Code of exercise 2

```
#Create simulator
set ns [new Simulator]

$ns color 1 Red
$ns color 2 Blue
$ns color 3 Green
#trace file
set tf [open exercise_2.tr w]
$ns trace-all $tf

#nam tracefile
set nf [open exercise_2.nam w]
$ns namtrace-all $nf

proc finish {} {
  #finalize trace files
   global ns nf tf
   $ns flush-trace
   close $tf
   close $nf

   exec nam exercise_2.nam &
   exit 0
}

# create nodes
set n0 [$ns node]
set n1 [$ns node]
set n2 [$ns node]
set n3 [$ns node]
set n4 [$ns node]
set n5 [$ns node]

#create links
$ns duplex-link $n0 $n2 10Mb 10ms DropTail
$ns duplex-link $n0 $n4 10Mb 10ms DropTail
$ns duplex-link $n0 $n1 10Mb 10ms DropTail
$ns duplex-link $n1 $n3 10Mb 10ms DropTail
$ns duplex-link $n1 $n5 10Mb 10ms DropTail

#set queue limit for link between nodes n0 & n1
$ns queue-limit $n0 $n1 20

#setup 1 ftp over tcp connection between nodes n3 & n2
set tcp0 [new Agent/TCP/Reno]
$ns attach-agent $n3 $tcp0
set sink [new Agent/TCPSink]
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48 $ns attach-agent $n2 $sink
49 $ns connect $tcp0 $sink
50 $tcp0 set fid_ 4
51 $tcp0 set window_ 80
52 set ftp0 [new Application/FTP]
53 $ftp0 attach-agent $tcp0
54
55 #setup 120 ftp over tcp connections between nodes n5 & n4
56 for {set i 1} {$i < 121} {incr i} {
57  set tcp($i) [new Agent/TCP]
58 $ns attach-agent $n5 $tcp($i)
59 set sink [new Agent/TCPSink]
60 $ns attach-agent $n4 $sink
61 $ns connect $tcp($i) $sink
62 if { $i < 121 } {
63 $tcp($i) set fid_ 1
64 }
65 if { $i < 81 } {
66 $tcp($i) set fid_ 2
67 }
68 if { $i < 41 } {
69 $tcp($i) set fid_ 3
70 }
71 set ftp($i) [new Application/FTP]
72 $ftp($i) attach-agent $tcp($i)
73 }
74
75 #setup delays with their respective distributions
76 set delay_init [new RandomVariable/Exponential]
77 $delay_init set avg_ 0.05
78
79 set RVSize [new RandomVariable/Pareto]
80 $RVSize set avg_ 150000
81 $RVSize set shape_ 1.5
82 #setup start and end times of long lasting ftp
       connection between nodes n3 & n2
83 $ns at 0.0 "$ftp0 start"
84 $ns at 20.0 "$ftp0 stop"
85 #setup start and end times of bursts of traffic over ftp
       connection between nodes n5 & n4
86 set startT(0)  5.0
87 for {set i 1} {$i < 41} {incr i} {
88 set Size($i) [expr [$RVSize value]]
89 set startT($i) [expr $startT([expr $i - 1]) +
       [$delay_init value]]
90 $ns at $startT($i) "$ftp($i) send $Size($i)"
91 $ns at 7.0 "$ftp($i) stop"
92 }
93
94 set startT(40)  10.0
```

```
95 for {set i 41} {$i < 81} {incr i} {
96 set Size($i) [expr [$RVSize value]]
97 set startT($i) [expr $startT([expr $i - 1]) +
     [$delay_init value]]
98 $ns at $startT($i) "$ftp($i) send $Size($i)"
99 $ns at 12.0 "$ftp($i) stop"
100 }
101
102 set startT(80)  15.0
103 for {set i 81} {$i < 121} {incr i} {
104 set Size($i) [expr [$RVSize value]]
105 set startT($i) [expr $startT([expr $i - 1]) +
     [$delay_init value]]
106 $ns at $startT($i) "$ftp($i) send $Size($i)"
107 $ns at 17.0 "$ftp($i) stop"
108 }
109
110 proc plotWindow {tcpSource1 outWindow} {
111    global ns
112    set now [$ns now]
113    set cwnd [$tcpSource1 set cwnd_]
114
115    puts  $outWindow "$now $cwnd"
116    #Recursive call
117    $ns at [expr $now+0.1] "plotWindow $tcpSource1
         $outWindow"
118 }
119
120 proc plotThresh {tcpSource2 outThresh} {
121    global ns
122    set now [$ns now]
123    set ssthresh [$tcpSource2 set ssthresh_]
124
125    puts  $outThresh  "$now $ssthresh"
126    #Recursive call
127    $ns at [expr $now+0.1] "plotThresh $tcpSource2
         $outThresh"
128 }
129
130 set outWindow [open  "window"  w]
131 $ns  at  0.0  "plotWindow $tcp0  $outWindow"
132
133 set outThresh [open  "thresh"  w]
134 $ns  at  0.0  "plotThresh $tcp0  $outThresh"
135
136 #finishing statements
137 $ns at 20 "finish"
138 $ns run
```

Listing 1: Code of exercise 2