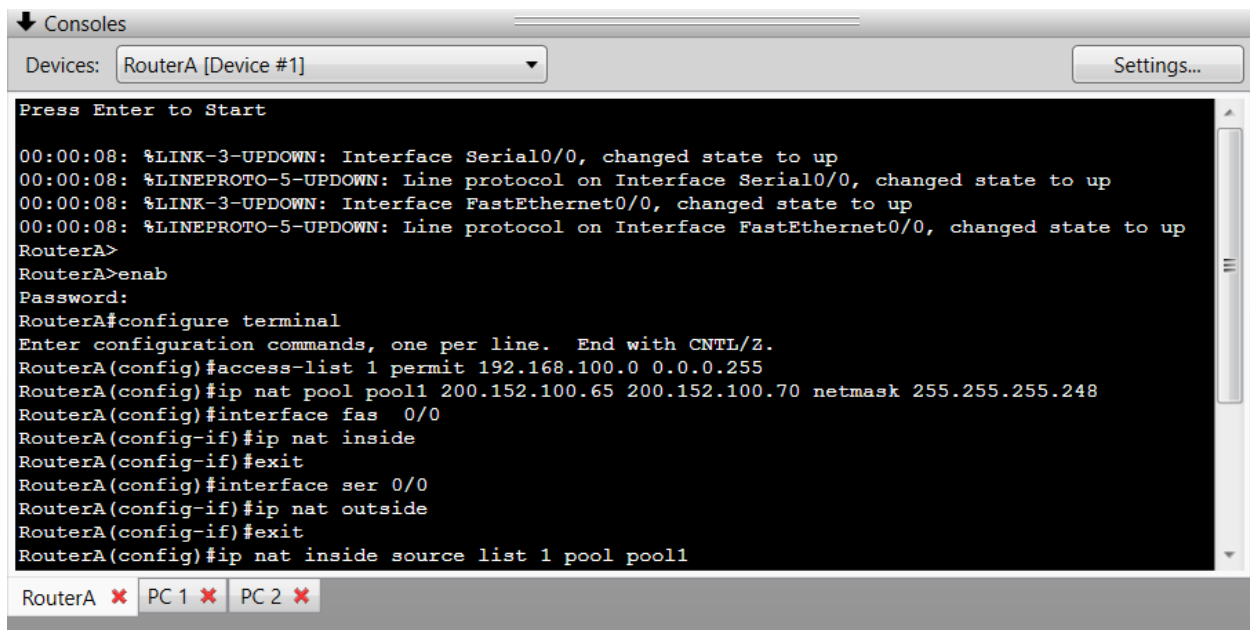


به نام خدا

۹۷۲۳۱۰۰	محمد مهدی هجرتی
آشنایی با مکانیزم NAT و پروتکل DHCP	آزمایشگاه شبکه - آزمایش نهم
۱۴۰۰ خرداد	استاد نقی زاده

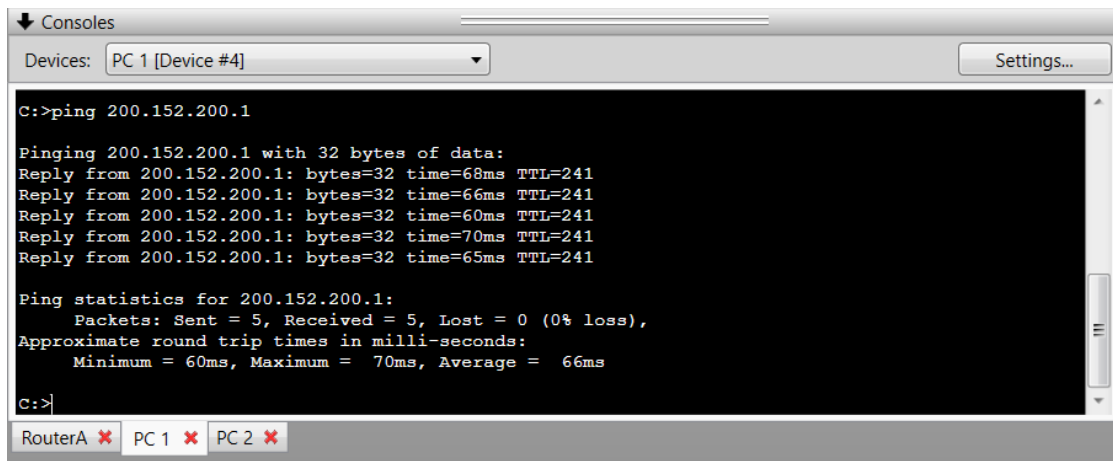
سوال ۵

دستورات وارد شده در روتر را به ترتیب در تصاویر زیر می بینیم.



```
Press Enter to Start
00:00:08: %LINK-3-UPDOWN: Interface Serial0/0, changed state to up
00:00:08: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0, changed state to up
00:00:08: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
00:00:08: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
RouterA>
RouterA>enab
Password:
RouterA#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
RouterA(config)#access-list 1 permit 192.168.100.0 0.0.0.255
RouterA(config)#ip nat pool pool1 200.152.100.65 200.152.100.70 netmask 255.255.255.248
RouterA(config)#interface fas 0/0
RouterA(config-if)#ip nat inside
RouterA(config-if)#exit
RouterA(config)#interface ser 0/0
RouterA(config-if)#ip nat outside
RouterA(config-if)#exit
RouterA(config)#ip nat inside source list 1 pool pool1
```

در نهایت میبینیم که دستور ping در هر دو PC با موفقیت انجام می شود.



```
C:>ping 200.152.200.1

Pinging 200.152.200.1 with 32 bytes of data:
Reply from 200.152.200.1: bytes=32 time=68ms TTL=241
Reply from 200.152.200.1: bytes=32 time=66ms TTL=241
Reply from 200.152.200.1: bytes=32 time=60ms TTL=241
Reply from 200.152.200.1: bytes=32 time=70ms TTL=241
Reply from 200.152.200.1: bytes=32 time=65ms TTL=241

Ping statistics for 200.152.200.1:
    Packets: Sent = 5, Received = 5, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 60ms, Maximum = 70ms, Average = 66ms

C:>
```

```
Consoles
Devices: PC 2 [Device #5] Settings...

Press Enter to begin
C:>ping 200.152.200.1

Pinging 200.152.200.1 with 32 bytes of data:
Reply from 200.152.200.1: bytes=32 time=71ms TTL=241
Reply from 200.152.200.1: bytes=32 time=52ms TTL=241
Reply from 200.152.200.1: bytes=32 time=57ms TTL=241
Reply from 200.152.200.1: bytes=32 time=49ms TTL=241
Reply from 200.152.200.1: bytes=32 time=49ms TTL=241

Ping statistics for 200.152.200.1:
    Packets: Sent = 5, Received = 5, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 49ms, Maximum = 71ms, Average = 56ms

C:>|
```

جدول NAT به صورت زیر می باشد.

```
Consoles
Devices: RouterA [Device #1] Settings...

RouterA#show ip nat translation

Pro Inside global      Inside local      Outside local      Outside global
icmp 200.152.100.65:9392 192.168.100.2:9392 200.152.200.1:9392 200.152.200.1:9392
icmp 200.152.100.65:9393 192.168.100.2:9393 200.152.200.1:9393 200.152.200.1:9393
icmp 200.152.100.65:9394 192.168.100.2:9394 200.152.200.1:9394 200.152.200.1:9394
icmp 200.152.100.65:9395 192.168.100.2:9395 200.152.200.1:9395 200.152.200.1:9395
icmp 200.152.100.65:9396 192.168.100.2:9396 200.152.200.1:9396 200.152.200.1:9396

icmp 200.152.100.65:9392 192.168.100.129:9392 200.152.200.1:9392 200.152.200.1:9392
icmp 200.152.100.65:9393 192.168.100.129:9393 200.152.200.1:9393 200.152.200.1:9393
icmp 200.152.100.65:9394 192.168.100.129:9394 200.152.200.1:9394 200.152.200.1:9394
icmp 200.152.100.65:9395 192.168.100.129:9395 200.152.200.1:9395 200.152.200.1:9395
icmp 200.152.100.65:9396 192.168.100.129:9396 200.152.200.1:9396 200.152.200.1:9396

Pro Inside global      Inside local      Outside local      Outside global
icmp 200.152.100.65:9392 192.168.100.2:9392 200.152.200.1:9392 200.152.200.1:9392
icmp 200.152.100.65:9393 192.168.100.2:9393 200.152.200.1:9393 200.152.200.1:9393
icmp 200.152.100.65:9394 192.168.100.2:9394 200.152.200.1:9394 200.152.200.1:9394
icmp 200.152.100.65:9395 192.168.100.2:9395 200.152.200.1:9395 200.152.200.1:9395
icmp 200.152.100.65:9396 192.168.100.2:9396 200.152.200.1:9396 200.152.200.1:9396

icmp 200.152.100.65:9392 192.168.100.129:9392 200.152.200.1:9392 200.152.200.1:9392
icmp 200.152.100.65:9393 192.168.100.129:9393 200.152.200.1:9393 200.152.200.1:9393
icmp 200.152.100.65:9394 192.168.100.129:9394 200.152.200.1:9394 200.152.200.1:9394
icmp 200.152.100.65:9395 192.168.100.129:9395 200.152.200.1:9395 200.152.200.1:9395
icmp 200.152.100.65:9396 192.168.100.129:9396 200.152.200.1:9396 200.152.200.1:9396

RouterA#
```

سوال ۸

دستورات وارد شده در روتر را به ترتیب در تصاویر زیر می بینیم.

```

RouterA>
RouterA>
RouterA>
RouterA>en
Password:
RouterA#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
RouterA(config)#access-list 2 permit 192.168.100.0 0.0.0.255
RouterA(config)#intr
RouterA(config)#interface fas 0/0
RouterA(config-if)#ip nat inside
RouterA(config-if)#exit
RouterA(config)#interface ser 0/0
RouterA(config-if)#ip nat outside
RouterA(config-if)#exit
RouterA(config)#ip nat inside source list 2 interface seial 0/0 overload
RouterA(config)#exit
  
```

RouterA ✖ PC 1 ✖ PC 2 ✖

در نهایت میبینیم که دستور ping در هر دو PC با موفقیت انجام می شود.

```

Press Enter to begin
C:>ping 200.152.200.1

Pinging 200.152.200.1 with 32 bytes of data:
Reply from 200.152.200.1: bytes=32 time=68ms TTL=241
Reply from 200.152.200.1: bytes=32 time=66ms TTL=241
Reply from 200.152.200.1: bytes=32 time=60ms TTL=241
Reply from 200.152.200.1: bytes=32 time=70ms TTL=241
Reply from 200.152.200.1: bytes=32 time=65ms TTL=241

Ping statistics for 200.152.200.1:
    Packets: Sent = 5, Received = 5, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 60ms, Maximum = 70ms, Average = 66ms

C:>
  
```

RouterA ✖ PC 1 ✖ PC 2 ✖

```

Press Enter to begin
C:>ping 200.152.200.1

Pinging 200.152.200.1 with 32 bytes of data:
Reply from 200.152.200.1: bytes=32 time=56ms TTL=241
Reply from 200.152.200.1: bytes=32 time=63ms TTL=241
Reply from 200.152.200.1: bytes=32 time=68ms TTL=241
Reply from 200.152.200.1: bytes=32 time=59ms TTL=241
Reply from 200.152.200.1: bytes=32 time=59ms TTL=241

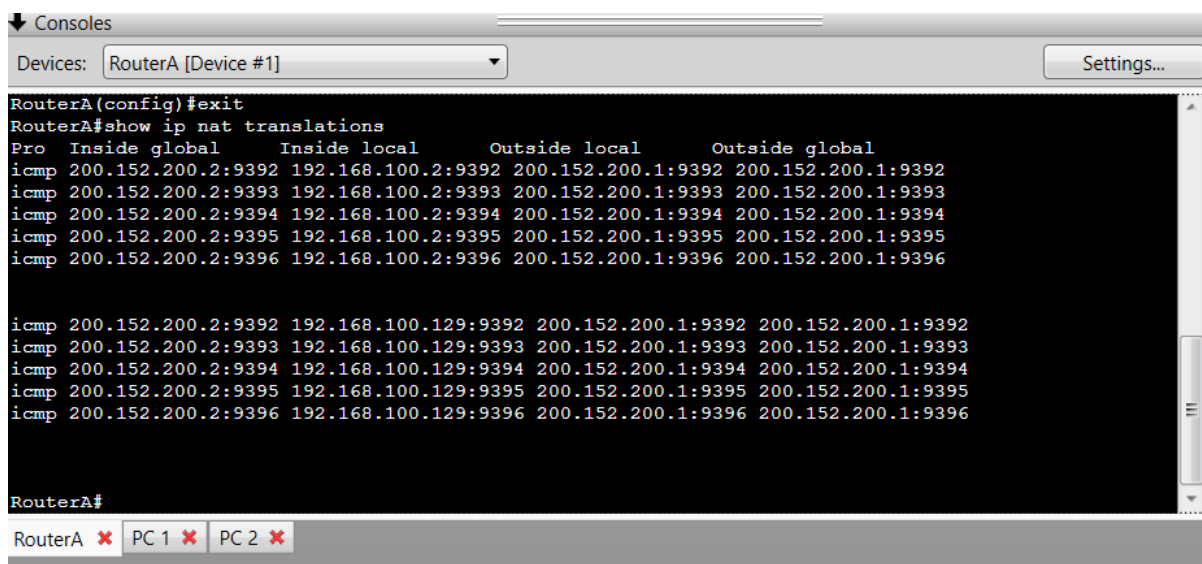
Ping statistics for 200.152.200.1:
    Packets: Sent = 5, Received = 5, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 56ms, Maximum = 68ms, Average = 61ms

C:>
  
```

RouterA ✖ PC 1 ✖ PC 2 ✖

سوال ۹

دستورات جدول NAT به صورت زیر می باشد.



The screenshot shows a Cisco Packet Tracer console window for RouterA. The user has entered the command `show ip nat translations`. The output displays two tables of NAT translations. The first table shows translations for ports 9392 through 9396, mapping inside global addresses (200.152.200.2) to inside local addresses (192.168.100.2) and then to outside local/global addresses (200.152.200.1). The second table shows translations for ports 9392 through 9396, mapping inside global addresses (200.152.200.2) to inside local addresses (192.168.100.129) and then to outside local/global addresses (200.152.200.1).

```
RouterA(config)#exit
RouterA#show ip nat translations
Pro  Inside global      Inside local      Outside local      Outside global
icmp 200.152.200.2:9392  192.168.100.2:9392 200.152.200.1:9392 200.152.200.1:9392
icmp 200.152.200.2:9393 192.168.100.2:9393 200.152.200.1:9393 200.152.200.1:9393
icmp 200.152.200.2:9394 192.168.100.2:9394 200.152.200.1:9394 200.152.200.1:9394
icmp 200.152.200.2:9395 192.168.100.2:9395 200.152.200.1:9395 200.152.200.1:9395
icmp 200.152.200.2:9396 192.168.100.2:9396 200.152.200.1:9396 200.152.200.1:9396

icmp 200.152.200.2:9392 192.168.100.129:9392 200.152.200.1:9392 200.152.200.1:9392
icmp 200.152.200.2:9393 192.168.100.129:9393 200.152.200.1:9393 200.152.200.1:9393
icmp 200.152.200.2:9394 192.168.100.129:9394 200.152.200.1:9394 200.152.200.1:9394
icmp 200.152.200.2:9395 192.168.100.129:9395 200.152.200.1:9395 200.152.200.1:9395
icmp 200.152.200.2:9396 192.168.100.129:9396 200.152.200.1:9396 200.152.200.1:9396

RouterA#
```

در پویا آدرس ها از یک pool انتخاب می شوند. ولی در PAT همه به یک آدرس نگاشت می شوند.

ابتدا به اینترفیس ها آی پی های گفته شده را اختصاص می دهیم.

The screenshot shows a console window titled 'Consoles' with a dropdown menu set to 'Router1 [Device #1]'. The terminal output shows the following commands and responses:

```
Router>en
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface fast 0/1
Router(config-if)#ip address 180.10.1.2 255.255.255.0
Router(config-if)#no shutdown
00:50:23: %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state to up
00:50:24: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
00:50:30: %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state to down
00:50:30: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to down
Router(config-if)#exit
Router(config)#interface fast 0/0
Router(config-if)#ip address 192.168.1.1 255.255.255.0
Router(config-if)#no shi
Router(config-if)#no shutdown
00:51:00: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
00:51:02: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
Router(config-if)#exit
Router(config)#
```

At the bottom of the window, there is a status bar with 'Router1' and a red 'X' icon.

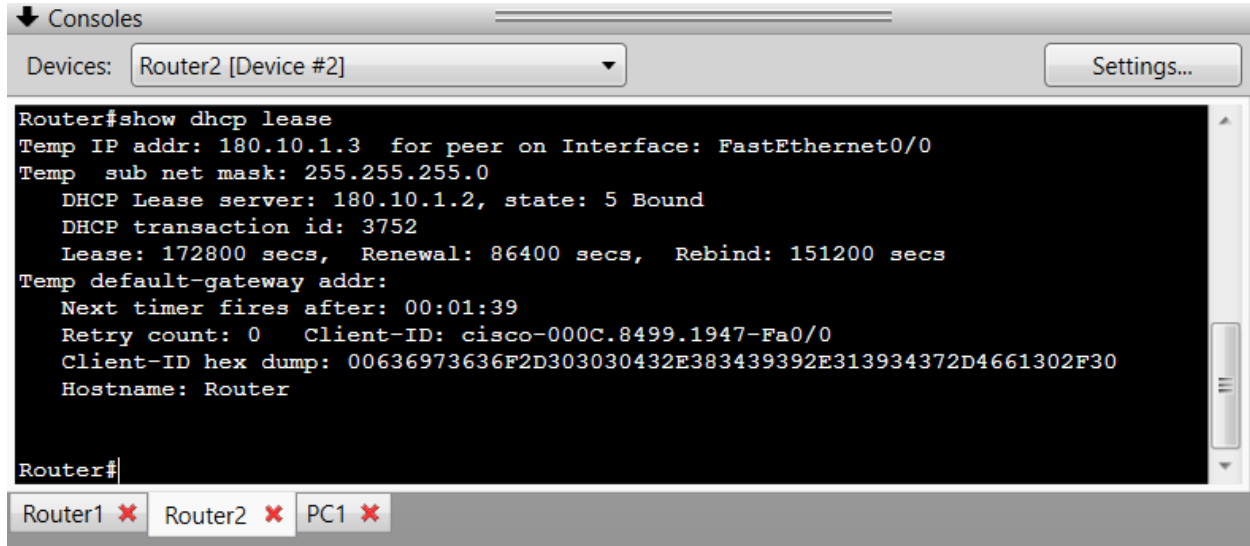
در ادامه دستورات خواسته شده را اجرا می کنیم.

The screenshot shows a console window titled 'Consoles' with a dropdown menu set to 'Router1 [Device #1]'. The terminal output shows the following commands and responses:

```
Router(config-if)#exit
Router(config)#service dhcp
Router(config)#ip dhcp excluded-address 180.10.1.2
Router(config)#ip dhcp excluded-address 192.168.1.1
Router(config)#ip dhcp pool pool1
Router(dhcp-config)#network 192.168.1.0 255.255.255.0
^
% Invalid input detected at '^' marker.
Router(dhcp-config)#network 192.168.1.0 255.255.255.0
Router(dhcp-config)#lease 2
Router(dhcp-config)#default-router 192.168.1.1
Router(dhcp-config)#
```

At the bottom of the window, there is a status bar with 'Router1' and a red 'X' icon. Below the console window, there is a blue link that says 'Update Available'.

در نهایت خروجی دستور show dhcp lease تصویر زیر می باشد.



```
Router#show dhcp lease
Temp IP addr: 180.10.1.3 for peer on Interface: FastEthernet0/0
Temp sub net mask: 255.255.255.0
  DHCP Lease server: 180.10.1.2, state: 5 Bound
  DHCP transaction id: 3752
  Lease: 172800 secs, Renewal: 86400 secs, Rebind: 151200 secs
Temp default-gateway addr:
Next timer fires after: 00:01:39
Retry count: 0 Client-ID: cisco-000C.8499.1947-Fa0/0
Client-ID hex dump: 00636973636F2D303030432E383439392E313934372D4661302F30
Hostname: Router

Router#
```

The screenshot shows a network simulator interface with a console window for Router2. The command 'show dhcp lease' has been executed, displaying the DHCP lease details for the IP address 180.10.1.3 on interface FastEthernet0/0. The lease is in a 'Bound' state with a transaction ID of 3752. The lease duration is 172800 seconds, with renewal at 86400 seconds and rebind at 151200 seconds. The default gateway is not set. The next timer fires in 00:01:39. The client ID is cisco-000C.8499.1947-Fa0/0, and its hex dump is 00636973636F2D303030432E383439392E313934372D4661302F30. The hostname is Router.

که در آن مقدار Lease، ۱۷۲۸۰۰ ثانیه یا همان ۲ روز تنظیم شده می باشد.

زمان Renewal، ۸۶۴۰۰ ثانیه است.

زمان Rebind نیز ۱۵۱۲۰۰ ثانیه تنظیم شده است.

زمان Renewal نصف زمان Lease می باشد. و زمان Rebind نیز $\frac{1}{3}$ Lease است.

و نحوه ی کارکرد آن به این صورت است که بعد از تمام شدن renewal کلاینت سعی می کند IP را تمدید کند. اگر موفق نشد وارد تایم rebind شده و سعی میکند با هر سرور dhcp در شبکه ارتباط برقرار کند و lease time را عقب بیندازد و باز هم اگر نشد، بعد از آن دیگر کلاینت حق استفاده از IP را ندارد.