

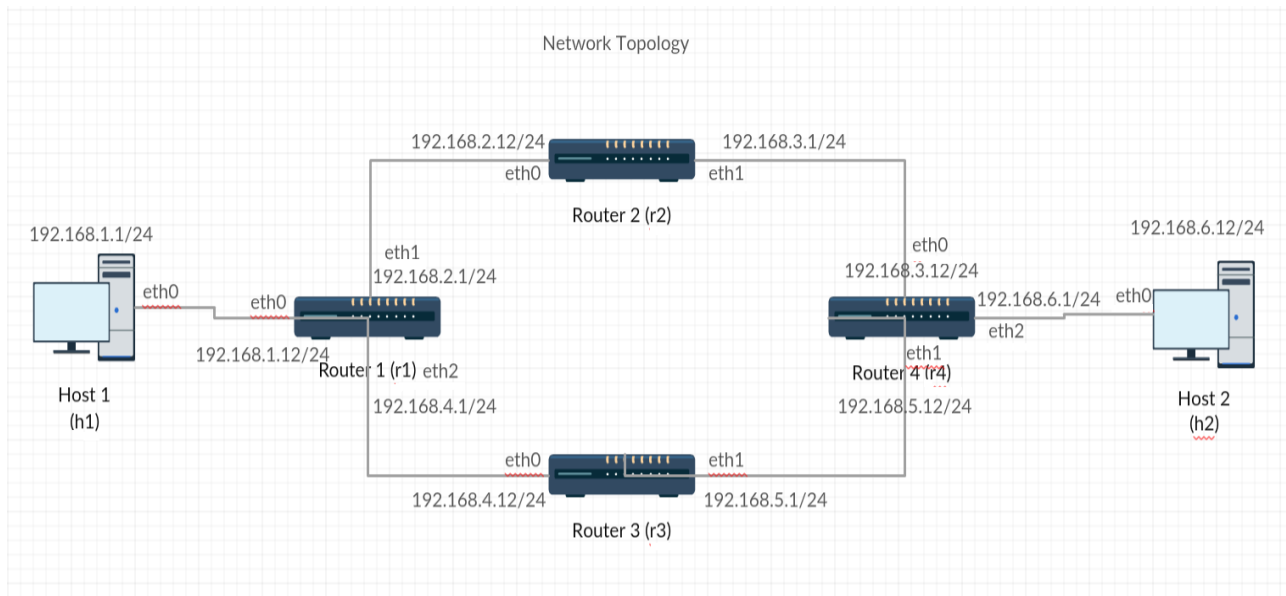
Part A

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:

 mininet@mininet-vm: ~/hw3


```
mininext> r4 route -n
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
192.168.1.0      192.168.3.1     255.255.255.0    UG      0      0      0 r4-eth0
192.168.2.0      192.168.3.1     255.255.255.0    UG      0      0      0 r4-eth0
192.168.3.0      192.168.3.1     255.255.255.0    UG      0      0      0 r4-eth0
192.168.3.0      0.0.0.0         255.255.255.0    U       0      0      0 r4-eth0
192.168.4.0      192.168.5.1     255.255.255.0    UG      0      0      0 r4-eth1
192.168.5.0      192.168.5.1     255.255.255.0    UG      0      0      0 r4-eth1
192.168.5.0      0.0.0.0         255.255.255.0    U       0      0      0 r4-eth1
192.168.6.0      192.168.6.12    255.255.255.0    UG      0      0      0 r4-eth2
192.168.6.0      0.0.0.0         255.255.255.0    U       0      0      0 r4-eth2
mininext> █
```

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:

 mininet@mininet-vm: ~/hw3


```
mininext> h2 route -n
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
0.0.0.0          192.168.6.1     0.0.0.0          UG      0      0      0 h2-eth0
192.168.6.0      0.0.0.0         255.255.255.0    U       0      0      0 h2-eth0
mininext> █
```


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:

 mininet@mininet-vm: ~/hw3

```
mininext> h1 traceroute h2
traceroute to 192.168.6.12 (192.168.6.12), 30 hops max, 60 byte packets
 1  192.168.1.12 (192.168.1.12)  0.139 ms  0.008 ms  0.005 ms
 2  192.168.2.12 (192.168.2.12)  0.021 ms  0.008 ms  0.006 ms
 3  192.168.3.12 (192.168.3.12)  0.017 ms  0.009 ms  0.008 ms
 4  192.168.6.12 (192.168.6.12)  0.129 ms  0.013 ms  0.011 ms
mininext> █
```

Traceroute from H2 to H1:

 mininet@mininet-vm: ~/hw3

```
mininext> h2 traceroute h1
traceroute to 192.168.1.1 (192.168.1.1), 30 hops max, 60 byte packets
 1  192.168.6.1 (192.168.6.1)  0.070 ms  0.013 ms  0.006 ms
 2  192.168.3.1 (192.168.3.1)  0.018 ms  0.008 ms  0.006 ms
 3  192.168.2.1 (192.168.2.1)  0.016 ms  0.009 ms  0.009 ms
 4  192.168.1.1 (192.168.1.1)  0.035 ms  0.011 ms  0.009 ms
mininext> █
```