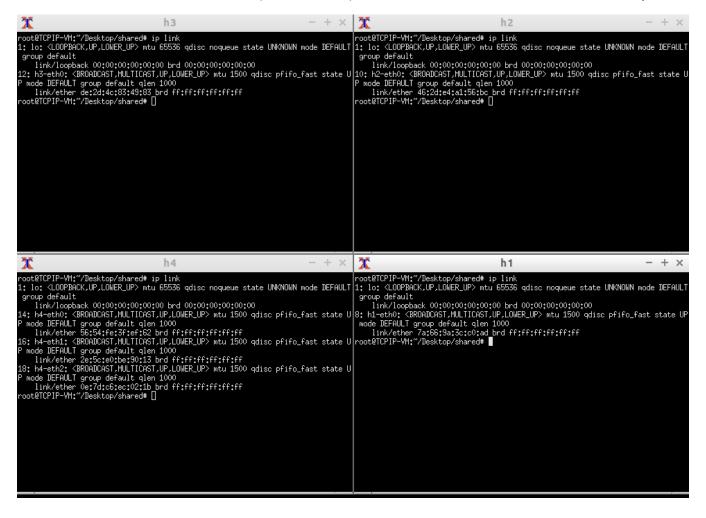به نام خدا

زهراسادات طباطبائی – ۹۹۵۲۱۴۱۵ – ستاره باباجانی - ۹۹۵۲۱۱۰۹ – تمرین دوم

الف) ابتدا با دستور sudo -E python lanTopology فایلی که تغییرات را ایجاد کردیم را ران می‌کنیم:

```
mininet@TCPIP-VM:~/Desktop/shared$ sudo -E python lanTopology.py
[sudo] password for mininet:
*** Adding controller
*** Adding hosts
*** Adding switch
*** Creating links
*** Starting network
*** Configuring hosts
h1 h2 h3 h4
*** Starting controller
*** Starting 3 switches
s14 s24 s34
*** Starting terminals on hosts
*** Running the command line interface
*** Starting CLI:
mininet>
```

ب) برای چک کردن up یا down بودن از دستور ip link استفاده می‌کنیم و مشاهده میکنیم همه بالا هستند.

سوال ۱)

دستور ping 10.10.14.4 را اجرا می‌کنیم و مشاهده میکنیم بسته ای ارسال نشده:

```
Link/ether fe.b5.33.14.41.1b brd ff.ff.ff.ff.ff.ff
root@TCPIP-VM:~/Desktop/shared# ping 10.10.14.4
PING 10.10.14.4 (10.10.14.4) 56(84) bytes of data.
From 10.0.0.1 icmp_seq=1 Destination Host Unreachable
From 10.0.0.1 icmp_seq=2 Destination Host Unreachable
From 10.0.0.1 icmp_seq=3 Destination Host Unreachable
^C
--- 10.10.14.4 ping statistics ---
5 packets transmitted, 0 received, +3 errors, 100% packet loss, time 4014ms
pipe 3
root@TCPIP-VM:~/Desktop/shared#
```

برای رسیدن به دلیل دستور Arp -a را اجرا میکنیم:

```
ip aa \ifLHr/ x25 \generic x.25/ calo4 \generic L8/
root@TCPIP-VM:~/Desktop/shared# arp -a
? (10.10.14.4) at <incomplete> on h1-eth0
root@TCPIP-VM:~/Desktop/shared#
```

Arp request ارسال میشود اما به دلیل موجود نبودن ip شبکه arp reply ارسال میشود و در نتیجه دریافت نمیشود.

ج) با استفاده از دستور ip addr del/add اینترفیس های هاست را تغییر میدهیم:

```
root@TCPIP-VM:~/Desktop/shared# ip addr flush h1-eth0
root@TCPIP-VM:~/Desktop/shared# ip addr add 10.10.14.1/24 dev h1-eth0
root@TCPIP-VM:~/Desktop/shared# ifconfig
h1-eth0   Link encap:Ethernet  HWaddr 7a:66:9a:3c:c0:ad
          inet addr:10.10.14.1  Bcast:0.0.0.0  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:20 errors:0 dropped:0 overruns:0 frame:0
          TX packets:16 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1924 (1.9 KB)  TX bytes:1080 (1.0 KB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:4 errors:0 dropped:0 overruns:0 frame:0
          TX packets:4 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:448 (448.0 B)  TX bytes:448 (448.0 B)

root@TCPIP-VM:~/Desktop/shared#
```

H2 :

```
root@TCPIP-VM:~/Desktop/shared# ip addr flush h2-eth0
root@TCPIP-VM:~/Desktop/shared# ip addr add 10.10.24.2/24 dev h2-eth0
root@TCPIP-VM:~/Desktop/shared# if config
> ^C
root@TCPIP-VM:~/Desktop/shared# ifconfig
h2-eth0    Link encap:Ethernet  HWaddr 46:2d:e4:a1:56:bc
           inet addr:10.10.24.2  Bcast:0.0.0.0  Mask:255.255.255.0
           UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
           RX packets:18 errors:0 dropped:0 overruns:0 frame:0
           TX packets:10 errors:0 dropped:0 overruns:0 carrier:0
           collisions:0 txqueuelen:1000
           RX bytes:1756 (1.7 KB)  TX bytes:828 (828.0 B)

lo         Link encap:Local Loopback
           inet addr:127.0.0.1  Mask:255.0.0.0
           inet6 addr: ::1/128 Scope:Host
           UP LOOPBACK RUNNING  MTU:65536  Metric:1
           RX packets:0 errors:0 dropped:0 overruns:0 frame:0
           TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
           collisions:0 txqueuelen:0
           RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

root@TCPIP-VM:~/Desktop/shared#
```

H3 :

```
root@TCPIP-VM:~/Desktop/shared# ip addr flush h3-eth0
root@TCPIP-VM:~/Desktop/shared# ip addr add 10.10.34.3/24
Not enough information: "dev" argument is required.
root@TCPIP-VM:~/Desktop/shared# ip addr add 10.10.34.3/24 dev h3-eth0
root@TCPIP-VM:~/Desktop/shared# ifconfig
h3-eth0    Link encap:Ethernet  HWaddr de:2d:4c:83:49:83
           inet addr:10.10.34.3  Bcast:0.0.0.0  Mask:255.255.255.0
           UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
           RX packets:19 errors:0 dropped:0 overruns:0 frame:0
           TX packets:10 errors:0 dropped:0 overruns:0 carrier:0
           collisions:0 txqueuelen:1000
           RX bytes:1846 (1.8 KB)  TX bytes:828 (828.0 B)

lo         Link encap:Local Loopback
           inet addr:127.0.0.1  Mask:255.0.0.0
           inet6 addr: ::1/128 Scope:Host
           UP LOOPBACK RUNNING  MTU:65536  Metric:1
           RX packets:0 errors:0 dropped:0 overruns:0 frame:0
           TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
           collisions:0 txqueuelen:0
           RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

root@TCPIP-VM:~/Desktop/shared#
```

H4:

```
root@TCPIP-VM:~/Desktop/shared# ip addr flush h4-eth0
root@TCPIP-VM:~/Desktop/shared# ip addr add 10.10.14.4/24 dev h4-eth0
root@TCPIP-VM:~/Desktop/shared# ip addr add 10.10.24.4/24 dev h4-eth1
root@TCPIP-VM:~/Desktop/shared# ip addr add 10.10.34.4/24 dev h4-eth2
root@TCPIP-VM:~/Desktop/shared# ifconfig
h4-eth0   Link encap:Ethernet  HWaddr 56:54:fe:3f:ef:62
          inet addr:10.10.14.4  Bcast:0.0.0.0  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:27 errors:0 dropped:0 overruns:0 frame:0
          TX packets:10 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:2278 (2.2 KB)  TX bytes:828 (828.0 B)

h4-eth1   Link encap:Ethernet  HWaddr 2e:5c:e0:be:90:13
          inet addr:10.10.24.4  Bcast:0.0.0.0  Mask:255.255.255.0
          inet6 addr: fe80::2c5c:e0ff:febe:9013/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:21 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:2014 (2.0 KB)  TX bytes:648 (648.0 B)

h4-eth2   Link encap:Ethernet  HWaddr 0e:7d:c6:ec:02:1b
          inet addr:10.10.34.4  Bcast:0.0.0.0  Mask:255.255.255.0
          inet6 addr: fe80::c7d:c6ff:feec:21b/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:21 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:2026 (2.0 KB)  TX bytes:648 (648.0 B)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

root@TCPIP-VM:~/Desktop/shared#
```

بعد از اینها مجددا پینگ میگیریم:

```
root@TCPIP-VM:~/Desktop/shared# ping 10.10.14.4
PING 10.10.14.4 (10.10.14.4) 56(84) bytes of data.
64 bytes from 10.10.14.4: icmp_seq=1 ttl=64 time=2.59 ms
64 bytes from 10.10.14.4: icmp_seq=2 ttl=64 time=1.83 ms
^C
--- 10.10.14.4 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
rtt min/avg/max/mdev = 1.834/2.214/2.594/0.380 ms
root@TCPIP-VM:~/Desktop/shared#
```

در وایرشارک چنین چیزی مشاهده میکنیم:

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	d6:99:05:8c:a9:fe	Broadcast	ARP	42	Who has 10.10.14.4? Tell 10.10.14.1
2	0.001718213	32:5c:d9:3f:12:c9	d6:99:05:8c:a9:fe	ARP	42	10.10.14.4 is at 32:5c:d9:3f:12:c9
3	0.001722822	10.10.14.1	10.10.14.4	ICMP	98	Echo (ping) request id=0x2539, seq=1/256, ttl=64 (reply in 4)
4	0.003618447	10.10.14.4	10.10.14.1	ICMP	98	Echo (ping) reply id=0x2539, seq=1/256, ttl=64 (request in...
5	1.001727028	10.10.14.1	10.10.14.4	ICMP	98	Echo (ping) request id=0x2539, seq=2/512, ttl=64 (reply in 6)
6	1.001874684	10.10.14.4	10.10.14.1	ICMP	98	Echo (ping) reply id=0x2539, seq=2/512, ttl=64 (request in...
7	2.028460149	10.10.14.1	10.10.14.4	ICMP	98	Echo (ping) request id=0x2539, seq=3/768, ttl=64 (reply in 8)
8	2.028487050	10.10.14.4	10.10.14.1	ICMP	98	Echo (ping) reply id=0x2539, seq=3/768, ttl=64 (request in...
9	3.052512643	10.10.14.1	10.10.14.4	ICMP	98	Echo (ping) request id=0x2539, seq=4/1024, ttl=64 (reply in ...
10	3.052539603	10.10.14.4	10.10.14.1	ICMP	98	Echo (ping) reply id=0x2539, seq=4/1024, ttl=64 (request i...
11	5.196892695	32:5c:d9:3f:12:c9	d6:99:05:8c:a9:fe	ARP	42	Who has 10.10.14.1? Tell 10.10.14.4
12	5.196901802	d6:99:05:8c:a9:fe	32:5c:d9:3f:12:c9	ARP	42	10.10.14.1 is at d6:99:05:8c:a9:fe

سوال ۲) با توجه به این ها میفهمیم h1 تونسته h4 رو پیدا کنه و icmp reply و arp repl , شنود شده اند.

د)

سوال ۳) خیر همانطور که مشاهده میشود اتصال به ان ها امکان پذیر نیست زیرا میان دو نود اینترفیسی نیست

```
root@TCPIP-VM:~/Desktop/shared# ping 10.10.24.4
connect: Network is unreachable
root@TCPIP-VM:~/Desktop/shared# ping 10.10.34.4
connect: Network is unreachable
root@TCPIP-VM:~/Desktop/shared#
```

سوال ۴) 10.10.14.0 مقصد بسته ارسالی است و 10.10.14.1 نیز بیانگر h1-eth0 است

```
connect: Network is unreachable
root@TCPIP-VM:~/Desktop/shared# ip route
10.10.14.0/24 dev h1-eth0  proto kernel  scope link  src 10.10.14.1
root@TCPIP-VM:~/Desktop/shared#
```

سوال ۵) بله زیرا برای اینترفیس مقصد default gateway تعریف کردیم:

```
root@TCPIP-VM:~/Desktop/shared# ip route add default via 10.10.14.1
root@TCPIP-VM:~/Desktop/shared# ip route
default via 10.10.14.1 dev h1-eth0
10.10.14.0/24 dev h1-eth0  proto kernel  scope link  src 10.10.14.1
root@TCPIP-VM:~/Desktop/shared# ping 10.10.34.4
PING 10.10.34.4 (10.10.34.4) 56(84) bytes of data.
64 bytes from 10.10.34.4: icmp_seq=1 ttl=64 time=1.93 ms
64 bytes from 10.10.34.4: icmp_seq=2 ttl=64 time=1.42 ms
64 bytes from 10.10.34.4: icmp_seq=3 ttl=64 time=0.060 ms
64 bytes from 10.10.34.4: icmp_seq=4 ttl=64 time=0.045 ms
^C
--- 10.10.34.4 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3003ms
rtt min/avg/max/mdev = 0.045/0.865/1.935/0.833 ms
root@TCPIP-VM:~/Desktop/shared#
```

سوال ۶) همانطور که مشاهده میکنیم بسته ها ارسال نمیشود و برای حل آن default gateway را برای آن ها تغییر میدهیم تا درست شود

```
root@TCPIP-VM:~/Desktop/shared# ping 10.10.34
connect: Network is unreachable
root@TCPIP-VM:~/Desktop/shared# echo 1 > /proc/sys/net/ipv4/ip_forward
root@TCPIP-VM:~/Desktop/shared# ping 10.10.34
connect: Network is unreachable
root@TCPIP-VM:~/Desktop/shared# ping 10.10.34.3
PING 10.10.34.3 (10.10.34.3) 56(84) bytes of data.
64 bytes from 10.10.34.3: icmp_seq=1 ttl=64 time=0.019 ms
64 bytes from 10.10.34.3: icmp_seq=2 ttl=64 time=0.120 ms
64 bytes from 10.10.34.3: icmp_seq=3 ttl=64 time=0.061 ms
^C
--- 10.10.34.3 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2004ms
rtt min/avg/max/mdev = 0.019/0.066/0.120/0.042 ms
root@TCPIP-VM:~/Desktop/shared#
```

```
root@TCPIP-VM:~/Desktop/shared# ip route add default via 10.10.24.4
root@TCPIP-VM:~/Desktop/shared#
```

```
root@TCPIP-VM:~/Desktop/shared# ping 10.10.34.4
PING 10.10.34.4 (10.10.34.4) 56(84) bytes of data.
64 bytes from 10.10.34.4: icmp_seq=1 ttl=64 time=1.38 ms
64 bytes from 10.10.34.4: icmp_seq=2 ttl=64 time=4.24 ms
64 bytes from 10.10.34.4: icmp_seq=3 ttl=64 time=0.437 ms
^C
--- 10.10.34.4 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2005ms
rtt min/avg/max/mdev = 0.437/2.022/4.244/1.618 ms
root@TCPIP-VM:~/Desktop/shared#
```

سوال ۷)

H1 – H2:

```
root@TCPIP-VM:~/Desktop/shared# ping 10.10.24.2
PING 10.10.24.2 (10.10.24.2) 56(84) bytes of data.
64 bytes from 10.10.24.2: icmp_seq=1 ttl=64 time=0.078 ms
64 bytes from 10.10.24.2: icmp_seq=2 ttl=64 time=0.045 ms
^C
--- 10.10.24.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
rtt min/avg/max/mdev = 0.045/0.061/0.078/0.018 ms
root@TCPIP-VM:~/Desktop/shared# S
```

H2 – H3:

```
PING 10.10.34.4 (10.10.34.4) 56(84) bytes of data.
64 bytes from 10.10.34.4: icmp_seq=1 ttl=64 time=1.47 ms
64 bytes from 10.10.34.4: icmp_seq=2 ttl=64 time=4.00 ms
64 bytes from 10.10.34.4: icmp_seq=3 ttl=64 time=0.259 ms
^C
--- 10.10.34.4 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2004ms
rtt min/avg/max/mdev = 0.259/1.912/4.000/1.558 ms
```

H3 – H1 :

```
root@TCPIP-VM:~/Desktop/shared# ping 10.10.14.4
PING 10.10.14.4 (10.10.14.4) 56(84) bytes of data.
64 bytes from 10.10.14.4: icmp_seq=1 ttl=64 time=1.33 ms
64 bytes from 10.10.14.4: icmp_seq=2 ttl=64 time=3.35 ms
^C
--- 10.10.14.4 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
rtt min/avg/max/mdev = 1.336/2.345/3.354/1.009 ms
root@TCPIP-VM:~/Desktop/shared#
```

مقادیر rtt اختلاف کمی دارن و به هم نزدیک هستن دلیل این موضوع هستن که تعداد لینک ها و سوویچ ها برابرن و شبکه کتقارن است.