Part B

B1

(a) myRIP.py created

(b) Routing tables at each node

H1 routing table

```
mininet> h1 route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.2.7.1       0.0.0.0         UG    0      0        0 h1-eth0
172.2.7.0       0.0.0.0         255.255.255.0   U     0      0        0 h1-eth0
```

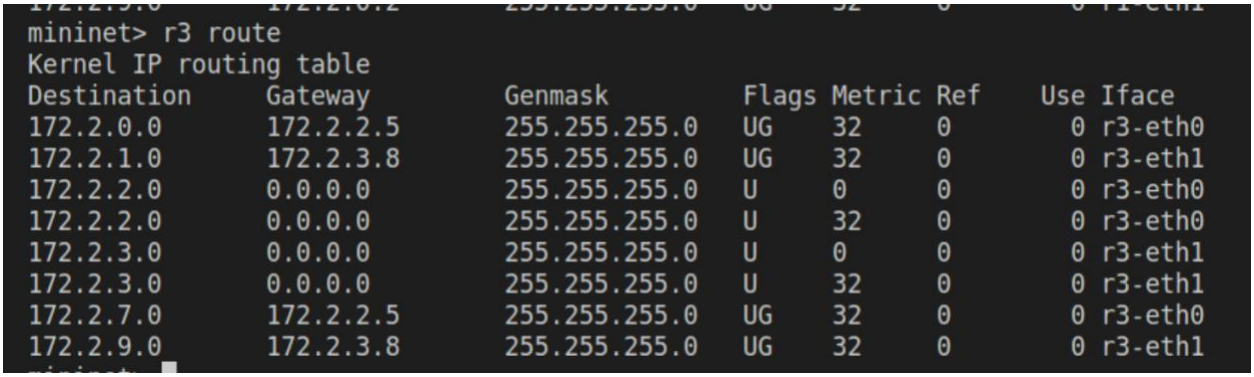
R1 routing table

```
mininet> r1 route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
172.2.0.0       0.0.0.0         255.255.255.0   U     0      0        0 r1-eth1
172.2.0.0       0.0.0.0         255.255.255.0   U     32     0        0 r1-eth1
172.2.1.0       172.2.0.2       255.255.255.0   UG    32     0        0 r1-eth1
172.2.2.0       0.0.0.0         255.255.255.0   U     0      0        0 r1-eth2
172.2.2.0       0.0.0.0         255.255.255.0   U     32     0        0 r1-eth2
172.2.3.0       172.2.2.6       255.255.255.0   UG    32     0        0 r1-eth2
172.2.7.0       0.0.0.0         255.255.255.0   U     0      0        0 r1-eth0
172.2.7.0       0.0.0.0         255.255.255.0   U     32     0        0 r1-eth0
172.2.9.0       172.2.0.2       255.255.255.0   UG    32     0        0 r1-eth1
```

R2 routing table

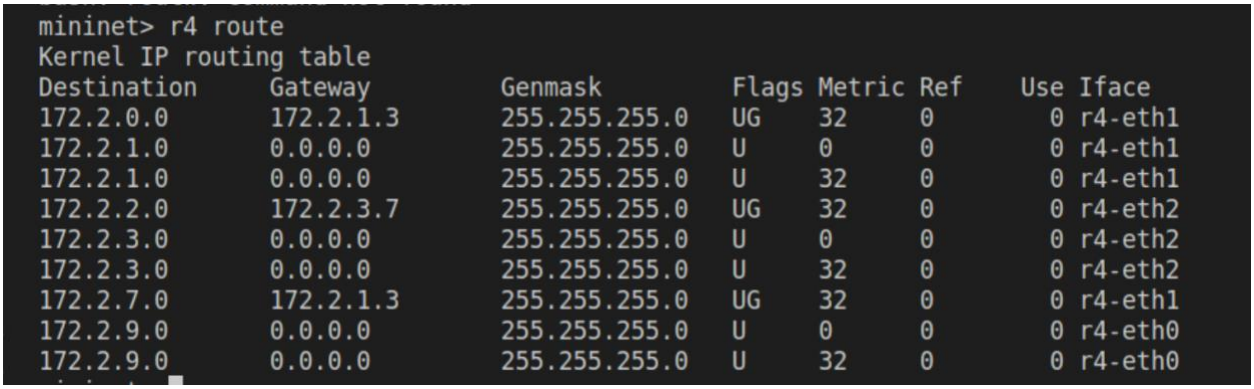
```
mininet> r2 route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
172.2.0.0       0.0.0.0         255.255.255.0   U     0      0        0 r2-eth0
172.2.0.0       0.0.0.0         255.255.255.0   U     32     0        0 r2-eth0
172.2.1.0       0.0.0.0         255.255.255.0   U     0      0        0 r2-eth1
172.2.1.0       0.0.0.0         255.255.255.0   U     32     0        0 r2-eth1
172.2.2.0       172.2.0.1       255.255.255.0   UG    32     0        0 r2-eth0
172.2.3.0       172.2.1.4       255.255.255.0   UG    32     0        0 r2-eth1
172.2.7.0       172.2.0.1       255.255.255.0   UG    32     0        0 r2-eth0
172.2.9.0       172.2.1.4       255.255.255.0   UG    32     0        0 r2-eth1
```

R3 routing table



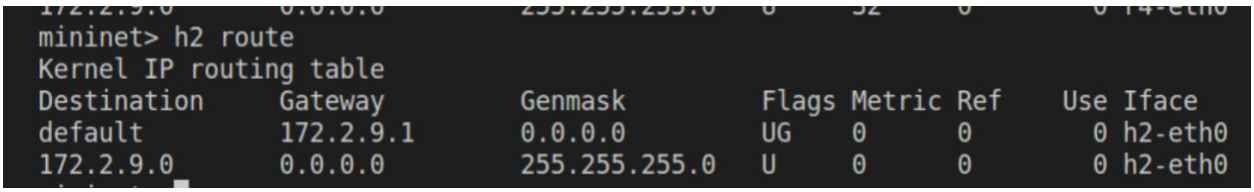
```
mininet> r3 route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
172.2.0.0       172.2.2.5       255.255.255.0   UG    32     0        0 r3-eth0
172.2.1.0       172.2.3.8       255.255.255.0   UG    32     0        0 r3-eth1
172.2.2.0       0.0.0.0         255.255.255.0   U     0      0        0 r3-eth0
172.2.2.0       0.0.0.0         255.255.255.0   U     32     0        0 r3-eth0
172.2.3.0       0.0.0.0         255.255.255.0   U     0      0        0 r3-eth1
172.2.3.0       0.0.0.0         255.255.255.0   U     32     0        0 r3-eth1
172.2.7.0       172.2.2.5       255.255.255.0   UG    32     0        0 r3-eth0
172.2.9.0       172.2.3.8       255.255.255.0   UG    32     0        0 r3-eth1
```

R4 routing table



```
mininet> r4 route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
172.2.0.0       172.2.1.3       255.255.255.0   UG    32     0        0 r4-eth1
172.2.1.0       0.0.0.0         255.255.255.0   U     0      0        0 r4-eth1
172.2.1.0       0.0.0.0         255.255.255.0   U     32     0        0 r4-eth1
172.2.2.0       172.2.3.7       255.255.255.0   UG    32     0        0 r4-eth2
172.2.3.0       0.0.0.0         255.255.255.0   U     0      0        0 r4-eth2
172.2.3.0       0.0.0.0         255.255.255.0   U     32     0        0 r4-eth2
172.2.7.0       172.2.1.3       255.255.255.0   UG    32     0        0 r4-eth1
172.2.9.0       0.0.0.0         255.255.255.0   U     0      0        0 r4-eth0
172.2.9.0       0.0.0.0         255.255.255.0   U     32     0        0 r4-eth0
```

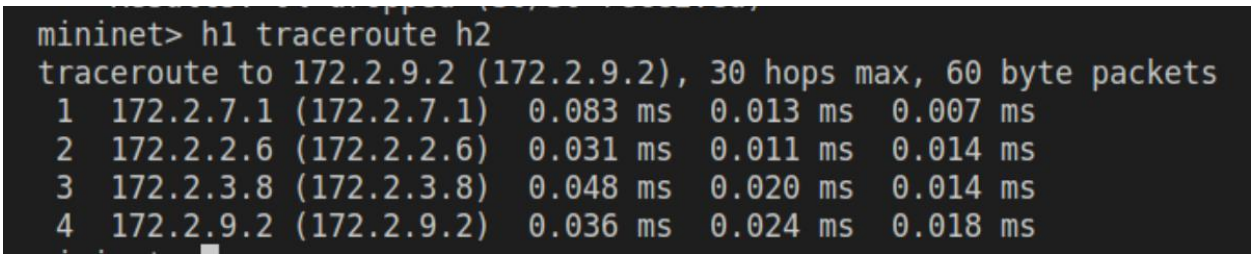
H2 routing table



```
mininet> h2 route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.2.9.1       0.0.0.0         UG    0      0        0 h2-eth0
172.2.9.0       0.0.0.0         255.255.255.0   U     0      0        0 h2-eth0
```

(c) The traceroute output that gives the path between nodes H1 & H2

Command used - *h1 traceroute h2*



```
mininet> h1 traceroute h2
traceroute to 172.2.9.2 (172.2.9.2), 30 hops max, 60 byte packets
 1  172.2.7.1 (172.2.7.1)  0.083 ms  0.013 ms  0.007 ms
 2  172.2.2.6 (172.2.2.6)  0.031 ms  0.011 ms  0.014 ms
 3  172.2.3.8 (172.2.3.8)  0.048 ms  0.020 ms  0.014 ms
 4  172.2.9.2 (172.2.9.2)  0.036 ms  0.024 ms  0.018 ms
```

The path of from h1 to h2 is *h1 -> r1 -> r3 -> r4-> h2*.

(d) BIRD config files created

Example of a bird config file of r1

```
debug protocols all;

protocol kernel{
    ipv4{
        import all;
        export all;
    };
}

protocol device{}

protocol direct{
    ipv4;
    interface "-arc","*";
}

protocol rip r1RIP{
    ipv4{
        import all;
        export all;
    };
    interface "r1-eth*"{
        mode broadcast;
    };
}
```

Similarly, I have created files for all the routers (r2, r3, r4) and hosts (h1 and h2)

(a) How to get the link to go down

To get the link go down I have used *link <node1> <node2> down* command. In the initial traceroute output we can see that the routing path is via r1 r3. So, to get the link of r1 and r3 to go down I use link *r1 r3 down*.

(b) The traceroute output that gives the new path between nodes H1 & H2

Commands used -

link r1 r3 down

h1 traceroute h2

```
mininet> link r1 r3 down
mininet> h1 traceroute h2
traceroute to 172.2.9.2 (172.2.9.2), 30 hops max, 60 byte packets
 1  172.2.7.1 (172.2.7.1)  0.068 ms  0.011 ms  0.006 ms
 2  172.2.0.2 (172.2.0.2)  0.073 ms  0.011 ms  0.008 ms
 3  172.2.1.4 (172.2.1.4)  0.036 ms  0.014 ms  0.011 ms
 4  172.2.9.2 (172.2.9.2)  0.025 ms  0.017 ms  0.015 ms
```

Here the routing path of h1 to h2 is via r2 i.e., *h1 -> r1 -> r2 -> r4 -> h2* instead of r3 as we took down the link of r1 r3.