Q)Set up topology and demonstrate the working of multicast routing protocol. Plot the congestion window for the source node and write your observation on protocol performance. Assume your own parameters for bandwidth and delay.

***Save this file as p5.tcl:***

```
set ns [new Simulator -multicast on]
set tf [open prog5.tr w]
$ns trace-all $tf

set fd [open prog5.nam w]
$ns namtrace-all $fd

set n0 [$ns node]
set n1 [$ns node]
set n2 [$ns node]
set n3 [$ns node]
set n4 [$ns node]
set n5 [$ns node]
set n6 [$ns node]
set n7 [$ns node]

$ns duplex-link $n0 $n2 1.5Mb 10ms DropTail
$ns duplex-link $n1 $n2 1.5Mb 10ms DropTail
$ns duplex-link $n2 $n3 1.5Mb 10ms DropTail
$ns duplex-link $n3 $n4 1.5Mb 10ms DropTail
$ns duplex-link $n3 $n7 1.5Mb 10ms DropTail
$ns duplex-link $n4 $n5 1.5Mb 10ms DropTail
$ns duplex-link $n4 $n6 1.5Mb 10ms DropTail

set mproto DM
set mrthandle [$ns mrtproto $mproto {}]

set group1 [Node allocaddr]
set group2 [Node allocaddr]

set udp0 [new Agent/UDP]
$ns attach-agent $n0 $udp0
$udp0 set dst_addr_ $group1
$udp0 set dst_port_ 0
set cbr1 [new Application/Traffic/CBR]
$cbr1 attach-agent $udp0

set udp1 [new Agent/UDP]
$ns attach-agent $n1 $udp1
$udp1 set dst_addr_ $group2
$udp1 set dst_port_ 0
set cbr2 [new Application/Traffic/CBR]
$cbr2 attach-agent $udp1

set rcvr1 [new Agent/Null]
```

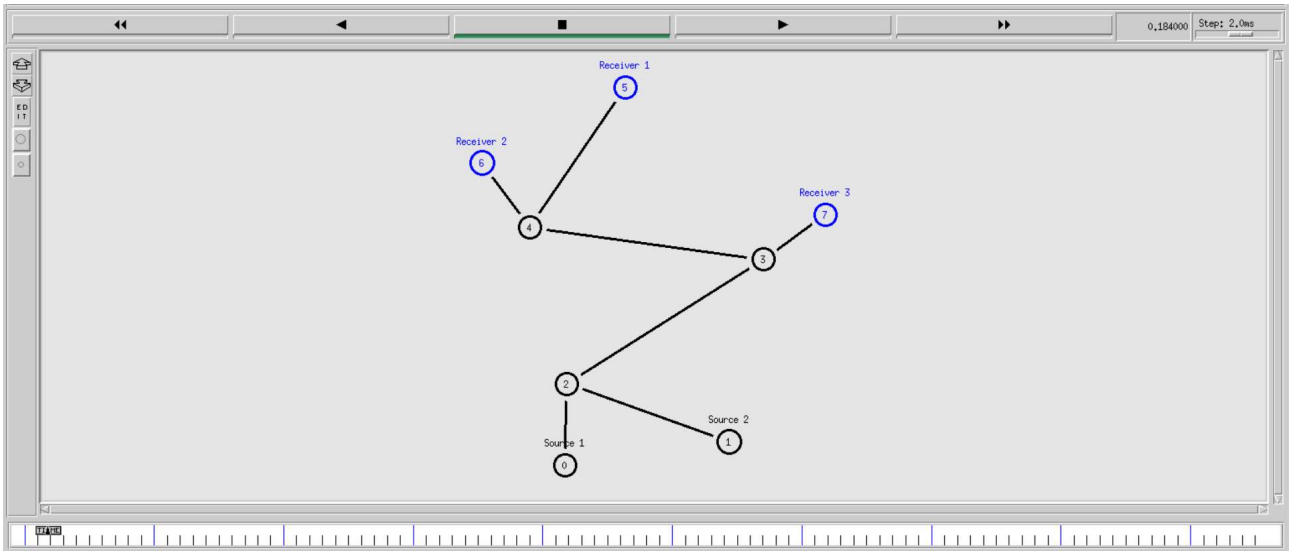
```
$ns attach-agent $n5 $rcvr1
$ns at 1.0 "$n5 join-group $rcvr1 $group1"

set rcvr2 [new Agent/Null]
$ns attach-agent $n6 $rcvr2
$ns at 1.5 "$n6 join-group $rcvr2 $group1"

set rcvr3 [new Agent/Null]
$ns attach-agent $n7 $rcvr3
$ns at 2.0 "$n7 join-group $rcvr3 $group1"

set rcvr4 [new Agent/Null]
$ns attach-agent $n5 $rcvr1
$ns at 2.5 "$n5 join-group $rcvr1 $group2"

set rcvr5 [new Agent/Null]
$ns attach-agent $n6 $rcvr1
$ns at 3.0 "$n6 join-group $rcvr2 $group2"

set rcvr6 [new Agent/Null]
$ns attach-agent $n7 $rcvr1
$ns at 3.5 "$n7 join-group $rcvr3 $group2"

$ns at 4.0 "$n5 leave-group $rcvr1 $group1"
$ns at 4.5 "$n6 leave-group $rcvr2 $group1"
$ns at 5.0 "$n7 leave-group $rcvr3 $group1"

$ns at 5.5 "$n5 leave-group $rcvr4 $group2"
$ns at 6.0 "$n6 leave-group $rcvr5 $group2"
$ns at 6.5 "$n7 leave-group $rcvr6 $group2"

$ns at 0.5 "$cbr1 start"
$ns at 9.5 "$cbr1 stop"

$ns at 0.5 "$cbr2 start"
$ns at 9.5 "$cbr2 stop"

$ns at 10.0 "finish"

proc finish {} {
global ns tf fd
$ns flush-trace
close $tf
close $fd
exec nam prog5.nam &
exit 0
}

$n0 label "Source 1"
$n1 label "Source 2"
$ns color 1 red
$ns color 2 green
```

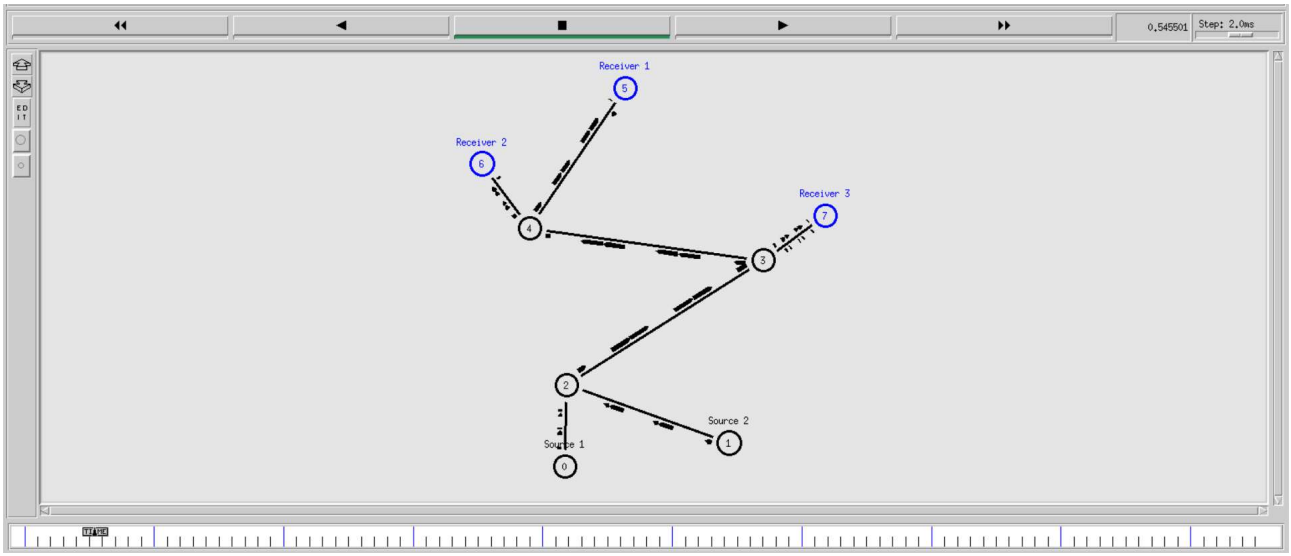
```
$n5 label "Receiver 1"
$n5 color blue

$n6 label "Receiver 2"
$n6 color blue

$n7 label "Receiver 3"
$n7 color blue

$ns run
```

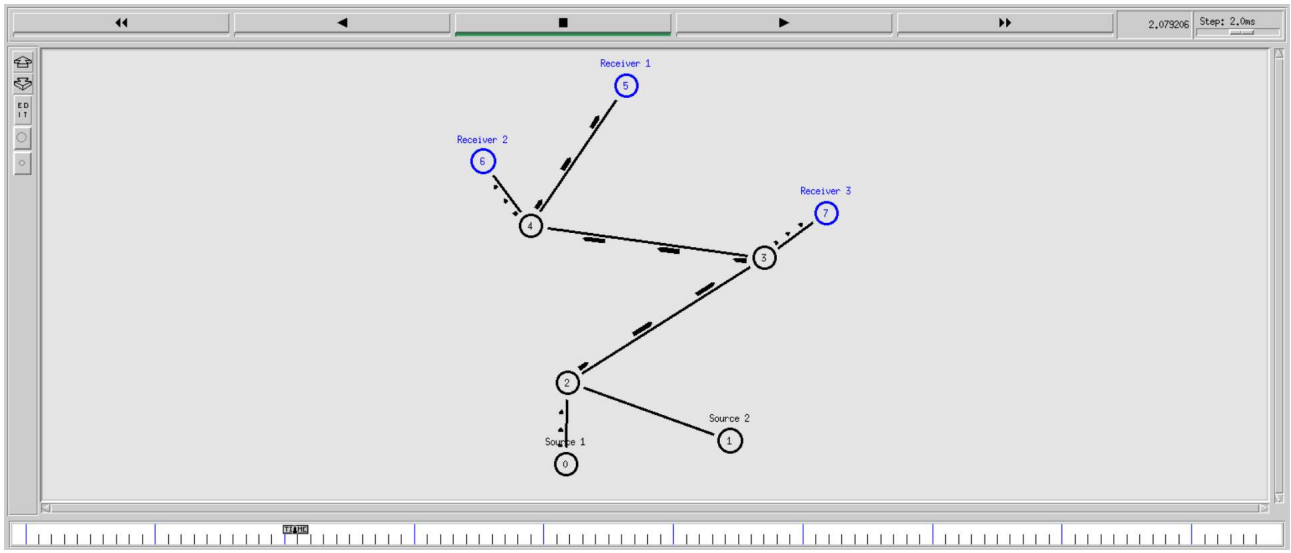
***Execution command:***

1) ns p5.tcl

***Outputs:***




2.079206
Step: 2.0ms
Receiver 1
5
Receiver 2
6
Receiver 3
7
4
3
2
Source 2
1
Source 1
0