## COL334 - Assignment 4 - Part B

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### **Description for Part B:**

In this part of the assignment we are going to analyse the routing protocol on the topology given in the assignment by varying various parameters as given in the sub parts and create plots via studying the routing tables for each of the routers present in the given topology.

#### **Code Explanation:**

The code files used to analyse this part are partB1.cc,partB2.cc,partB3.cc, plotB1.py, plotB2.py, plotB3.py where the files partB1.cc, partB2.cc,partB3.cc are used to print the corresponding routing tables in the terminal when ran using ns3 and the files plotB1.py,plotB2.py and plotB3.py are the corresponding plotting scripts to generate the manual plots of convergence generated using Matplotlib library.

In order to implement this part B, I have taken the reference code from **rip-simple-network.cc** file and just edited the code to match the topology given in the assignment and then printed the routing tables at various instances in the terminal by varying the different parameters.

#### Part B(i)

### (A) Routing Tables as well as Graphs:

#### (a) For CSMA Delay equal to 100 Millisecond

For this delay value, we get the following routing tables (Here Node 2 means router 1, Node 3 means router 2 and Node 4 means router 3):

```
Node: 2, Time: +0.0s, Local time: +0.0s, Ipv4ListRouting table
 Priority: 0 Protocol: ns3::Rip
Node: 2, Time: +0.0s, Local time: +0.0s, IPv4 RIP table
Destination Gateway
                        Genmask
                                           Flags Metric Ref
                                                              Use
Iface
10.0.0.0
             0.0.0.0
                             255.255.255.0 U
                                                 1
                                                               - 1
                            255.255.255.0 U
                                                 1
                                                                  2
10.0.1.0
             0.0.0.0
10.0.3.0
             0.0.0.0
                             255.255.255.0
                                                                  3
                                                 1
Node: 3, Time: +0.0s, Local time: +0.0s, Ipv4ListRouting table
```

Priority: 0 Protocol: ns3::Rip Node: 3, Time: +0.0s, Local time: +0.0s, IPv4 RIP table Destination Gateway Genmask Flags Metric Ref Use Iface 10.0.1.0 0.0.0.0 255.255.255.0 U 1 - 1 10.0.2.0 0.0.0.0 255.255.255.0 U 1 2 Node: 4, Time: +0.0s, Local time: +0.0s, Ipv4ListRouting table Priority: 0 Protocol: ns3::Rip Node: 4, Time: +0.0s, Local time: +0.0s, IPv4 RIP table Destination Genmask Gateway Flags Metric Ref Use Iface 10.0.2.0 0.0.0.0 255.255.255.0 U 1 - 1 255.255.255.0 U 10.0.3.0 0.0.0.0 1 2 10.0.4.0 0.0.0.0 255.255.255.0 U 3 1 Node: 2, Time: +10.0s, Local time: +10.0s, Ipv4ListRouting table Priority: 0 Protocol: ns3::Rip Node: 2, Time: +10.0s, Local time: +10.0s, IPv4 RIP table Destination Gateway Flags Metric Ref Genmask Use Iface 10.0.4.0 10.0.3.2 255.255.255.0 UGS 2 3 10.0.2.0 10.0.3.2 255.255.255.0 UGS 2 3 10.0.0.0 0.0.0.0 255.255.255.0 U 1 - 1 255.255.255.0 U 2 10.0.1.0 0.0.0.0 1 0.0.0.0 255.255.255.0 U 1 10.0.3.0 3 Node: 3, Time: +10.0s, Local time: +10.0s, Ipv4ListRouting table Priority: 0 Protocol: ns3::Rip Node: 3, Time: +10.0s, Local time: +10.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.4.0	10.0.2.2	255.255.255.0	UGS	2	-	-	2
10.0.3.0	10.0.1.1	255.255.255.0	UGS	2	-	-	1
10.0.0.0	10.0.1.1	255.255.255.0	UGS	2	-	-	1
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.2.0	0.0.0.0	255.255.255.0	U	1	_	_	2

Node: 4, Time: +10.0s, Local time: +10.0s, Ipv4ListRouting table Priority: 0 Protocol: ns3::Rip

Node: 4, Time: +10.0s, Local time: +10.0s, IPv4 RIP table

Destination Gateway Genmask Flags Metric Ref Use

Iface

10.0.1.0	10.0.3.1	255.255.255.0	UGS	2	-	_	2	
10.0.0.0	10.0.3.1	255.255.255.0	UGS	2	-	-	2	
10.0.2.0	0.0.0.0	255.255.255.0	U	1	-	-	1	
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	-	2	
10.0.4.0	0.0.0.0	255.255.255.0	U	1	-	_	3	

Node: 2, Time: +50.0s, Local time: +50.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 2, Time: +50.0s, Local time: +50.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.4.0	10.0.3.2	255.255.255.0	UGS	2	_	-	3
10.0.2.0	10.0.3.2	255.255.255.0	UGS	2	_	-	3
10.0.0.0	0.0.0.0	255.255.255.0	U	1	_	-	1
10.0.1.0	0.0.0.0	255.255.255.0	U	1	_	-	2
10.0.3.0	0.0.0.0	255.255.255.0	U	1	_	_	3

Node: 3, Time: +50.0s, Local time: +50.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 3, Time: +50.0s, Local time: +50.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.4.0	10.0.2.2	255.255.255.0	UGS	2	-	-	2
10.0.3.0	10.0.1.1	255.255.255.0	UGS	2	-	-	1
10.0.0.0	10.0.1.1	255.255.255.0	UGS	2	-	-	1
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.2.0	0.0.0.0	255.255.255.0	U	1	_	_	2

Node: 4, Time: +50.0s, Local time: +50.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 4, Time: +50.0s, Local time: +50.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.1.0	10.0.3.1	255.255.255.0	UGS	2	-	-	2
10.0.0.0	10.0.3.1	255.255.255.0	UGS	2	-	-	2
10.0.2.0	0.0.0.0	255.255.255.0	U	1	-	_	1
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	_	2
10.0.4.0	0.0.0.0	255.255.255.0	U	1	_	_	3

Node: 2, Time: +100.0s, Local time: +100.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 2, Time: +100.0s, Local time: +100.0s, IPv4 RIP table

Destination Gateway Genmask Flags Metric Ref Use

Iface								
10.0.4.0	10.0.3.2	255.255.255.0	UGS	2	-	-	3	
10.0.2.0	10.0.3.2	255.255.255.0	UGS	2	-	-	3	
10.0.0.0	0.0.0.0	255.255.255.0	U	1	-	-	1	
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	-	2	
10.0.3.0	0.0.0.0	255.255.255.0	U	1	_	_	3	

Node: 3, Time: +100.0s, Local time: +100.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 3, Time: +100.0s, Local time: +100.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.4.0	10.0.2.2	255.255.255.0	UGS	2	-	-	2
10.0.3.0	10.0.1.1	255.255.255.0	UGS	2	-	-	1
10.0.0.0	10.0.1.1	255.255.255.0	UGS	2	-	-	1
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.2.0	0.0.0.0	255.255.255.0	U	1	_	_	2

Node: 4, Time: +100.0s, Local time: +100.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 4, Time: +100.0s, Local time: +100.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.1.0	10.0.3.1	255.255.255.0	UGS	2	-	-	2
10.0.0.0	10.0.3.1	255.255.255.0	UGS	2	-	-	2
10.0.2.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	-	2
10.0.4.0	0.0.0.0	255.255.255.0	U	1	_	_	3

Node: 2, Time: +500.0s, Local time: +500.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 2, Time: +500.0s, Local time: +500.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	<u>:</u>
Iface							
10.0.4.0	10.0.3.2	255.255.255.0	UGS	2	-	-	3
10.0.2.0	10.0.3.2	255.255.255.0	UGS	2	-	-	3
10.0.0.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	-	2
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	_	3

Node: 3, Time: +500.0s, Local time: +500.0s, Ipv4ListRouting table

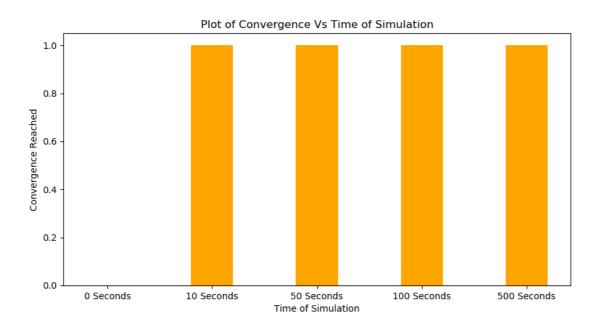
Priority: 0 Protocol: ns3::Rip

Node: 3, Time: +500.0s, Local time: +500.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.4.0	10.0.2.2	255.255.255.0	UGS	2	-	-	2
10.0.3.0	10.0.1.1	255.255.255.0	UGS	2	-	-	1
10.0.0.0	10.0.1.1	255.255.255.0	UGS	2	-	-	1
10.0.1.0	0.0.0.0	255.255.255.0	U	1	_	-	1
10.0.2.0	0.0.0.0	255.255.255.0	U	1	_	-	2
Node: 4, Time:	: +500.0s, Local	time: +500.0s, Ip	v4List	Routing	table		
Priority: 0	Protocol: ns3::	Rip					
Node: 4, Time:	: +500.0s, Local	time: +500.0s, IF	V4 RIP	table			
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	<u> </u>
Iface							
10.0.1.0	10.0.3.1	255.255.255.0	UGS	2	_	_	2
10.0.0.0	10.0.3.1	255.255.255.0	UGS	2	_	_	2
10.0.0.0	10.0.3.1	255.255.255.0 255.255.255.0	UGS U	2	- -	-	2
				_	- - -		_
10.0.2.0	0.0.0.0	255.255.255.0	U	1			1
10.0.2.0	0.0.0.0	255.255.255.0 255.255.255.0	U U	1			1 2

From the above routing tables we can see that at time 10 seconds, all the routers have the information about all the nodes that are reachable from that router, hence we can say that the routing tables converge after 10 seconds.

The corresponding plot of convergence is as follows:



## (b) For CSMA Delay equal to 1000 Millisecond

For this delay value, we get the following routing tables (Here Node 2 means router 1, Node 3 means router 2 and Node 4 means router 3):

	•	time: +0.0s, IPv4					
Destination Iface	Gateway	Genmask	Flag	s Metr	ic Ref	Use	5
10.0.0.0	0.0.0.0	255.255.255.0	U	1	_	_	
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	_	
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	-	,
Node: 3, Time	: +0.0s, Local	time: +0.0s, Ipv4L	istRou	ting ta	able		
Priority: 0	Protocol: ns3:	:Rip					
Node: 3, Time	: +0.0s, Local	time: +0.0s, IPv4	RIP ta	ble			
Destination	Gateway	Genmask	Flag	s Metr	ic Ref	Use	9
Iface							
10.0.1.0	0.0.0.0	255.255.255.0	U	1	_	-	
10.0.2.0	0.0.0.0	255.255.255.0	U	1	-	-	
Node: 4, Time	: +0.0s, Local	time: +0.0s, Ipv4L	istRou	ting ta	able		
Priority: 0	Protocol: ns3:	:Rip					
Node: 4, Time	: +0.0s, Local	time: +0.0s, IPv4	RIP ta	ble			
Destination	Gateway	Genmask	Flag	s Metr	ic Ref	Use	ē
Iface							
Trace							
	0.0.0.0	255.255.255.0	U	1	-	_	
10.0.2.0	0.0.0.0	255.255.255.0 255.255.255.0		1	-	-	
10.0.2.0	0.0.0.0		U	1	- - -	- - -	
10.0.2.0 10.0.3.0 10.0.4.0	0.0.0.0	255.255.255.0	U U	1		-	
10.0.2.0 10.0.3.0 10.0.4.0 Node: 2, Time	0.0.0.0	255.255.255.0 255.255.255.0 time: +10.0s, Ipv	U U	1		-	
10.0.2.0 10.0.3.0 10.0.4.0 Node: 2, Time Priority: 0	0.0.0.0 0.0.0.0 : +10.0s, Local Protocol: ns3:	255.255.255.0 255.255.255.0 time: +10.0s, Ipv	U U 4ListR	1 1 outing		-	
10.0.2.0 10.0.3.0 10.0.4.0 Node: 2, Time Priority: 0	0.0.0.0 0.0.0.0 : +10.0s, Local Protocol: ns3: : +10.0s, Local	255.255.255.0 255.255.255.0 time: +10.0s, Ipv	U U 4ListR 4 RIP	1 1 outing table	table	- - -	
10.0.2.0 10.0.3.0 10.0.4.0 Node: 2, Time Priority: 0 Node: 2, Time	0.0.0.0 0.0.0.0 : +10.0s, Local Protocol: ns3: : +10.0s, Local	255.255.255.0 255.255.255.0 time: +10.0s, Ipv	U U 4ListR 4 RIP	1 1 outing table	table	- - Use	
10.0.2.0 10.0.3.0 10.0.4.0 Node: 2, Time Priority: 0 Node: 2, Time Destination	0.0.0.0 0.0.0.0 : +10.0s, Local Protocol: ns3: : +10.0s, Local Gateway	255.255.255.0 255.255.255.0 time: +10.0s, Ipv	U U 4ListR 4 RIP Flag	1 1 outing table s Metr	table		ė
10.0.2.0 10.0.3.0 10.0.4.0 Node: 2, Time Priority: 0 Node: 2, Time Destination Iface 10.0.4.0	0.0.0.0 0.0.0.0 : +10.0s, Local Protocol: ns3: : +10.0s, Local Gateway  10.0.3.2	255.255.255.0 255.255.255.0 time: +10.0s, Ipv4 :Rip time: +10.0s, IPv4 Genmask	U U 4ListR 4 RIP Flag UGS	1 1 outing table s Metr	table ic Ref -	_	ē
10.0.2.0 10.0.3.0 10.0.4.0 Node: 2, Time Priority: 0 Node: 2, Time Destination Iface 10.0.4.0 10.0.2.0	0.0.0.0 0.0.0.0 1: +10.0s, Local Protocol: ns3: 1: +10.0s, Local Gateway 10.0.3.2 10.0.3.2	255.255.255.0 255.255.255.0 time: +10.0s, Ipv4 :Rip time: +10.0s, IPv4 Genmask	U U 4ListR 4 RIP Flag UGS UGS	1 1 outing table s Metr- 2 2	table ic Ref -	- -	9
10.0.2.0 10.0.3.0 10.0.4.0 Node: 2, Time Priority: 0 Node: 2, Time Destination Iface 10.0.4.0 10.0.2.0	0.0.0.0 0.0.0.0 1: +10.0s, Local Protocol: ns3: 1: +10.0s, Local Gateway 10.0.3.2 10.0.3.2 0.0.0.0	255.255.255.0 255.255.255.0 time: +10.0s, Ipva :Rip time: +10.0s, IPva Genmask 255.255.255.0 255.255.255.0	U U 4ListR 4 RIP Flag UGS UGS	1 1 outing table s Metr- 2 2 1	table ic Ref - -	- - -	
10.0.2.0 10.0.3.0 10.0.4.0 Node: 2, Time Priority: 0 Node: 2, Time Destination Iface 10.0.4.0 10.0.2.0 10.0.0.0	0.0.0.0 0.0.0.0 1: +10.0s, Local Protocol: ns3: 1: +10.0s, Local Gateway 10.0.3.2 10.0.3.2 0.0.0.0 0.0.0.0	255.255.255.0 255.255.255.0 time: +10.0s, Ipva :Rip time: +10.0s, IPva Genmask 255.255.255.0 255.255.255.0 255.255.255.0	U U 4ListR 4 RIP Flag UGS UGS U	1 1 outing table s Metr 2 2 1 1	table ic Ref - -	- - -	

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.4.0	10.0.2.2	255.255.255.0	UGS	2	-	-	2
10.0.3.0	10.0.2.2	255.255.255.0	UGS	2	-	-	2
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.2.0	0.0.0.0	255.255.255.0	U	1	_	-	2
Node: 4, Time:	+10.0s, Local tin	ne: +10.0s, Ipv4l	−istRou	uting ta	able		
Priority: 0 P	rotocol: ns3::Rip	)					
Node: 4, Time:	+10.0s, Local tin	ne: +10.0s, IPv4	RIP ta	able			
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.1.0	10.0.2.1	255.255.255.0	UGS	2	_	_	1
10.0.2.0	0.0.0.0	255.255.255.0	U	1	_	_	1
10.0.3.0	0.0.0.0	255.255.255.0	U	1	_	_	2
10.0.4.0	0.0.0.0	255.255.255.0	U	1	_	_	3
Node: 2, Time:	+50.0s, Local tin	ne: +50.0s, Ipv4l	−istRou	uting ta	able		
Priority: 0 P	rotocol: ns3::Rip						
Node: 2, Time:	+50.0s, Local tin	ne: +50.0s, IPv4	RIP ta	able			
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.4.0	10.0.3.2	255.255.255.0	UGS	2	_	_	3
10.0.2.0	10.0.3.2	255.255.255.0	UGS	2	_	_	3
10.0.0.0	0.0.0.0	255.255.255.0	U	1	_	_	1
10.0.1.0	0.0.0.0	255.255.255.0	U	1	_	_	2
10.0.3.0	0.0.0.0	255.255.255.0	U	1	_	-	3
Node: 3, Time:	+50.0s, Local tin	ne: +50.0s, Ipv4l	_istRou	uting ta	able		
Priority: 0 P	rotocol: ns3::Rip	)					
Node: 3, Time:	+50.0s, Local tin	ne: +50.0s, IPv4	RIP ta	able			
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.0.0	10.0.1.1	255.255.255.0	UGS	2	_	_	1
10.0.4.0	10.0.2.2	255.255.255.0	UGS	2	_	_	2
10.0.3.0	10.0.2.2	255.255.255.0	UGS	2	_	_	2
10.0.1.0	0.0.0.0	255.255.255.0	U	1	_	_	1
10 0 0	0 0 0 0	0== 0== 0== 0		_			

Node: 4, Time: +50.0s, Local time: +50.0s, Ipv4ListRouting table
Priority: 0 Protocol: ns3::Rip

Node: 4, Time: +50.0s, Local time: +50.0s, IPv4 RIP table

10.0.2.0 0.0.0.0 255.255.255.0 U 1

Destination Gateway Genmask Flags Metric Ref Use

I	face							
1	0.0.0.0	10.0.3.1	255.255.255.0	UGS	2	-	-	2
1	0.0.1.0	10.0.2.1	255.255.255.0	UGS	2	-	-	1
1	0.0.2.0	0.0.0.0	255.255.255.0	U	1	-	-	1
1	0.0.3.0	0.0.0.0	255.255.255.0	U	1	-	-	2
1	0.0.4.0	0.0.0.0	255.255.255.0	U	1	_	_	3

Node: 2, Time: +100.0s, Local time: +100.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 2, Time: +100.0s, Local time: +100.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.4.0	10.0.3.2	255.255.255.0	UGS	2	-	-	3
10.0.2.0	10.0.3.2	255.255.255.0	UGS	2	-	-	3
10.0.0.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	-	2
10.0.3.0	0.0.0.0	255.255.255.0	U	1	_	-	3

Node: 3, Time: +100.0s, Local time: +100.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 3, Time: +100.0s, Local time: +100.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.0.0	10.0.1.1	255.255.255.0	UGS	2	-	-	1
10.0.4.0	10.0.2.2	255.255.255.0	UGS	2	-	-	2
10.0.3.0	10.0.2.2	255.255.255.0	UGS	2	-	-	2
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.2.0	0.0.0.0	255.255.255.0	U	1	_	_	2

Node: 4, Time: +100.0s, Local time: +100.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 4, Time: +100.0s, Local time: +100.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.0.0	10.0.3.1	255.255.255.0	UGS	2	-	-	2
10.0.1.0	10.0.2.1	255.255.255.0	UGS	2	-	-	1
10.0.2.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	-	2
10.0.4.0	0.0.0.0	255.255.255.0	U	1	_	_	3

Node: 2, Time: +500.0s, Local time: +500.0s, Ipv4ListRouting table

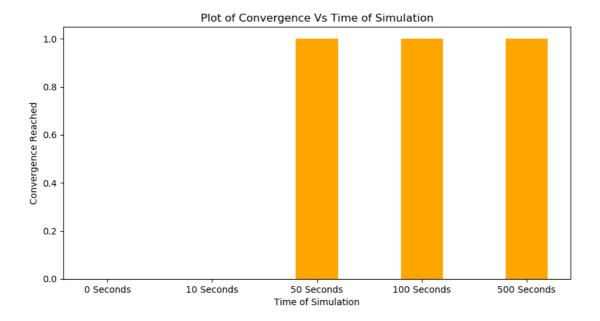
Priority: 0 Protocol: ns3::Rip

Node: 2, Time: +500.0s, Local time: +500.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface	,		Ü				
10.0.4.0	10.0.3.2	255.255.255.0	UGS	2	_	_	3
10.0.2.0	10.0.3.2	255.255.255.0	UGS	2	_	_	3
10.0.0.0	0.0.0.0	255.255.255.0	U	1	_	_	1
10.0.1.0	0.0.0.0	255.255.255.0	U	1	_	_	2
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	-	3
		l time: +500.0s, I	pv4List	Routing	table		
	Protocol: ns3::	•					
		l time: +500.0s, I			- 6		
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.0.0	10.0.1.1	255.255.255.0	UGS	2	_	_	1
10.0.4.0	10.0.2.2	255.255.255.0	UGS	2	-	_	2
10.0.3.0	10.0.2.2	255.255.255.0	UGS	2	_	-	2
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.2.0	0.0.0.0	255.255.255.0	U	1	-	-	2
Node: 4, Time	: +500.0s, Loca	l time: +500.0s, I	pv4List	Routing	table		
_	Protocol: ns3::						
Node: 4, Time	: +500.0s, Local	l time: +500.0s, I	Pv4 RIP	table			
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.0.0	10.0.3.1	255.255.255.0	UGS	2	_	-	2
10.0.1.0	10.0.2.1	255.255.255.0	UGS	2	-	-	1
10.0.2.0	0.0.0.0	255.255.255.0	U	1	-	_	1
10.0.3.0	0.0.0.0	255.255.255.0	U	1	_	_	2
10.0.4.0	0.0.0.0	255.255.255.0	U	1	-	_	3

From the above routing tables we can see that at time 50 seconds, all the routers have the information about all the nodes that are reachable from that router, hence we can say that the routing tables converge after 50 seconds.

The corresponding plot of convergence is as follows:



## (c) For CSMA Delay equal to 20000 Millisecond

For this delay value, we get the following routing tables (Here Node 2 means router 1, Node 3 means router 2 and Node 4 means router 3):

•	•		istRou	ting tal	ole		
Node: 2, Time:	Priority: 0 Protocol: ns3::Rip lode: 2, Time: +0.0s, Local time: +0.0s, IPv4 RIP table lestination						
Destination	Node: 2, Time: +0.0s, Local time: +0.0s, IPv4 RIP table Destination Gateway Genmask Flags Metric Ref Use  Iface  10.0.0.0 0.0.0.0 255.255.255.0 U 1 - 1  10.0.1.0 0.0.0.0 255.255.255.0 U 1 - 2  10.0.3.0 0.0.0.0 255.255.255.0 U 1 - 3  Node: 3, Time: +0.0s, Local time: +0.0s, Ipv4ListRouting table Priority: 0 Protocol: ns3::Rip  Node: 3, Time: +0.0s, Local time: +0.0s, IPv4 RIP table Destination Gateway Genmask Flags Metric Ref Use  Iface  10.0.1.0 0.0.0 255.255.255.0 U 1 - 1  10.0.2.0 0.0.0.0 255.255.255.0 U 1 - 2  Node: 4, Time: +0.0s, Local time: +0.0s, Ipv4ListRouting table Priority: 0 Protocol: ns3::Rip  Node: 4, Time: +0.0s, Local time: +0.0s, Ipv4ListRouting table Priority: 0 Protocol: ns3::Rip  Node: 4, Time: +0.0s, Local time: +0.0s, IPv4 RIP table Destination Gateway Genmask Flags Metric Ref Use  Iface  10.0.2.0 0.0.0.0 255.255.255.0 U 1 1						
Iface							
10.0.0.0	0.0.0.0	255.255.255.0	U	1	_	_	1
10.0.1.0	0.0.0.0	255.255.255.0	U	1	_	_	2
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	-	3
•	•		istRou	ting tal	ole		
Node: 3, Time:	+0.0s, Local ti	ime: +0.0s, IPv4	RIP ta	ble			
Destination	Priority: 0 Protocol: ns3::Rip  de: 2, Time: +0.0s, Local time: +0.0s, IPv4 RIP table  stination						
Iface							
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	-	1
Priority: 0 Protocol: ns3::Rip Node: 2, Time: +0.0s, Local time: +0.0s, IPv4 RIP table Destination							
			istRou	ting tal	ole		
Node: 4, Time:	+0.0s, Local ti	ime: +0.0s, IPv4	RIP ta	ble			
Destination Iface	Gateway	Genmask	Flag	s Metri	c Ref	Use	9
10.0.2.0	0.0.0.0	255.255.255.0	U	1	_	_	1
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	-	2

10.0.4.0 0.0.0.0 255.255.255.0 U 1 - - 3

Node: 2, Time: +10.0s, Local time: +10.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 2, Time: +10.0s, Local time: +10.0s, IPv4 RIP table

Destination Gateway Genmask Flags Metric Ref Use Iface 10.0.0.0 0.0.0.0 255.255.255.0 U 1 1 10.0.1.0 0.0.0.0 255.255.255.0 U 1 2 10.0.3.0 0.0.0.0 255.255.255.0 U 3 1

Node: 3, Time: +10.0s, Local time: +10.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 3, Time: +10.0s, Local time: +10.0s, IPv4 RIP table

Destination Gateway Genmask Flags Metric Ref Use Iface 10.0.1.0 0.0.0.0 255.255.255.0 U 1 1 10.0.2.0 0.0.0.0 255.255.255.0 U 1 2

Node: 4, Time: +10.0s, Local time: +10.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 4, Time: +10.0s, Local time: +10.0s, IPv4 RIP table

Destination Gateway Genmask Flags Metric Ref Use Iface 10.0.2.0 0.0.0.0 255.255.255.0 1 U 1 10.0.3.0 0.0.0.0 255.255.255.0 U 1 10.0.4.0 0.0.0.0 255.255.255.0 U 3 1

Node: 2, Time: +50.0s, Local time: +50.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 2, Time: +50.0s, Local time: +50.0s, IPv4 RIP table

Destination Flags Metric Ref Gateway Genmask Use Iface 10.0.0.0 0.0.0.0 255.255.255.0 U 1 1 10.0.1.0 0.0.0.0 255.255.255.0 2 U 1 255.255.255.0 U 10.0.3.0 0.0.0.0 1 3

Node: 3, Time: +50.0s, Local time: +50.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 3, Time: +50.0s, Local time: +50.0s, IPv4 RIP table

Destination Gateway Genmask Flags Metric Ref Use Iface
10.0.1.0 0.0.0.0 255.255.255.0 U 1 - - 1

10.0.2.0 0.0.0.0 255.255.255.0 U 1 - - 2

Node: 4, Time: +50.0s, Local time: +50.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 4, Time: +50.0s, Local time: +50.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.2.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	-	2
10.0.4.0	0.0.0.0	255.255.255.0	U	1	_	_	3

Node: 2, Time: +100.0s, Local time: +100.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 2, Time: +100.0s, Local time: +100.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.4.0	10.0.3.2	255.255.255.0	UGS	2	_	-	3
10.0.2.0	10.0.3.2	255.255.255.0	UGS	2	_	-	3
10.0.0.0	0.0.0.0	255.255.255.0	U	1	_	-	1
10.0.1.0	0.0.0.0	255.255.255.0	U	1	_	-	2
10.0.3.0	0.0.0.0	255.255.255.0	U	1	_	_	3

Node: 3, Time: +100.0s, Local time: +100.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 3, Time: +100.0s, Local time: +100.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	j
Iface							
10.0.4.0	10.0.2.2	255.255.255.0	UGS	2	-	-	2
10.0.3.0	10.0.2.2	255.255.255.0	UGS	2	-	-	2
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.2.0	0.0.0.0	255.255.255.0	U	1	_	-	2

Node: 4, Time: +100.0s, Local time: +100.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 4, Time: +100.0s, Local time: +100.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.2.0	0.0.0.0	255.255.255.0	U	1	_	-	1
10.0.3.0	0.0.0.0	255.255.255.0	U	1	_	-	2
10.0.4.0	0.0.0.0	255.255.255.0	U	1	_	_	3

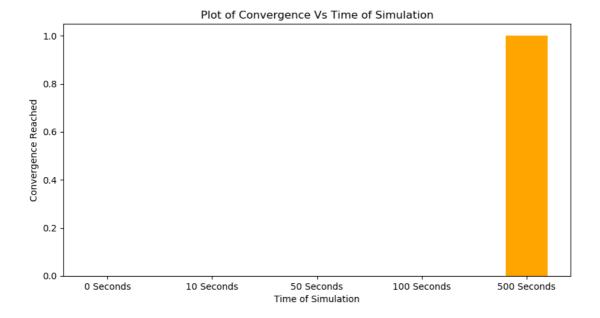
Node: 2, Time: +500.0s, Local time: +500.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 2, Time:	+500.0s, Local	l time: +500.0s, ]		table			
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.4.0	10.0.3.2	255.255.255.0	UGS	2	_	-	3
10.0.2.0	10.0.3.2	255.255.255.0	UGS	2	-	-	3
10.0.0.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	_	2
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	-	3
Node: 3, Time:	+500.0s, Local	l time: +500.0s, ]	pv4List	Routing	table		
Priority: 0	Protocol: ns3::	Rip					
Node: 3, Time:	+500.0s, Local	l time: +500.0s, ]					
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.0.0	10.0.1.1	255.255.255.0	UGS	2	_	-	1
10.0.4.0	10.0.2.2	255.255.255.0	UGS	2	-	-	2
10.0.3.0	10.0.2.2	255.255.255.0	UGS	2	-	_	2
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	_	1
10.0.2.0	0.0.0.0	255.255.255.0	U	1	-	-	2
Node: 4, Time:	+500.0s, Local	l time: +500.0s, ]	pv4List	Routing	table		
Priority: 0	Protocol: ns3::	Rip					
Node: 4, Time:	+500.0s, Local	l time: +500.0s, ]	Pv4 RIP	table			
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.1.0	10.0.3.1	255.255.255.0	UGS	2	-	_	2
10.0.0.0	10.0.3.1	255.255.255.0	UGS	2	-	_	2
10.0.2.0	0.0.0.0	255.255.255.0	U	1	-	_	1
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	_	2
							3

From the above routing tables we can see that at time 500 seconds, all the routers have the information about all the nodes that are reachable from that router, hence we can say that the routing tables converge after 500 seconds.

The corresponding plot of convergence is as follows:



## (d) For CSMA Delay equal to 80000 Millisecond

For this delay value, we get the following routing tables (Here Node 2 means router 1, Node 3 means router 2 and Node 4 means router 3):

•	•		istRou	ting tal	ole		
Node: 2, Time:	Priority: 0 Protocol: ns3::Rip lode: 2, Time: +0.0s, Local time: +0.0s, IPv4 RIP table lestination						
Destination	Node: 2, Time: +0.0s, Local time: +0.0s, IPv4 RIP table Destination Gateway Genmask Flags Metric Ref Use  Iface  10.0.0.0 0.0.0.0 255.255.255.0 U 1 - 1  10.0.1.0 0.0.0.0 255.255.255.0 U 1 - 2  10.0.3.0 0.0.0.0 255.255.255.0 U 1 - 3  Node: 3, Time: +0.0s, Local time: +0.0s, Ipv4ListRouting table Priority: 0 Protocol: ns3::Rip  Node: 3, Time: +0.0s, Local time: +0.0s, IPv4 RIP table Destination Gateway Genmask Flags Metric Ref Use  Iface  10.0.1.0 0.0.0 255.255.255.0 U 1 - 1  10.0.2.0 0.0.0.0 255.255.255.0 U 1 - 2  Node: 4, Time: +0.0s, Local time: +0.0s, Ipv4ListRouting table Priority: 0 Protocol: ns3::Rip  Node: 4, Time: +0.0s, Local time: +0.0s, Ipv4ListRouting table Priority: 0 Protocol: ns3::Rip  Node: 4, Time: +0.0s, Local time: +0.0s, IPv4 RIP table Destination Gateway Genmask Flags Metric Ref Use  Iface  10.0.2.0 0.0.0.0 255.255.255.0 U 1 1						
Iface							
10.0.0.0	0.0.0.0	255.255.255.0	U	1	_	_	1
10.0.1.0	0.0.0.0	255.255.255.0	U	1	_	_	2
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	-	3
•	•		istRou	ting tal	ole		
Node: 3, Time:	+0.0s, Local ti	ime: +0.0s, IPv4	RIP ta	ble			
Destination	Priority: 0 Protocol: ns3::Rip  de: 2, Time: +0.0s, Local time: +0.0s, IPv4 RIP table  stination						
Iface							
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	-	1
Priority: 0 Protocol: ns3::Rip Node: 2, Time: +0.0s, Local time: +0.0s, IPv4 RIP table Destination							
			istRou	ting tal	ole		
Node: 4, Time:	+0.0s, Local ti	ime: +0.0s, IPv4	RIP ta	ble			
Destination Iface	Gateway	Genmask	Flag	s Metri	c Ref	Use	9
10.0.2.0	0.0.0.0	255.255.255.0	U	1	_	_	1
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	-	2

10.0.4.0 0.0.0.0 255.255.255.0 U 1 - - 3

Node: 2, Time: +10.0s, Local time: +10.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 2, Time: +10.0s, Local time: +10.0s, IPv4 RIP table

Destination Gateway Genmask Flags Metric Ref Use Iface 10.0.0.0 0.0.0.0 255.255.255.0 U 1 1 10.0.1.0 0.0.0.0 255.255.255.0 U 1 2 10.0.3.0 0.0.0.0 255.255.255.0 U 3 1

Node: 3, Time: +10.0s, Local time: +10.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 3, Time: +10.0s, Local time: +10.0s, IPv4 RIP table

Destination Gateway Genmask Flags Metric Ref Use Iface 10.0.1.0 0.0.0.0 255.255.255.0 U 1 1 10.0.2.0 0.0.0.0 255.255.255.0 U 1 2

Node: 4, Time: +10.0s, Local time: +10.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 4, Time: +10.0s, Local time: +10.0s, IPv4 RIP table

Destination Gateway Genmask Flags Metric Ref Use Iface 10.0.2.0 0.0.0.0 255.255.255.0 1 U 1 10.0.3.0 0.0.0.0 255.255.255.0 U 1 10.0.4.0 0.0.0.0 255.255.255.0 U 3 1

Node: 2, Time: +50.0s, Local time: +50.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 2, Time: +50.0s, Local time: +50.0s, IPv4 RIP table

Destination Flags Metric Ref Gateway Genmask Use Iface 10.0.0.0 0.0.0.0 255.255.255.0 U 1 1 10.0.1.0 0.0.0.0 255.255.255.0 2 U 1 255.255.255.0 U 10.0.3.0 0.0.0.0 1 3

Node: 3, Time: +50.0s, Local time: +50.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 3, Time: +50.0s, Local time: +50.0s, IPv4 RIP table

Destination Gateway Genmask Flags Metric Ref Use Iface
10.0.1.0 0.0.0.0 255.255.255.0 U 1 - - 1

10.0.2.0 0.0.0.0 255.255.255.0 U 1 - - 2

Node: 4, Time: +50.0s, Local time: +50.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 4, Time: +50.0s, Local time: +50.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.2.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	-	2
10.0.4.0	0.0.0.0	255.255.255.0	U	1	_	_	3

Node: 2, Time: +100.0s, Local time: +100.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 2, Time: +100.0s, Local time: +100.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.0.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	-	2
10.0.3.0	0.0.0.0	255.255.255.0	U	1	_	_	3

Node: 3, Time: +100.0s, Local time: +100.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 3, Time: +100.0s, Local time: +100.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.2.0	0.0.0.0	255.255.255.0	U	1	_	_	2

Node: 4, Time: +100.0s, Local time: +100.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 4, Time: +100.0s, Local time: +100.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.2.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	_	2
10.0.4.0	0.0.0.0	255.255.255.0	U	1	_	_	3

Node: 2, Time: +500.0s, Local time: +500.0s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

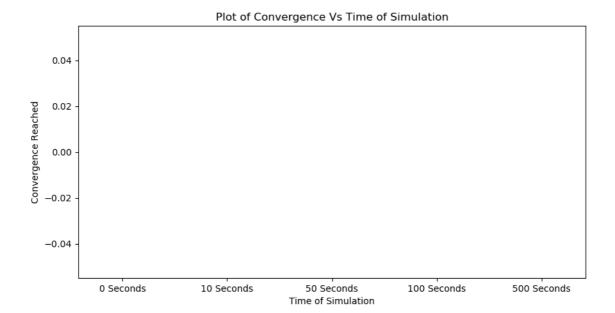
Node: 2, Time: +500.0s, Local time: +500.0s, IPv4 RIP table

Destination	Gateway	Genmask	Flags	s Metric	Ref	Use	
Iface							
10.0.4.0	10.0.3.2	255.255.255.0	UGS	2	_	_	3

10.0.2.0	10.0.3.2	255.255.255.0	UGS	2	-	-	3
10.0.0.0	0.0.0.0	255.255.255.0	U	1	-	-	1
10.0.1.0	0.0.0.0	255.255.255.0	U	1	-	_	2
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	_	3
Node: 3, Time:	+500.0s, Local	time: +500.0s, Ip	v4List	Routing	table		
Priority: 0	Protocol: ns3::R	ip					
Node: 3, Time:	+500.0s, Local	time: +500.0s, IF	v4 RIP	table			
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.3.0	10.0.2.2	255.255.255.0	UGS	2	_	_	2
10.0.4.0	10.0.2.2	255.255.255.0	UGS	2	_	_	2
10.0.1.0	0.0.0.0	255.255.255.0	U	1	_	_	1
10.0.2.0	0.0.0.0	255.255.255.0	U	1	-	-	2
Node: 4, Time:	+500.0s, Local	time: +500.0s, Ip	v4List	Routing	table		
Priority: 0	Protocol: ns3::R	ip					
Node: 4, Time:	+500.0s, Local	time: +500.0s, IF	v4 RIP	table			
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	
Iface							
10.0.1.0	10.0.2.1	255.255.255.0	UGS	2	_	_	1
10.0.2.0	0.0.0.0	255.255.255.0	U	1	_	_	1
10.0.3.0	0.0.0.0	255.255.255.0	U	1	_	_	2
10.0.4.0	0.0.0.0	255.255.255.0	U	1	-	_	3

From the above routing tables we can see that even at time 500 seconds, all the routers do not have the information about all the nodes that are reachable from that router, hence we can say that the routing tables does **not converge** hence all values are 0 in the below bar graph till 500 seconds.

The corresponding plot of convergence is as follows:



## (B) Observation and Explanation for Part B(i):

Here after observing these routing tables, my observation is that as we increase the value of channel delay (CSMA channel here), then the time taken for the information to reach across each subnet increases, resulting in a **more time required for convergence**. This happens because of **increased travelling time** per frame to propagate information via the routing protocol.

#### Part B(ii)

(a) Here the routing tables printed at time 121 seconds are:Labels: Node2 → Router1, Node3 → Router2, Node4 → Router3

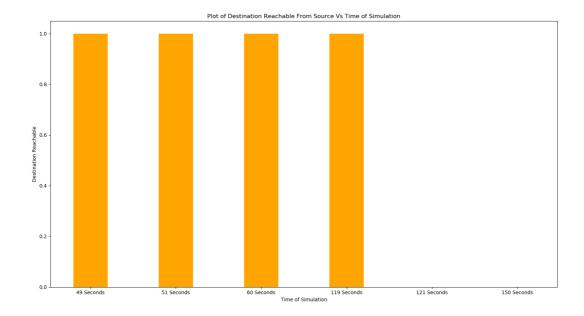
```
Node: 2, Time: +121.0s, Local time: +121.0s, Ipv4ListRouting table
  Priority: 0 Protocol: ns3::Rip
Node: 2, Time: +121.0s, Local time: +121.0s, IPv4 RIP table
Destination
                                 Genmask
                Gateway
                                                  Flags Metric Ref
                                                                      Use
Iface
10.0.0.0
                0.0.0.0
                                 255.255.255.0
                                                                           1
Node: 3, Time: +121.0s, Local time: +121.0s, Ipv4ListRouting table
  Priority: 0 Protocol: ns3::Rip
Node: 3, Time: +121.0s, Local time: +121.0s, IPv4 RIP table
Destination
                Gateway
                                 Genmask
                                                  Flags Metric Ref
                                                                      Use
Iface
10.0.4.0
                10.0.2.2
                                 255.255.255.0
                                                  UGS
                                                                           2
10.0.3.0
                                                                           2
                10.0.2.2
                                 255.255.255.0
                                                  UGS
                                                        2
                                                                           2
                10.0.2.2
10.0.0.0
                                 255.255.255.0
                                                  UGS
                                                        3
10.0.2.0
                0.0.0.0
                                 255.255.255.0
                                                                           2
                                                  U
                                                        1
```

```
Node: 4, Time: +121.0s, Local time: +121.0s, Ipv4ListRouting table
 Priority: 0 Protocol: ns3::Rip
Node: 4, Time: +121.0s, Local time: +121.0s, IPv4 RIP table
Destination
               Gateway
                              Genmask
                                              Flags Metric Ref
                                                                 Use
Iface
10.0.1.0
              10.0.2.1
                              255.255.255.0 UGS
                                                   16
                                                                     1
10.0.2.0
              0.0.0.0
                             255.255.255.0
                                              U
                                                   1
                                                                     1
                              255.255.255.0 U
10.0.4.0
              0.0.0.0
                                                   1
                                                                     3
```

The routing tables at time 180 seconds are as follows with same labelling convention:

```
Node: 2, Time: +180.0s, Local time: +180.0s, Ipv4ListRouting table
 Priority: 0 Protocol: ns3::Rip
Node: 2, Time: +180.0s, Local time: +180.0s, IPv4 RIP table
Destination Gateway
                             Genmask
                                           Flags Metric Ref
                                                              Use
Iface
10.0.0.0
                             255.255.255.0 U
         0.0.0.0
                                                 1
Node: 3, Time: +180.0s, Local time: +180.0s, Ipv4ListRouting table
 Priority: 0 Protocol: ns3::Rip
Node: 3, Time: +180.0s, Local time: +180.0s, IPv4 RIP table
Destination
           Gateway
                             Genmask
                                           Flags Metric Ref
                                                              Use
Iface
             10.0.2.2 255.255.255.0 UGS
10.0.4.0
                                                 2
                                                                  2
10.0.2.0 0.0.0.0
                           255.255.255.0 U
                                                 1
                                                                  2
Node: 4, Time: +180.0s, Local time: +180.0s, Ipv4ListRouting table
 Priority: 0 Protocol: ns3::Rip
Node: 4, Time: +180.0s, Local time: +180.0s, IPv4 RIP table
Destination Gateway
                                           Flags Metric Ref
                            Genmask
                                                              Use
Iface
10.0.1.0
             10.0.2.1
                             255.255.255.0 UGS
                                                 16
                                                                  1
10.0.2.0
             0.0.0.0
                             255.255.255.0 U
                                                 1
                                                                  1
10.0.4.0
              0.0.0.0
                             255.255.255.0 U
                                                 1
                                                                  3
```

(b) In order to check the reachability to destination from the source, we will print the routing table of the router next to source (i.e. router 1) and check if the subnet in which the destination node lies is present in that routing table or not (Note: In order to do this, I have left some commented portion in its code file which can be uncommented to check for the routing tables at corresponding time stamps). The graph of reachability is as follows:



(c) By seeing the above reachability graph and observing the routing table of router 1(connected to source) at time 51 seconds, 119 seconds and 121 seconds. We observe a **similarity** between the behaviour of reachability at time 51 seconds and 119 seconds because at both these time stamps the only possible way from source datagram to reach the destination is to take the path via the link R1-R3 while we observe a **difference** between behaviour of reachability at time 119 seconds and time 121 seconds since there is path for a datagram from source to destination at time 121 seconds as all the connections from router 1 going towards destination have torn down.

## Part B(iii)

(a) Here the routing tables at time 70 seconds are:

Labels: Node2 → Router1, Node3 → Router2, Node4 → Router3

```
Node: 2, Time: +70.0s, Local time: +70.0s, Ipv4ListRouting table
  Priority: 0 Protocol: ns3::Rip
Node: 2, Time: +70.0s, Local time: +70.0s, IPv4 RIP table
Destination
                Gateway
                                Genmask
                                                 Flags Metric Ref
                                                                     Use
Iface
10.0.0.0
                0.0.0.0
                                255.255.255.0
Node: 3, Time: +70.0s, Local time: +70.0s, Ipv4ListRouting table
  Priority: 0 Protocol: ns3::Rip
Node: 3, Time: +70.0s, Local time: +70.0s, IPv4 RIP table
Destination
                Gateway
                                Genmask
                                                 Flags Metric Ref
                                                                     Use
Iface
10.0.4.0
                10.0.2.2
                                255.255.255.0
                                                 UGS
```

10.0.2.0	0.0.0.0	255.255.255.0	U	1	-	-	2
•	: +70.0s, Local d	time: +70.0s, Ipv4 Rip	4ListR	outing	table		
Node: 4, Time	: +70.0s, Local 1	time: +70.0s, IPv	4 RIP	table			
Destination	Gateway	Genmask	Flag	s Metri	c Ref	Use	9
Iface							
10.0.2.0	0.0.0.0	255.255.255.0	U	1	-	_	1
10.0.4.0	0.0.0.0	255.255.255.0	U	1	-	_	3

# The routing tables at time 180 seconds are as follows with the same labelling convention:

	+180.0s, Local t Protocol: ns3::Ri		v4List	Routing	table		
Node: 2, Time:	+180.0s, Local t	ime: +180.0s, IF	v4 RIP	table			
Destination Iface	Gateway	Genmask	Flags	Metric	Ref	Use	è
10.0.4.0	10.0.3.2	255.255.255.0	UGS	2	_	_	3
10.0.2.0	10.0.1.2	255.255.255.0	UGS	2	_	_	2
10.0.0.0	0.0.0.0	255.255.255.0	U	1	_	_	1
10.0.1.0	0.0.0.0	255.255.255.0	U	1	_	_	2
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	-	3
Priority: 0 F	+180.0s, Local t	ip			table		
	+180.0s, Local t				D (		
Destination	Gateway	Genmask	Flags	Metric	кет	Use	2
Iface	10 0 0 0	255 255 255 2	1166	2			2
10.0.4.0	10.0.2.2	255.255.255.0	UGS	2	_	_	2
10.0.3.0	10.0.1.1	255.255.255.0	UGS	2	_	_	1
10.0.0.0	10.0.1.1	255.255.255.0	UGS	2	_	_	1
10.0.1.0	10.0.2.2	255.255.255.0	UGS	3	_	_	2
10.0.2.0	0.0.0.0	255.255.255.0	U	1	_	_	2
10.0.1.0	0.0.0.0	255.255.255.0	U	1	_	-	1
	+180.0s, Local t Protocol: ns3::Ri		v4List	Routing	table		
Node: 4, Time:	+180.0s, Local t	ime: +180.0s, IF	v4 RIP	table			
Destination Iface	Gateway	Genmask	Flags	Metric	Ref	Use	2
10.0.1.0	10.0.3.1	255.255.255.0	UGS	2	_	_	2
10.0.0.0	10.0.3.1	255.255.255.0	UGS	2	-	_	2

10.0.2.0	0.0.0.0	255.255.255.0	U	1	-	_	1
10.0.3.0	10.0.2.1	255.255.255.0	UGS	3	-	-	1
10.0.4.0	0.0.0.0	255.255.255.0	U	1	-	-	3
10.0.3.0	0.0.0.0	255.255.255.0	U	1	-	_	2

(b) In order to check the reachability to destination from the source, we will print the routing table of the router next to source (i.e. router 1) and check if the subnet in which the destination node lies is present in that routing table or not (Note: In order to do this, I have left some commented portion in its code file which can be uncommented to check for the routing tables at corresponding time stamps). The graph of reachability is as follows:

