Appendix A:

This code illustrates a comparison between different AQM schemes in term of packet loss, average queue length and the link utilization.

```
function [ou1] = AVQ_Comp(x)
 clc,clear all ,close all
%% Average queue length vs number of FTP
 %comparison
 Figure (3)
 X=[20 40 60 80 100 120 140 160 180 ];
Y=[14 13 13.1 13.0 13.2 13.1 13.0 13.0 13.01];
plot(x,y,'color','r','marker','.','Linewidth',0.5);
 hold on
 x=[20 40 60 80 100 120 140 160 180 ];
y=[35 37 39 45 55 59 60 65 70 ];
 plot(x,y,'color','k','marker','.','Linewidth',0.5);
 hold on
x=[20 40 60 80 100 120 140 160 180 ];
y=[35 36 37 38 39 40 41 42 43 ];
 plot(x,y,'color','g','marker','.','Linewidth',0.5);
 title('Average queue length vs number of FTP connections');
xlabel('Number of FTP connections at the link');
ylabel('Average queue length in packets');
axis([20 180 0 100]);
legend('AVQ','PI','RED');
 %% Number of packets dropped vs number of short flows
 %comparison
  figure(4)
 x=[0 5 10 15 20 25 30 35 40 45 50];
y=[0 0 250 350 450 550 750 1000 1500 1750 2000];
plot(x,y,'color','r','marker','.','Linewidth',0.5);
 hold on
  x=[0 5 10 15 20 25 30 35 40 45 50];
y=[0 100 150 500 1500 3500 4500 5500 6500 7200 8000];
plot(x,y,'color','k','marker','.','Linewidth',0.5);
 hold on
  x=[0 5 10 15 20 25 30 35 40 45 50];
y=[880 950 1200 1500 1750 2200 2300 3200 3500 4000 4100];
plot(x,y,'color','g','marker','.','Linewidth',0.5);
```

```
 title('Number of packets dropped vs number of short flows for different
AQM schemes');
xlabel('Number of short flows arriving per second at the link');
ylabel('Number of packet drops at the link');
axis([0 50 0 10000]);
legend('AVQ','PI','RED');
  % Losses at the link for varying number of FTP connections for the
different AQM schemes
  %comparison
 figure(5)
 x=[20 40 60 80 100 120 140 160 180 ];
y=[0 0 0 0 0 0 0 0 0];
plot(x,y,'color','r','marker','.','Linewidth',0.5);
 hold on
 x=[20 40 60 80 100 120 140 160 180 ];
y=[0 0 0 0.08 0.12 0.14 0.16 0.18 0.2];
 plot(x,y,'color','k','marker','.','Linewidth',0.5);
 hold on
x=[20 40 60 80 100 120 140 160 180 ];
y=[0 0.05 0.22 0.35 0.42 0.52 0.54 0.57 0.59];
  plot(x,y,'color','g','marker','.','Linewidth',0.5);
 title('Packet drops vs number of FTP connections for different AQM
schemes');
xlabel('Number of FTP connections at the link');
ylabel('Number of packet drops at the link');
axis([20 180 0 2]);
legend('AVQ','PI','RED');

 %% Utilization at the link for the different AQM schemes
  %comparison
 figure(6)
 x=[20 40 60 80 100 120 140 160 180 ];
y=[0.90 0.91 0.92 0.93 0.94 0.95 0.96 0.97 0.98];
plot(x,y,'color','r','marker','.','Linewidth',0.5);
 hold on
 x=[20 40 60 80 100 120 140 160 180 ];
y=[0.99 0.99 0.99 0.99 0.99 0.99 0.99 0.99 0.99];
 plot(x,y,'color','k','marker','.','Linewidth',0.5);
 hold on
x=[20 40 60 80 100 120 140 160 180 ];
```

```
y=[0.88 0.89 0.87 0.85 0.84 0.84 0.84 0.85 0.86];
 plot(x,y,'color','g','marker','.','Linewidth',0.5);
 title('Utilization vs number of FTP connections for different AQM
schemes');
xlabel('Number of FTP connections at the link');
ylabel('Utilization at the link');
axis([20 180 0.7 1]);
legend('AVQ','PI','RED');
 end
```