PROGRAM 1

1. Implement Three nodes point – to – point network with duplex links between them for different topologies. 1Set the queue size, vary the bandwidth, and find the number of packets dropped for various iterations.

```
set ns [new Simulator]
set ntrace [open pgm1.tr w]
$ns trace-all $ntrace
set namfile [open pgm1.nam w]
$ns namtrace-all $namfile

proc Finish {} {
global ns ntrace namfile
$ns flush-trace
close $ntrace
close $namfile
exec nam pgm1.nam &
exec echo "the number of packet drops is" &
exec grep -c "^d" pgm1.tr &
exit 0
}

set n0 [$ns node]
set n1 [$ns node]
set n2 [$ns node]

$n0 label "tcp source"
$n2 label "sink"

$ns color 1 blue

$ns duplex-link $n0 $n1 1Mb 10ms DropTail
$ns duplex-link $n1 $n2 1Mb 10ms DropTail
$ns duplex-link-op $n0 $n1 orient right
$ns duplex-link-op $n1 $n2 orient right

$ns queue-limit $n0 $n1 10
$ns queue-limit $n1 $n2 10

set tcp0 [new Agent/TCP]
$ns attach-agent $n0 $tcp0
set sink0 [new Agent/TCPSink]
$ns attach-agent $n2 $sink0
$ns connect $tcp0 $sink0
set cbr0 [new Application/Traffic/CBR]
$cbr0 set type_ CBR
$cbr0 set packetSize_ 100
$cbr0 set rate_ 1Mb
$cbr0 set random_ false
$cbr0 attach-agent $tcp0
$tcp0 set class_ 1
```

```
$ns at 0.0 "$cbr0 start"
$ns at 5.0 "Finish"
$ns run
```

PROGRAM 2

Implement transmission of ping messages/trace route over a network topology consisting of 6
nodes and find the number of packets dropped due to congestion in the network.

```
set ns [new Simulator]
$ns color 1 Blue
$ns color 2 Red
set ntrace [open prog2.tr w]
$ns trace-all $ntrace
set namfile [open prog2.nam w]
$ns namtrace-all $namfile

proc Finish {} {
global ns ntrace namfile

$ns flush-trace
close $ntrace
close $namfile

exec nam prog2.nam &
puts "the number of ping packets dropped are "
exec grep "^d" prog2.tr | cut -d " " -f 5 | grep -c "ping" &
exit 0
}

for {set i 0} {$i < 6} {incr i} {
set n($i) [$ns node]
}
for {set j 0} {$j < 5} {incr j} {
$ns duplex-link $n($j) $n([expr ($j+1)]) 0.1Mb 10ms DropTail
}
Agent/Ping instproc recv {from rtt} {
$self instvar node_
puts "node [$node_ id] received ping answer from $from with round trip time $rtt ms"
}

set p0 [new Agent/Ping]
$p0 set class_ 1
$ns attach-agent $n(0) $p0
set p1 [new Agent/Ping]
$p1 set class_ 1
$ns attach-agent $n(5) $p1
$ns connect $p0 $p1

$ns queue-limit $n(2) $n(3) 2
$ns duplex-link-op $n(2) $n(3) queuePos 0.5

set tcp0 [new Agent/TCP]
$tcp0 set class_ 2
$ns attach-agent $n(2) $tcp0
set sink0 [new Agent/TCPSink]
```

```
$ns attach-agent $n(4) $sink0
$ns connect $tcp0 $sink0

set cbr0 [new Application/Traffic/CBR]
$cbr0 set packetSize_ 500
$cbr0 set rate_ 1Mb
$cbr0 attach-agent $tcp0

$ns at 0.2 "$p0 send"
$ns at 0.4 "$p1 send"
$ns at 0.4 "$cbr0 start"
$ns at 0.8 "$p0 send"
$ns at 1.0 "$p1 send"
$ns at 1.2 "$cbr0 stop"
$ns at 1.4 "$p0 send"
$ns at 1.6 "$p1 send"
$ns at 1.8 "Finish"
$ns run
```

PROGRAM 3

Implement simple ESS and with transmitting nodes in wire-less LAN simulation and determine the throughput with respect to transmission of packets.

```
set ns [new Simulator]
set na [open prog3.nam w]
$ns namtrace-all-wireless $na 500 500
set nt [open prog3.tr w]
$ns trace-all $nt
set topo [new Topography]
$topo load_flatgrid 500 500
$ns node-config -adhocRouting DSDV
$ns node-config -llType LL
$ns node-config -macType Mac/802_11
$ns node-config -ifqType Queue/DropTail
$ns node-config -ifqLen 50
$ns node-config -phyType Phy/WirelessPhy
$ns node-config -channelType Channel/WirelessChannel
$ns node-config -propType Propagation/TwoRayGround
$ns node-config -antType Antenna/OmniAntenna
$ns node-config -topoInstance $topo
$ns node-config -agentTrace ON
$ns node-config -routeTrace ON
create-god 4
set n0 [$ns node]
set n1 [$ns node]
set n2 [$ns node]
set n3 [$ns node]
$n0 set X_ 250.0
$n0 set Y_ 250.0
$n0 set Z_ 0.0
$n1 set X_ 200.0
$n1 set Y_ 250.0
$n1 set Z_ 0.0
$n2 set X_ 250.0
$n2 set Y_ 250.0
$n2 set Z_ 0.0
$n3 set X_ 250.0
$n3 set Y_ 250.0
$n3 set Z_ 0.0

$ns at 0.0 "$n0 setdest 400.0 300.0 50.0"
$ns at 0.0 "$n1 setdest 50.0 100.0 20.0"
$ns at 0.0 "$n2 setdest 75.0 180.0 5.0"
$ns at 0.0 "$n3 setdest 100.0 100.0 25.0"
set tcp1 [new Agent/TCP]
$ns attach-agent $n0 $tcp1
set tcp2 [new Agent /TCP]
$ns attach-agent $n2 $tcp2
set sink1 [new Agent/TCPSink]
$ns attach-agent $n1 $sink1
```

```
set sink2 [new Agent/TCPSink]
$ns attach-agent $n3 $sink2
set cbr1 [new Application/Traffic/CBR]
$cbr1 attach-agent $tcp1
set cbr2 [new Application/Traffic/CBR]
$cbr2 attach-agent $tcp2
$ns connect $tcp1 $sink1
$ns connect $tcp2 $sink2

proc End {} {
global ns nt na
$ns flush-trace
close $na
close $nt
exec nam prog3.nam &
}
$ns at 0.0 "$cbr1 start"
$ns at 0.0 "$cbr2 start"
$ns at 10.0 "End"
$ns run

AWK FILE:

BEGIN {Num_of_pkts=0;}
{
if ($1 == "r" && $3 == "_1_" && $4 == "AGT" && $7 == "tcp")
{
Num_of_pkts = Num_of_pkts + $8;
}
}
END{
Throughput = Num_of_pkts*8/$2/1000000;
printf ("\n\n\t Throughput=%fbpms\n\n\n",Throughput);
}
```

PROGRAM 4

Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.

```
set ns [new Simulator]
$ns color 1 Blue
$ns color 2 Red

set ntrace [open prog4.tr w]
$ns trace-all $ntra
set  namfile [open prog4.nam w]
$ns namtrace-all $namfile

set winFile0 [open WinFile0 w]
set winFile1 [open WinFile1 w]

proc Finish {} {
global ns ntrace namfile
$ns flush-trace
close $ntrace
close $namfile
exec nam prog4.nam &

exec xgraph WinFile0 WinFile1 &
exit 0
}

proc PlotWindow {tcpSource file} {
global ns
set time 0.1
set now [$ns now]
set cwnd [$tcpSource set cwnd_]
puts $file "$now $cwnd"
$ns at [expr $now+time] "plotWindow $tcpSource $file"
}

for {set i 0} {$i<6} {incr i} {
set n($i) [$ns node]
}
$ns duplex-link $n(0) $n(2) 2Mb 10ms DropTail
$ns duplex-link $n(1) $n(2) 2Mb 10ms DropTail
$ns duplex-link $n(2) $n(3) 0.6Mb 100ms DropTail

set lan [$ns newLan "$n(3) $n(4) $n(5)" 0.5Mb 40ms LL Queue/DropTail MAC/802_3 Channel]

$ns duplex-link-op $n(0) $n(2) orient right-down
$ns duplex-link-op $n(1) $n(2) orient right-up
$ns duplex-link-op $n(2) $n(3) orient right

$ns queue-limit $n(2) $n(3) 20
$ns duplex-link-op $n(2) $n(3) queuePos 0.5
```

```
set loss_module [new ErrorModel]
$loss_module ranvar [new RandomVariable/Uniform]
$loss_module drop-target [new Agent/Null]
$ns lossmodel $loss_module $n(2) $n(3)

set tcp0 [new Agent/TCP/Newreno]
$tcp0 set fid_ 1
$tcp0 set window_ 8000
$tcp0 set packetSize_ 552
$ns attach-agent $n(0) $tcp0
set sink0 [new Agent/TCPSink/DelAck]
$ns attach-agent $n(4) $sink0
$ns connect $tcp0 $sink0

set ftp0 [new Application/FTP]
$ftp0 attach-agent $tcp0
$ftp0 set type_ FTP
set tcp1 [new Agent/TCP/Newreno]
$tcp1 set fid_ 2
$tcp1 set window_ 8000
$tcp1 set packetSize_ 552
$ns attach-agent $n(5) $tcp1
set sink1 [new Agent/TCPSink/DelAck]
$ns attach-agent &n(1) $sink1
$ns connect $tcp1 $sink1

set ftp1 [new Apllication/FTP]
$ftp1 attach-agent $tcp1
$ftp1 set type_ FTP

$ns at 0.1 "$ftp0 start"
$ns at 0.1 "PlotWindow $tcp0 $winFile0"
$ns at 0.5 "$ftp1 start"
$ns at 0.5 "PlotWindow $tcp1 $winFile1"
$ns at 25.0 "$ftp0 stop"
$ns at 25.1 "$ftp1 stop"
$ns at 25.2 "Finish"
$ns run
```