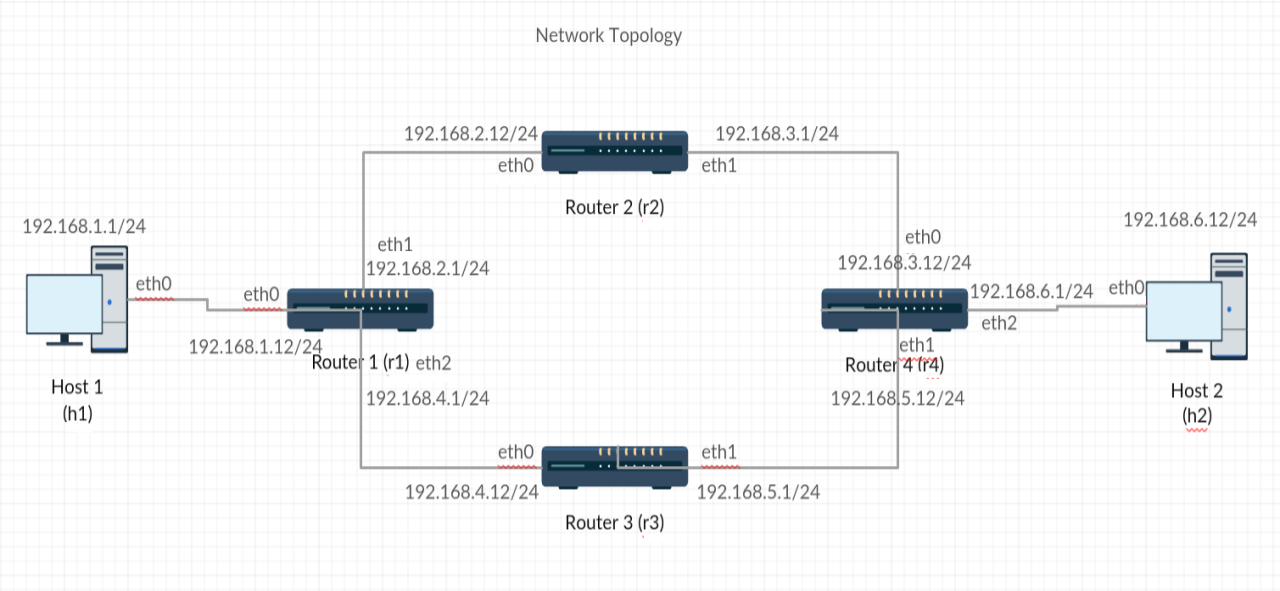
Part A

A1.

a). topo.py file is included in the directory.

b).

Network Topology:



A2.

a).

Host – 1:

Command Used:

py net.get('h1').cmd('route add -net 192.168.1.0 gw 192.168.1.12 net mask 255.255.255.0 h1-eth0')

Routing Table:

mininet@mininet-vm: ~/hw3

```
mininext> h1 route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0         192.168.1.12    0.0.0.0         UG    0      0        0 h1-eth0
192.168.1.0     0.0.0.0         255.255.255.0   U     0      0        0 h1-eth0
mininext>
```

Router – 1:

Command Used:

py net.get('r1').cmd('route add -net 192.168.1.0 gw 192.168.1.1 netmask 255.255.255.0 r1-eth0')
py net.get('r1').cmd('route add -net 192.168.2.0 gw 192.168.2.12 netmask 255.255.255.0 r1-eth1')
py net.get('r1').cmd('route add -net 192.168.4.0 gw 192.168.4.12 netmask 255.255.255.0 r1-eth2')
py net.get('r1').cmd('route add -net 192.168.3.0 gw 192.168.2.12 netmask 255.255.255.0 r1-eth1')
py net.get('r1').cmd('route add -net 192.168.5.0 gw 192.168.4.12 netmask 255.255.255.0 r1-eth2')
py net.get('r1').cmd('route add -net 192.168.6.0 gw 192.168.2.12 netmask 255.255.255.0 r1-eth1')

Routing Table:

mininet@mininet-vm: ~/hw3

```
mininext> r1 route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
192.168.1.0     192.168.1.1     255.255.255.0   UG    0      0        0 r1-eth0
192.168.1.0     0.0.0.0         255.255.255.0   U     0      0        0 r1-eth0
192.168.2.0     192.168.2.12    255.255.255.0   UG    0      0        0 r1-eth1
192.168.2.0     0.0.0.0         255.255.255.0   U     0      0        0 r1-eth1
192.168.3.0     192.168.2.12    255.255.255.0   UG    0      0        0 r1-eth1
192.168.4.0     192.168.4.12    255.255.255.0   UG    0      0        0 r1-eth2
192.168.4.0     0.0.0.0         255.255.255.0   U     0      0        0 r1-eth2
192.168.5.0     192.168.4.12    255.255.255.0   UG    0      0        0 r1-eth2
192.168.6.0     192.168.2.12    255.255.255.0   UG    0      0        0 r1-eth1
mininext>
```

Router – 2:

Command Used:

py net.get('r2').cmd('route add -net 192.168.1.0 gw 192.168.2.1 netmask 255.255.255.0 r2-eth0')
py net.get('r2').cmd('route add -net 192.168.2.0 gw 192.168.2.1 netmask 255.255.255.0 r2-eth0')
py net.get('r2').cmd('route add -net 192.168.4.0 gw 192.168.2.1 netmask 255.255.255.0 r2-eth0')
py net.get('r2').cmd('route add -net 192.168.3.0 gw 192.168.3.12 netmask 255.255.255.0 r2-eth1')
py net.get('r2').cmd('route add -net 192.168.5.0 gw 192.168.3.12 netmask 255.255.255.0 r2-eth1')
py net.get('r2').cmd('route add -net 192.168.6.0 gw 192.168.3.12 netmask 255.255.255.0 r2-eth1')

Routing Table:

mininet@mininet-vm: ~/hw3

```
mininext> r2 route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
192.168.1.0     192.168.2.1     255.255.255.0   UG    0      0        0 r2-eth0
192.168.2.0     192.168.2.1     255.255.255.0   UG    0      0        0 r2-eth0
192.168.2.0     0.0.0.0         255.255.255.0   U     0      0        0 r2-eth0
192.168.3.0     192.168.3.12    255.255.255.0   UG    0      0        0 r2-eth1
192.168.3.0     0.0.0.0         255.255.255.0   U     0      0        0 r2-eth1
192.168.4.0     192.168.2.1     255.255.255.0   UG    0      0        0 r2-eth0
192.168.5.0     192.168.3.12    255.255.255.0   UG    0      0        0 r2-eth1
192.168.6.0     192.168.3.12    255.255.255.0   UG    0      0        0 r2-eth1
mininext>
```

Router – 3:

Command Used:

py net.get('r3').cmd('route add -net 192.168.1.0 gw 192.168.4.1 netmask 255.255.255.0 r3-eth0')
py net.get('r3').cmd('route add -net 192.168.2.0 gw 192.168.4.1 netmask 255.255.255.0 r3-eth0')
py net.get('r3').cmd('route add -net 192.168.4.0 gw 192.168.4.1 netmask 255.255.255.0 r3-eth0')
py net.get('r3').cmd('route add -net 192.168.3.0 gw 192.168.5.12 netmask 255.255.255.0 r3-eth1')
py net.get('r3').cmd('route add -net 192.168.5.0 gw 192.168.5.12 netmask 255.255.255.0 r3-eth1')
py net.get('r3').cmd('route add -net 192.168.6.0 gw 192.168.5.12 netmask 255.255.255.0 r3-eth1')

Routing Table:

mininet@mininet-vm: ~/hw3

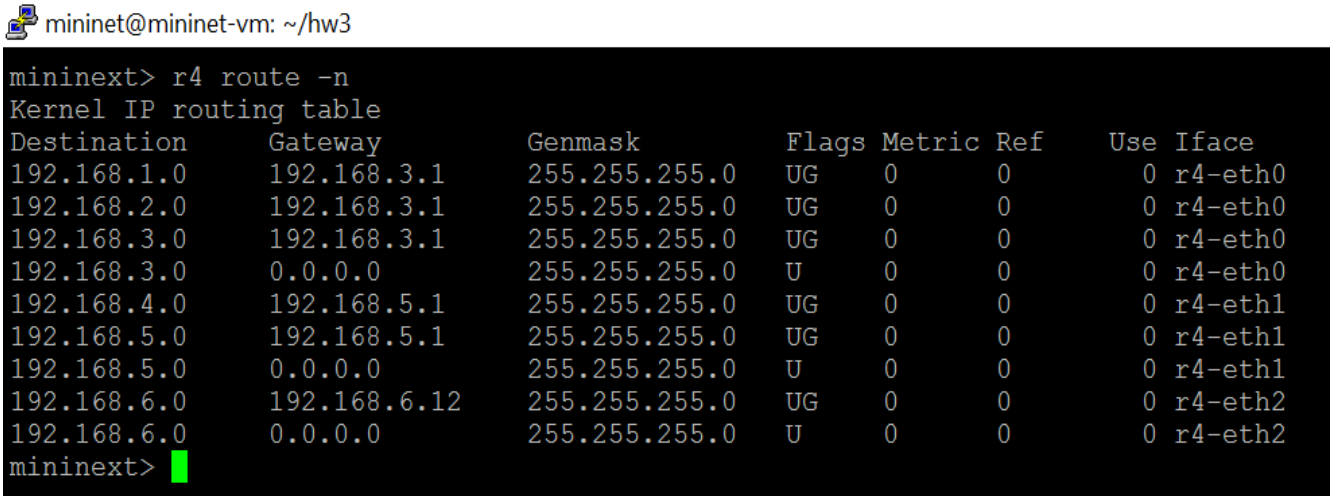
```
mininext> r3 route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
192.168.1.0     192.168.4.1     255.255.255.0   UG    0      0        0 r3-eth0
192.168.2.0     192.168.4.1     255.255.255.0   UG    0      0        0 r3-eth0
192.168.3.0     192.168.5.12    255.255.255.0   UG    0      0        0 r3-eth1
192.168.4.0     192.168.4.1     255.255.255.0   UG    0      0        0 r3-eth0
192.168.4.0     0.0.0.0         255.255.255.0   U     0      0        0 r3-eth0
192.168.5.0     192.168.5.12    255.255.255.0   UG    0      0        0 r3-eth1
192.168.5.0     0.0.0.0         255.255.255.0   U     0      0        0 r3-eth1
192.168.6.0     192.168.5.12    255.255.255.0   UG    0      0        0 r3-eth1
mininext>
```

Router – 4:

Command Used:

py net.get('r4').cmd('route add -net 192.168.1.0 gw 192.168.3.1 netmask 255.255.255.0 r4-eth0')
py net.get('r4').cmd('route add -net 192.168.2.0 gw 192.168.3.1 netmask 255.255.255.0 r4-eth0')
py net.get('r4').cmd('route add -net 192.168.3.0 gw 192.168.3.1 netmask 255.255.255.0 r4-eth0')
py net.get('r4').cmd('route add -net 192.168.4.0 gw 192.168.5.1 netmask 255.255.255.0 r4-eth1')
py net.get('r4').cmd('route add -net 192.168.5.0 gw 192.168.5.1 netmask 255.255.255.0 r4-eth1')
py net.get('r4').cmd('route add -net 192.168.6.0 gw 192.168.6.12 netmask 255.255.255.0 r4-eth2')

Routing Table:

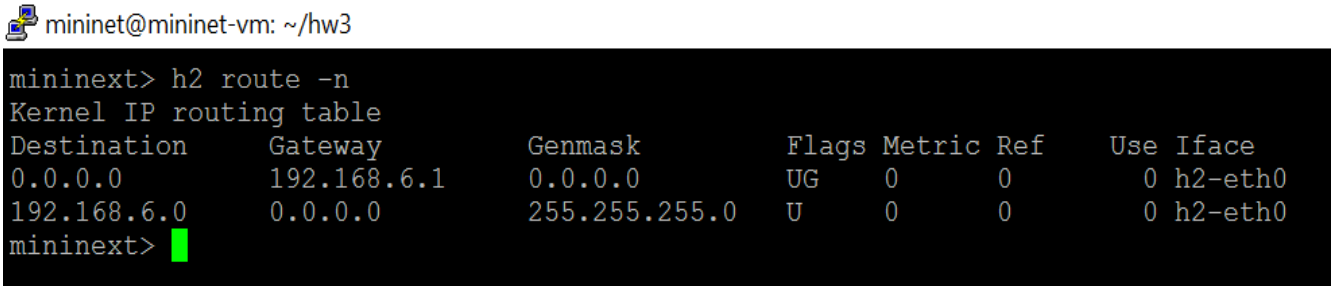


Host – 2:

Command Used:

py net.get('h2').cmd('route add -net 192.168.6.0 gw 192.168.6.1 net mask 255.255.255.0 h2-eth0')

Routing Table:



Pingall Command:

mininet@mininet-vm: ~/hw3

```
mininext> pingall
*** Ping: testing ping reachability
h1 -> h2 r1 r2 r3 r4
h2 -> h1 r1 r2 r3 r4
r1 -> h1 h2 r2 r3 r4
r2 -> h1 h2 r1 r3 r4
r3 -> h1 h2 r1 r2 r4
r4 -> h1 h2 r1 r2 r3
*** Results: 0% dropped (30/30 received)
mininext>
```

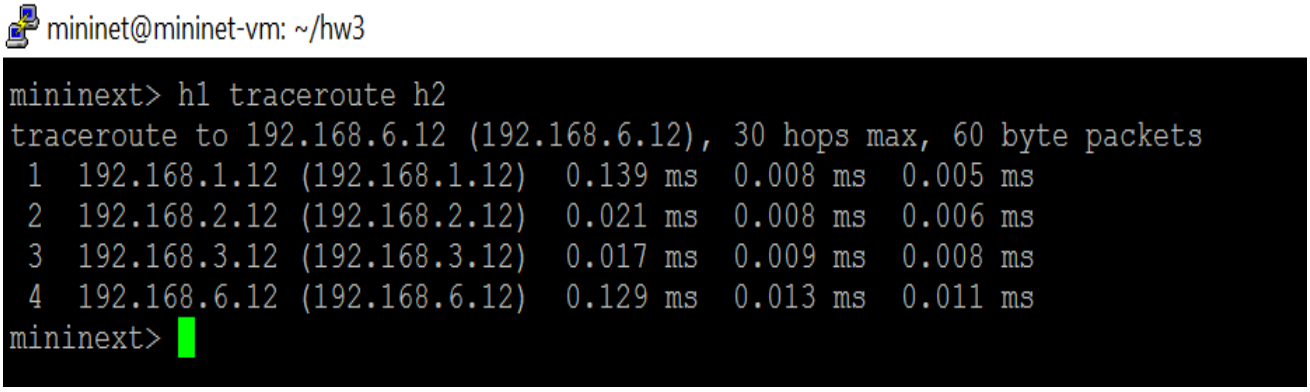
h1 ping h2:

mininet@mininet-vm: ~/hw3

```
mininext> h1 ping h2
PING 192.168.6.12 (192.168.6.12) 56(84) bytes of data.
64 bytes from 192.168.6.12: icmp_seq=1 ttl=61 time=0.067 ms
64 bytes from 192.168.6.12: icmp_seq=2 ttl=61 time=0.105 ms
64 bytes from 192.168.6.12: icmp_seq=3 ttl=61 time=0.112 ms
64 bytes from 192.168.6.12: icmp_seq=4 ttl=61 time=0.109 ms
64 bytes from 192.168.6.12: icmp_seq=5 ttl=61 time=0.114 ms
64 bytes from 192.168.6.12: icmp_seq=6 ttl=61 time=0.108 ms
64 bytes from 192.168.6.12: icmp_seq=7 ttl=61 time=0.112 ms
64 bytes from 192.168.6.12: icmp_seq=8 ttl=61 time=0.107 ms
```

b).

Traceroute from H1 to H2:



Traceroute from H2 to H1: