Typical Solution for Project No. 3 Part II

ECE 642

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See the analysis section for the detailed derivation of inter-departure statistics.

Programm list

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%Project 3 part II
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%Project 3%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%In this part, we consider the departure process of the finite M/M/1
% queuing system simulated in part I. We obtain the normalized histogram
% and compare it with the pdf of an exponential random variable with the
% same mean.
NumberOfSamples = 50000;
% for rho=0.3
[s1,Pb1,E_wait1,E_delay1] = delaythroughput(0.3,9,10,NumberOfSamples);
inter_dep1(1)=s1(1);inter_dep1(2:length(s1))=s1(2:length(s1))-s1(1:length(s1)-1);
% for rho =0.5
[s2,Pb6,E_wait6,E_delay6] = delaythroughput(0.5,9,10,NumberOfSamples);
inter_dep2(1)=s2(1);inter_dep2(2:length(s2))=s2(2:length(s2))-s2(1:length(s2)-1);
% for rho=0.9
[s3,Pb11,E_wait11,E_delay11] = delaythroughput(0.9,9,10,NumberOfSamples);
inter_dep3(1)=s3(1);inter_dep3(2:length(s3))=s3(2:length(s3))-s3(1:length(s3)-1);
%for rho=0.95
[s4,Pb16,E_wait16,E_delay16] = delaythroughput(0.95,9,10,NumberOfSamples);
inter_dep4(1)=s4(1);inter_dep4(2:length(s4))=s4(2:length(s4))-s4(1:length(s4)-1);

%simulation results

[n1,xo1] = hist(inter_dep1,50);
area1=sum(n1)*(max(inter_dep1)-min(inter_dep1))/50;
figure(4);bar(xo1,n1/area1);hold on
mean1=mean(inter_dep1);
X1=0:.01:max(inter_dep1);Y1=exppdf(X1,mean1);
plot(X1,Y1,'r')

[n2,xo2] = hist(inter_dep2,50);
area2=sum(n2)*(max(inter_dep2)-min(inter_dep2))/50;
figure(5);bar(xo2,n2/area2),hold on
mean2=mean(inter_dep2);
X2=0:.01:max(inter_dep2);Y2=exppdf(X2,mean2);
plot(X2,Y2,'r')
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[n3,xo3] = hist(inter_dep3,50);
area3=sum(n3)*(max(inter_dep3)-min(inter_dep3))/50;
figure(6);bar(xo3,n3/area3), hold on
mean3=mean(inter_dep3);
X3=0:.01:max(inter_dep3);Y3=exppdf(X3,mean3);
plot(X3,Y3,'r')
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[n4,xo4] = hist(inter_dep4,50);
area4=sum(n4)*(max(inter_dep4)-min(inter_dep4))/50;
figure(7);bar(xo4,n4/area4), hold on
mean4=mean(inter_dep4);
X4=0:.01:max(inter_dep4);Y4=exppdf(X4,mean4);
plot(X4,Y4,'r')
```

VI Simulation results:

In this section we simulate and derive the inter-departure times in the finite M/M/1 queue with number of buffers $N = 20$. The results show that for $\rho < 1$ and $N = 20$, the inter-departure times can be very well approximated by exponential random variables (with parameter λ). See the analysis for more details.

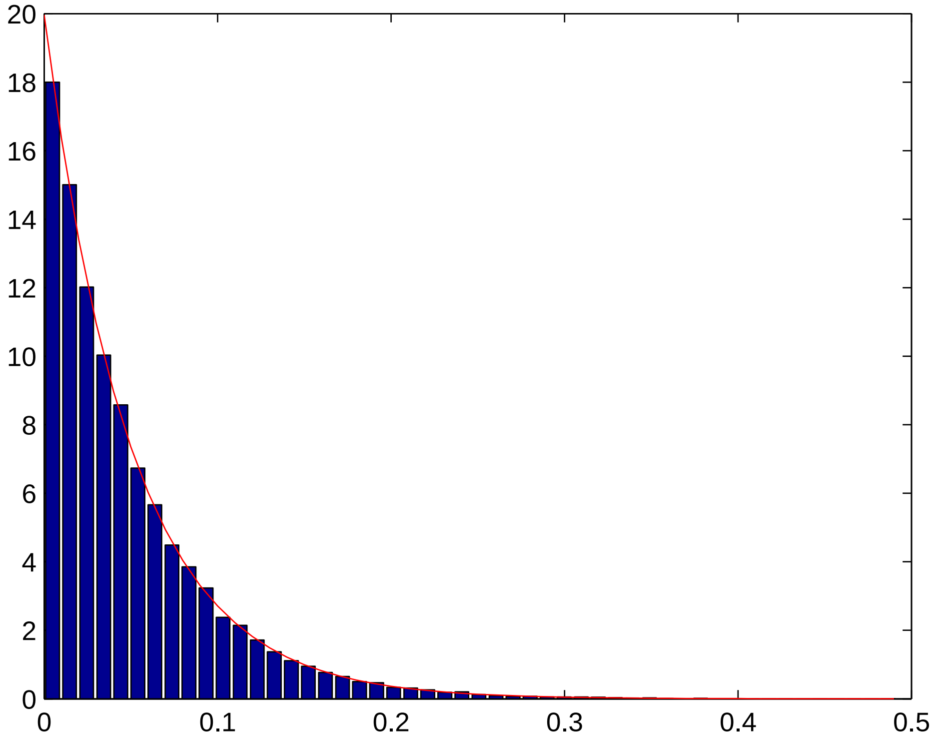

Figure 1: The normalized histogram of inter-departures along with the exponential pdf with the same mean ($\rho = 0.3$)

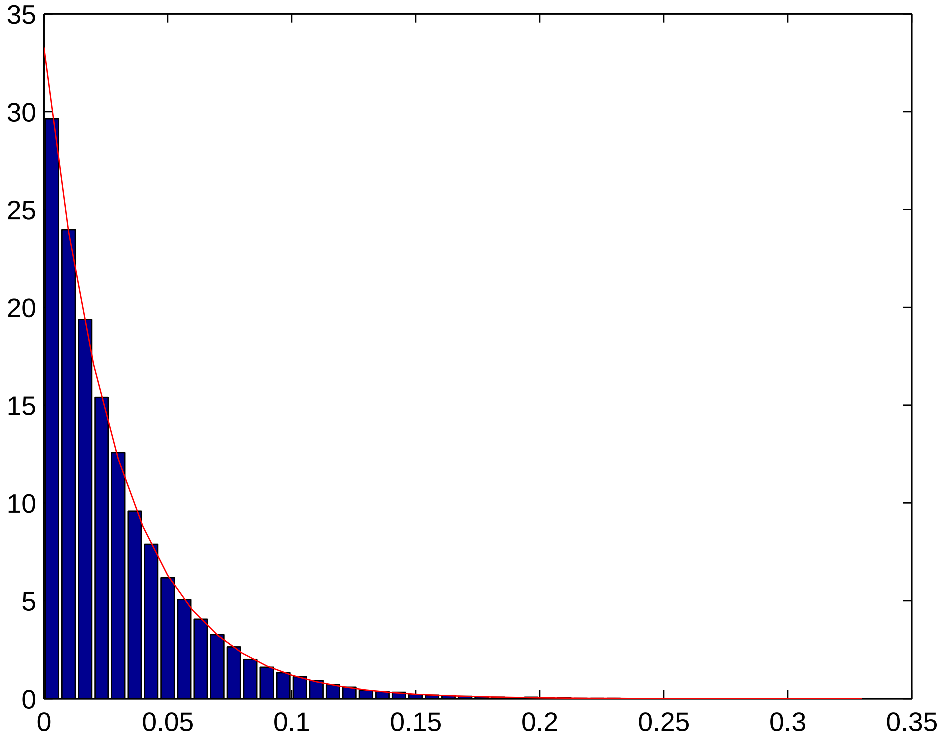

Figure 2: The normalized histogram of inter-departures along with the exponential pdf with the same mean ($\rho = 0.5$)

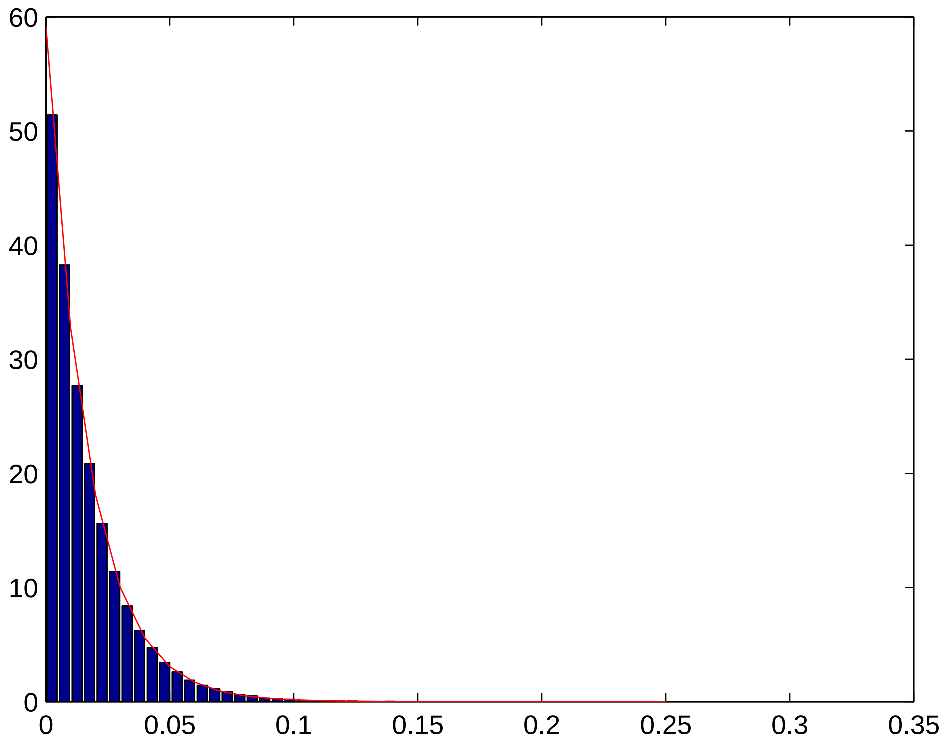

Figure 3: The normalized histogram of inter-departures along with the exponential pdf with the same mean ($\rho = 0.9$)

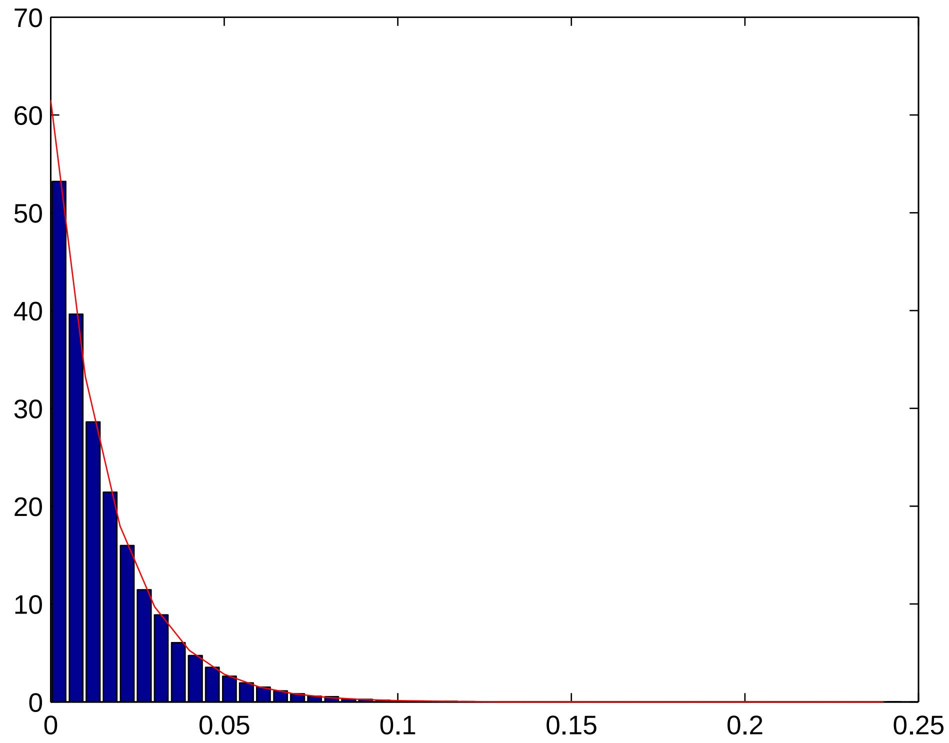

Figure 4: The normalized histogram of inter-departures along with the exponential pdf with the same mean ($\rho = 0.95$)