2.333
Mean no of items waiting to be served	0.3*0.3/1-0.3=0.129	0.4*0.4/1-0.4=0.267	0.5*0.5/1-0.5=0.5	0.9	1.633
Mean waiting time (includes items that have to wait and items with waiting time=0)	0.3*0.3/1-0.3=0.129	0.267	0.5*0.5/1-0.5=0.5	0.9	1.633
Average delay in queue	0.129	0.260	0.475	0.833	1.443
Average number in queue	0.129	0.260	0.472	0.832	1.428

Plot using MATLAB:

```
x = [0.3,0.4,0.5,0.6,0.7];
y1 = [0.129,0.260,0.475,0.833,1.443];
y2 = [0.129,0.267,0.5,0.9,1.633];
plot(x,y1,x,y2)
legend({'Analytical','Simulation'},'Location','northeast')
title('Delay/Waiting time in queue vs Utilization')
xlabel('Utilization- P')
ylabel('Waiting Time in minutes')
```

Figure:



The above figure shows the results for the measures both analytic and from simulation as a function of ρ(utilization) $= \lambda/\mu$ where λ is arrival rate(= inverse of mean interarrival time) and μ is service rate (inverse of mean service time)

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