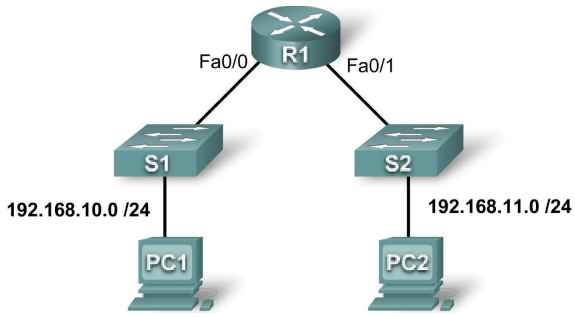
LAB 4 – DHCP + IPv6 basics

The aim of the exercise is to compare the basic methods of configuring network interfaces in IPv4 and IPv6 protocols.

NOTE: The report must contain all elements (questions, commands) highlighted in red.

Part I : DHCP

Create topology diagram as follows:



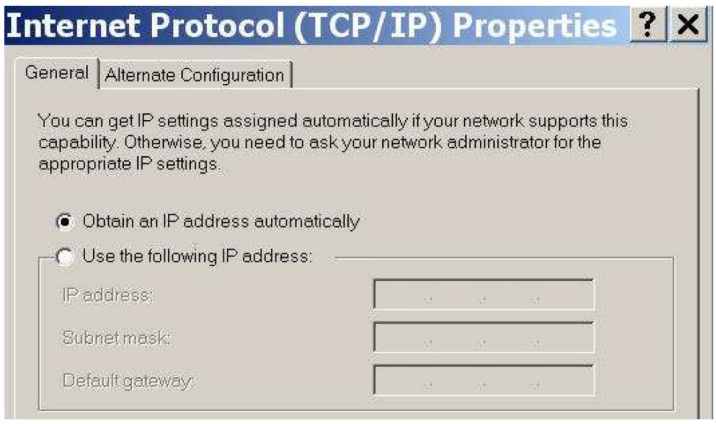
Note:
The interface names provided in the figure should be treated as an exemplar. Consider adequate interfaces according to the type of routers and switches used.

Start the exercise from creating a physical network according to the figure above. Parameters for configuring interfaces are presented in the table below.

Device	Interface	IP Address	Subnet Mask
R1	Fa0/0	192.168.10.1	255.255.255.0
	Fa0/1	192.168.11.1	255.255.255.0

1. Configure PC1 and PC2 to receive an IP address through DHCP.

a. On a Windows PC go to Start -> Control Panel -> Network Connections -> Local Area Connection.
Right mouse click on the Local Area Connection and select Properties. Make sure the button is selected that says Obtain an IP address automatically



Once this has been done on both PC1 and PC2, they are ready to receive an IP address from a DHCP server.

2. Configure a Cisco IOS DHCP Server

Cisco IOS software supports a DHCP server configuration called Easy IP. The goal for this lab is to have devices on the networks 192.168.10.0/24 and 192.168.11.0/24 request IP addresses via DHCP from R1.

a. Exclude statically assigned addresses

The DHCP server assumes that all IP addresses in a DHCP address pool subnet are available for assigning to DHCP clients. You must specify the IP addresses that the DHCP server should not assign to clients. These IP addresses are usually static addresses reserved for the router interface, switch management IP address, servers, and local network printer. The ip dhcp excluded-address command prevents the router from assigning IP addresses within the configured range. The following commands exclude the first 10 IP addresses from each pool for the LANs attached to R1. These addresses will not be assigned to any DHCP clients.

```
R1(config)#ip dhcp excluded-address 192.168.10.1 192.168.10.10
R1(config)#ip dhcp excluded-address 192.168.11.1 192.168.11.10
```

b. Configure the pool.

Each DHCP server must have at least one pool of addresses to be used by the DHCP protocol.
Create the DHCP pool using the ip dhcp pool <pool_name> command and name it R1Fa0.

R1(config)#ip dhcp pool R1Fa0

The next step is assigning the range of IP addresses to the created pool.

NOTE: The DHCP server will automatically associate the defined pool with the correct interface based on the IP addresses assigned to it.

For the DHCP server to grant clients IP addresses in the range 192.168.10.0/24, starting from address 192.168.10.1, execute the command:

R1(dhcp-config)#network 192.168.10.0 255.255.255.0

Due to the DHCP protocol, it is designed to provide clients many network parameters (not only the IP address), at least specify the address of the default router and DNS server (the given address is an example for the purpose of this laboratory exercise). It is good to write the following:
R1(dhcp-config)#dns-server 192.168.11.5
R1(dhcp-config)#default-router 192.168.10.1

According to the picture above, the DHCP server on R1 supports two subnets, it is necessary to declare the second address pool (for example with name R1Fa1) and its parameters. Therefore, please use the instructions below:
R1(config)#ip dhcp pool R1Fa1
R1(dhcp-config)#network 192.168.11.0 255.255.255.0
R1(dhcp-config)#dns-server 192.168.11.5
R1(dhcp-config)#default-router 192.168.11.1

c. Configure a helper address

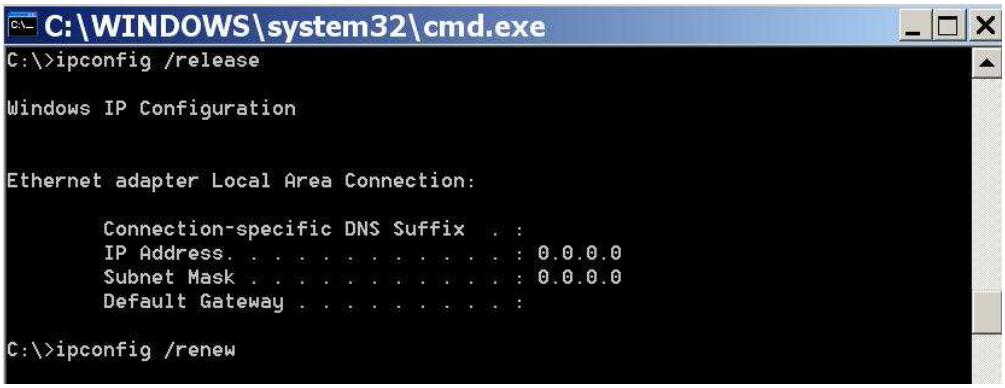
NOTE: The DHCP protocol assumes that the DHCP server and clients are in one broadcasting domain (the need to use link layer broadcasts). Router, in principle, does not transmit broadcasts between its interfaces. Therefore, in order to be able to configure clients without a direct connection to the interfaces of the router on which the DHCP server is configured (eg clients, between which a router is located between them and the DHCP server), it is necessary to use the so-called ***helper address***. It is configured on the router(s) between the DHCP server and the client(s).Thanks to this, these routers will be able to transmit broadcasts related to the operation of the DHCP protocol to a specific IP address (DHCP server address).The commands for such a case (it was assumed that the intermediate router is router R1 and the DHCP server has been configured on the connected R2 router with interface from R1 with IP address 10.1.1.2) are presented below:

R2(config)#interface fa0/0
R2(config-if)#ip helper-address 10.1.1.2
R2(config)#interface fa0/1

R2 (config-if)#ip helper-address 10.1.1.2

d. Release and Renew the IP addresses on PC hosts

Depending upon whether your PCs have been used in a different lab, or connected to the internet, they may already have learned an IP address automatically from a different DHCP server. We need to clear this IP address using the ipconfig /release and ipconfig /renew commands.



3. Verify the DHCP configuration

a. Execute ipconfig /all command on PC1 and PC2 hosts. The result of this command for one of the PCs should be included in the report.

b. Execute show ip dhcp binding command on the router R1 console. It allows you to find the currently existing connections of the client interface - the IP address (lease of addresses). The example of the router's response should look like the listing below:

```
R1#show ip dhcp binding
Bindings from all pools not associated with VRF:
IP address          Client-ID/              Lease expiration        Type
                    Hardware address/
                    User name
192.168.10.11       0063.6973.636f.2d30.    Sep 14 2007 07:33 PM    Automatic
                    3031.632e.3537.6563.
                    2e30.3634.302d.566c.
                    31
```

Include the result of this command in the report

c. The show ip dhcp pool command displays information on all currently configured DHCP pools on the router. In this output, the pool R1Fa0 is configured on R1. See example response below:

```
R2#show ip dhcp pool
Pool R1Fa0 :
 Utilization mark (high/low)    : 100 / 0
 Subnet size (first/next)       : 0 / 0
 Total addresses                : 254
 Leased addresses               : 1
 Pending event                  : none
 1 subnet is currently in the pool :
 Current index        IP address range                    Leased addresses
 192.168.10.12        192.168.10.1     - 192.168.10.254    1
```

Include the result of this command in the report

d. The debug ip dhcp server events command can be extremely useful when troubleshooting DHCP leases with a Cisco IOS DHCP server. The following is the debug output on R1 after connecting a host.
Using this command will display information about whether the server periodically checks the expiration of address leases. The processes related to the returned and assigned addresses will also be displayed. In the report, please put the result of this command and mark the lines proving that the address has been assigned to a specific PC interface, in analogy to the examples below.

```
*Sep 13 21:04:18.072: DHCPD: Sending notification of DISCOVER:
*Sep 13 21:04:18.072:   DHCPD: htype 1 chaddr 001c.57ec.0640
*Sep 13 21:04:18.072:   DHCPD: remote id 020a0000c0a80b01010000000000
*Sep 13 21:04:18.072:   DHCPD: circuit id 00000000
*Sep 13 21:04:18.072: DHCPD: Seeing if there is an internally specified pool
class:
*Sep 13 21:04:18.072:   DHCPD: htype 1 chaddr 001c.57ec.0640
*Sep 13 21:04:18.072:   DHCPD: remote id 020a0000c0a80b01010000000000
*Sep 13 21:04:18.072:   DHCPD: circuit id 00000000
*Sep 13 21:04:18.072: DHCPD: there is no address pool for 192.168.11.1.
*Sep 13 21:04:18.072: DHCPD: Sending notification of DISCOVER:
R1#
*Sep 13 21:04:18.072:   DHCPD: htype 1 chaddr 001c.57ec.0640
*Sep 13 21:04:18.072:   DHCPD: remote id 020a0000c0a80a01000000000000
*Sep 13 21:04:18.072:   DHCPD: circuit id 00000000
*Sep 13 21:04:18.072: DHCPD: Seeing if there is an internally specified pool
class:
*Sep 13 21:04:18.072:   DHCPD: htype 1 chaddr 001c.57ec.0640
*Sep 13 21:04:18.072:   DHCPD: remote id 020a0000c0a80a01000000000000
*Sep 13 21:04:18.072:   DHCPD: circuit id 00000000
R1#
*Sep 13 21:04:20.072: DHCPD: Adding binding to radix tree (192.168.10.12)
*Sep 13 21:04:20.072: DHCPD: Adding binding to hash tree
*Sep 13 21:04:20.072: DHCPD: assigned IP address 192.168.10.12 to client
0063.6973.636f.2d30.3031.632e.3537.6563.2e30.3634.302d.566c.31.
*Sep 13 21:04:20.072: DHCPD: Sending notification of ASSIGNMENT:
*Sep 13 21:04:20.072:  DHCPD: address 192.168.10.12 mask 255.255.255.0
*Sep 13 21:04:20.072:   DHCPD: htype 1 chaddr 001c.57ec.0640
*Sep 13 21:04:20.072:   DHCPD: lease time remaining (secs) = 86400
*Sep 13 21:04:20.076: DHCPD: Sending notification of ASSIGNMENT:
*Sep 13 21:04:20.076:  DHCPD: address 192.168.10.12 mask 255.255.255.0
R1#
*Sep 13 21:04:20.076:   DHCPD: htype 1 chaddr 001c.57ec.0640
*Sep 13 21:04:20.076:   DHCPD: lease time remaining (secs) = 86400
```

e. To check whether messages are received or sent by the router, use the command show ip dhcp server statistics. Using this command will display information about the number of DHCP messages sent and received. Please, include the results in the report. Additionally, underline the obtained DHCP messages. Is their order of occurrence consistent with the theoretical expectations and are the statistics complete (do the statistics contain all of the messages)? Briefly justify the answer.

Yes its satisfy expectations. We got a Discover, Offer, Request and Acknowledgement messages. And they are in the right order and number.

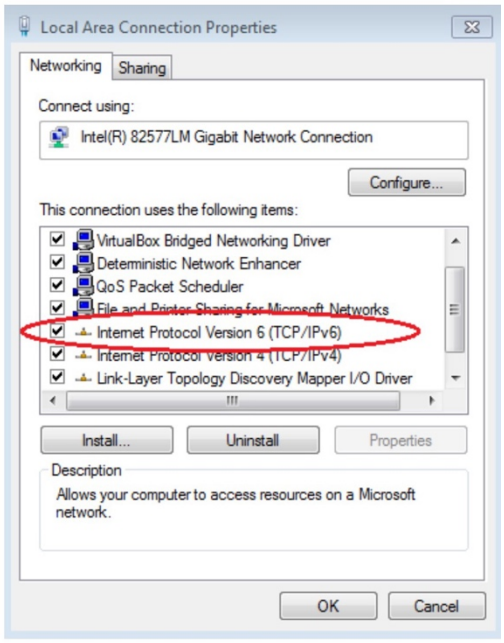
Part II : IPv6

This part of the exercise uses the topology of part I. During it, a small LAN will be configured using the IPv6 protocol and SAA autoconfiguration. The addressing of individual interfaces is presented in the ta below.

Device	Interface	IPv6 Address	Prefix Length	Default Gateway
R1	G0/0	2001:DB8:ACAD:A::1	64	N/A
	G0/1	2001:DB8:ACAD:1::1	64	N/A
PC-A	NIC	2001:DB8:ACAD:1::3	64	FE80::1
PC-B	NIC	2001:DB8:ACAD:A::3	64	FE80::1

1. **PC hosts configuration for IPv6 support.**

a. First, allow using IPv6 protocol on PC hosts. See the figure.



2. Setting iPv6 adresses manually

a. Setting IPv6 addresses to Ethernet interfaces on the R1 router. To do this, configure global unicast addresses (according to the address table above) on Ethernet interfaces by entering the following commands:

```
R1(config)# interface g0/0
R1(config-if)# ipv6 address 2001:db8:acad:a::1/64
R1(config-if)# no shutdown
R1(config-if)# interface g0/1
R1(config-if)# ipv6 address 2001:db8:acad:1::1/64
R1(config-if)# no shutdown
R1(config-if)# end
R1#
```

b. Use command show ipv6 interface brief to verify interfaces configuration.

```
R1# show ipv6 interface brief
Em0/0                  [administratively down/down]
   unassigned
GigabitEthernet0/0     [up/up]
   FE80::D68C:B5FF:FECE:A0C0
   2001:DB8:ACAD:A::1
GigabitEthernet0/1     [up/up]
   FE80::D68C:B5FF:FECE:A0C1
   2001:DB8:ACAD:1::1
Serial0/0/0            [administratively down/down]
   unassigned
Serial0/0/1            [administratively down/down]
   unassigned
R1#
```

c. Use show ipv6 interface g0/0 (instead of g0/0 use the accurate interface name). The exemplar results are listed below. Notify, to which multicast groups have been connected to each of the interfaces.

Include the result of this command for one of the router R1 Ethernet interfaces and specify the meaning of the individual multicast groups present in the listing.

All of them are Multicast link local addresses.

```
R1# show ipv6 interface g0/0
GigabitEthernet0/0 is up, line protocol is up
 IPv6 is enabled, link-local address is FE80::D68C:B5FF:FECE:A0C0
 No Virtual link-local address(es):
 Global unicast address(es):
   2001:DB8:ACAD:A::1, subnet is 2001:DB8:ACAD:A::/64
 Joined group address(es):
   FF02::1
   FF02::1:FF00:1
   FF02::1:FFCE:A0C0
 MTU is 1500 bytes
 ICMP error messages limited to one every 100 milliseconds
 ICMP redirects are enabled
 ICMP unreachables are sent
 ND DAD is enabled, number of DAD attempts: 1
 ND reachable time is 30000 milliseconds (using 30000)
 ND advertised reachable time is 0 (unspecified)
 ND advertised retransmit interval is 0 (unspecified)
 ND router advertisements are sent every 200 seconds
 ND router advertisements live for 1800 seconds
 ND advertised default router preference is Medium
 Hosts use stateless autoconfig for addresses.
R1#
```

d. In order to be compatible between the link-local address and the address, you can manually assign a link-local address to each of the Ethernet interfaces of the R1 router. Follow the instructions below:

```
R1# config t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)# interface g0/0
R1(config-if)# ipv6 address fe80::1 link-local
R1(config-if)# interface g0/1
R1(config-if)# ipv6 address fe80::1 link-local
R1(config-if)# end
R1#
```

Explain why yit is possible to assign the same link-local address to both interfaces eg. FE80::1.

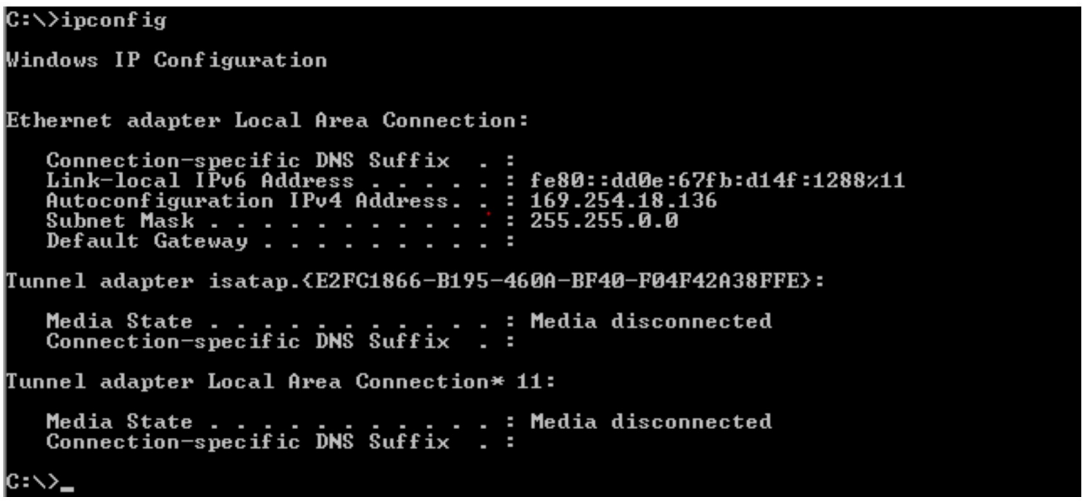
Because link-local address is used only for communications with directly connected devices. It can be same as long as they are unique on the link.

e. Use command show ipv6 interface for each of therouter R1 Ethernet interfaces. Has changed the assignment to multicast groups in relation to the previous point.
If so, please specify what has changed and the reason for this change (on the example of the chosen interface)

---

3. Konfiguracja routingu statycznego IPv6 na routerze

a. Check whether the IPv6 protocol and the link-local address are configured correctly on PC-A and PC-B hosts.



b. Activate the static IPv6 routing on router R1 using IPv6 unicast- routing command.

R1 # configure terminal R1(config)#
ipv6 unicast-routing R1(config)# exit
R1#

c. Use command show ipv6 interface for each of the router R1 Ethernet interfaces.

Has the assignment to multicast groups changed in relation to point 2e? If so, please specify what has changed and justify the reason for this change (on the example of the chosen interface).

---

d. Refresh the PC-A and PC-B configuration if router R1 belongs to the multicast group (all router multicast group) due to the previous step.

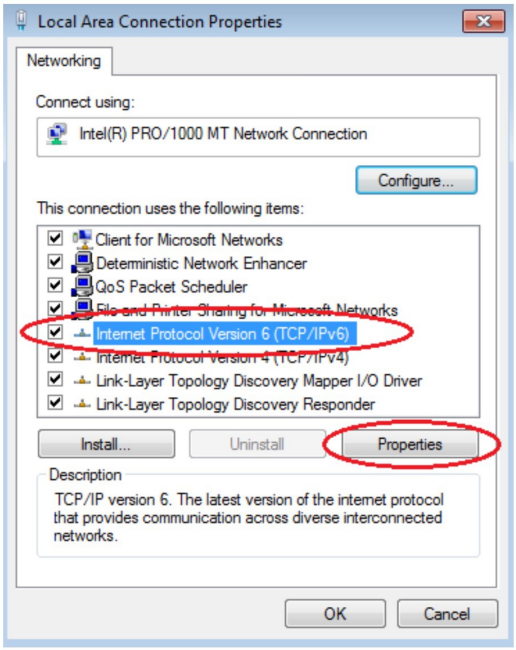
```
C:\>ipconfig

Windows IP Configuration

Ethernet adapter Local Area Connection:

   Connection-specific DNS Suffix  . :
   IPv6 Address. . . . . . . . . . . : 2001:db8:acad:a:dd0e:67fb:d14f:1288
   Temporary IPv6 Address. . . . . . : 2001:db8:acad:a:6082:dcb0:5fb2:3ece
   Link-local IPv6 Address . . . . . : fe80::dd0e:67fb:d14f:1288%11
   Autoconfiguration IPv4 Address. . : 169.254.18.136
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . : fe80::1%11

Tunnel adapter isatap.{E2FC1866-B195-460A-BF40-F04F42A38FFE}:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Tunnel adapter Local Area Connection* 11:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

C:\>
```

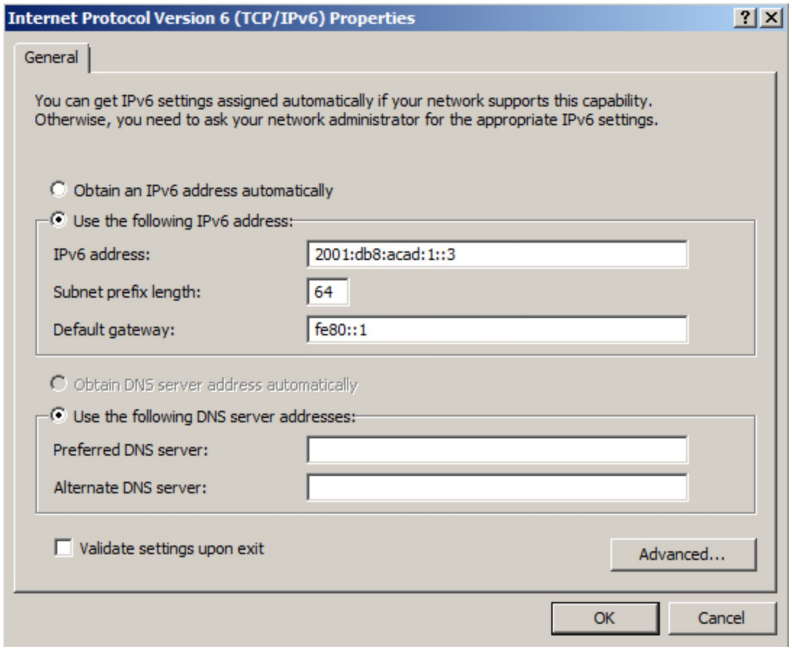
Explain why the PC-A and PC-B assigned are: Global Routing Prefix and Subnet ID the same as configured on R1?

Because they are in same multicast group.

4. Setting the static IPv6 on a PC.

a. Manually configure IPv6 addresses on the PC, hosts accordin to the address table (above) and the example figures (belowj.





b. Use the ***ipconfig*** command to check the configuration of network interfaces on both PCs. The result of this command for PC-A and PC-B should be included in the report.

c. Use *ping* commnad to verify comunication between PC-A and PC-B hosts.

Has the ping test ended successful? Put a screenshot of the ping action in the report.

5. SELF-MADE TASK

DHCP allows you to assign a specific IPv4 address based on the MAC address. How to configure this for a DHCP server running on the Cisco router.

Its called ip-mac binding.Can be done by using ‘config network ip-mac-binding’ command.

3) a)

```
C:\>ipconfig /all

FastEthernet0 Connection:(default port)

   Connection-specific DNS Suffix..:
   Physical Address.................: 0090.213E.C2BA
   Link-local IPv6 Address.........: FE80::290:21FF:FE3E:C2BA
   IP Address......................: 192.168.10.11
   Subnet Mask.....................: 255.255.255.0
   Default Gateway.................: 192.168.10.1
   DNS Servers.....................: 192.168.11.5
   DHCP Servers....................: 192.168.10.1
   DHCPv6 Client DUID..............: 00-01-00-01-3D-84-28-A8-00-90-21-3E-C2-BA
```

3) b)

```
R1#show ip dhcp binding
IP address       Client-ID/              Lease expiration        Type
                 Hardware address
192.168.10.11    0090.213E.C2BA           --                     Automatic
192.168.11.11    0010.11AB.478B           --                     Automatic
```

3) c)

```
R1#show ip dhcp pool

Pool R1Fa0 :
 Utilization mark (high/low)    : 100 / 0
 Subnet size (first/next)       : 0 / 0
 Total addresses                : 254
 Leased addresses               : 1
 Excluded addresses             : 2
 Pending event                  : none

 1 subnet is currently in the pool
 Current index        IP address range                    Leased/Excluded/Total
 192.168.10.1         192.168.10.1     - 192.168.10.254    1    / 2     / 254

Pool R1Fa1 :
 Utilization mark (high/low)    : 100 / 0
 Subnet size (first/next)       : 0 / 0
 Total addresses                : 254
 Leased addresses               : 1
 Excluded addresses             : 2
 Pending event                  : none

 1 subnet is currently in the pool
 Current index        IP address range                    Leased/Excluded/Total
 192.168.11.1         192.168.11.1     - 192.168.11.254    1    / 2     / 254
```

3) d)

```
*Nov  6 10:25:44.503: DHCPD: Sending notification of TERMINATION:
*Nov  6 10:25:44.503:  DHCPD: address 192.168.10.12 mask 255.255.255.0
*Nov  6 10:25:44.503:  DHCPD: reason flags: RELEASE
*Nov  6 10:25:44.503:   DHCPD: htype 1 chaddr 0026.188b.a4b3
*Nov  6 10:25:44.503:   DHCPD: lease time remaining (secs) = 84117
*Nov  6 10:25:44.503: DHCPD: returned 192.168.10.12 to address pool R1Fa0.
*Nov  6 10:25:48.187: DHCPD: Sending notification of DISCOVER:
*Nov  6 10:25:48.187:   DHCPD: htype 1 chaddr 0026.188b.a4b3
*Nov  6 10:25:48.187:   DHCPD: remote id 020a0000c0a80a0100000000
*Nov  6 10:25:48.187:   DHCPD: circuit id 00000000
*Nov  6 10:25:48.187: DHCPD: Seeing if there is an internally specified pool class:
*Nov  6 10:25:48.187:   DHCPD: htype 1 chaddr 0026.188b.a4b3
*Nov  6 10:25:48.187:   DHCPD: remote id 020a0000c0a80a0100000000
*Nov  6 10:25:48.187:   DHCPD: circuit id 00000000
*Nov  6 10:25:48.187: DHCPD: client requests 192.168.10.12.
*Nov  6 10:25:48.187: DHCPD: Allocated binding 21FADDF8
*Nov  6 10:25:48.187: DHCPD: Adding binding to radix tree (192.168.10.12)
*Nov  6 10:25:48.187: DHCPD: Adding binding to hash tree

################################################################################################
*Nov  6 10:25:48.187: DHCPD: assigned IP address 192.168.10.12 to client 0100.2618.8ba4.b3.         #
*Nov  6 10:25:50.187: DHCPD: Sending notification of DISCOVER:                                      #
*Nov  6 10:25:50.187:   DHCPD: htype 1 chaddr 0026.188b.a4b3                                       #
*Nov  6 10:25:50.187:   DHCPD: remote id 020a0000c0a80a0100000000                                  #
*Nov  6 10:25:50.187:   DHCPD: circuit id 00000000                                                 #
*Nov  6 10:25:50.187: DHCPD: Seeing if there is an internally specified pool class:                #
*Nov  6 10:25:50.187:   DHCPD: htype 1 chaddr 0026.188b.a4b3                                       #
*Nov  6 10:25:50.187:   DHCPD: remote id 020a0000c0a80a0100000000                                  #
*Nov  6 10:25:50.187:   DHCPD: circuit id 00000000                                                 #
*Nov  6 10:25:50.187: DHCPD: Sending notification of ASSIGNMENT:                                   #
*Nov  6 10:25:50.187:  DHCPD: address 192.168.10.12 mask 255.255.255.0                             #
################################################################################################

*Nov  6 10:25:50.187:   DHCPD: htype 1 chaddr 0026.188b.a4b3
*Nov  6 10:25:50.187:   DHCPD: lease time remaining (secs) = 86400
*Nov  6 10:25:51.987: DHCPD: checking for expired leases.
```

3) e)

```
Router#show ip dhcp server statistics
Memory usage         59035
Address pools        2
Database agents      0
Automatic bindings   4
Manual bindings      0
Expired bindings     0
Malformed messages   0
Secure arp entries   0

Message              Received
BOOTREQUEST          0
DHCPDISCOVER         4
DHCPREQUEST          4
DHCPDECLINE          0
DHCPRELEASE          0
DHCPINFORM           6

Message              Sent
BOOTREPLY            0
DHCPOFFER            4
DHCPACK              10
DHCPNAK              0
```

3. Verify the DHCP configuration

b)

```
Router#show ip dhcp binding
Bindings from all pools not associated with VRF:
IP address          Client-ID/              Lease expiration        Type
                    Hardware address/
                    User name
192.168.10.11       0063.6973.636f.2d64.    Nov 07 2019 09:46 AM    Automatic
                    3063.372e.3839.6532.
                    2e34.6634.302d.566c.
                    31
192.168.10.12       0100.2618.8ba4.b3       Nov 07 2019 09:47 AM    Automatic
192.168.11.11       0063.6973.636f.2d64.    Nov 07 2019 09:47 AM    Automatic
                    3063.372e.3839.6532.
                    2e34.3334.302d.566c.
                    31
192.168.11.12       0100.2618.8ba2.26       Nov 07 2019 09:49 AM    Automatic
```

c)

```
Router#show ip dhcp pool

Pool R1Fa0 :
 Utilization mark (high/low)    : 100 / 0
 Subnet size (first/next)       : 0 / 0
 Total addresses                : 254
 Leased addresses               : 2
 Pending event                  : none
 1 subnet is currently in the pool :
 Current index        IP address range                    Leased addresses
 192.168.10.13        192.168.10.1     - 192.168.10.254    2

Pool R1Fa1 :
 Utilization mark (high/low)    : 100 / 0
 Subnet size (first/next)       : 0 / 0
 Total addresses                : 254
 Leased addresses               : 2
 Pending event                  : none
 1 subnet is currently in the pool :
 Current index        IP address range                    Leased addresses
 192.168.11.13        192.168.11.1     - 192.168.11.254    2
```

2. Setting iPv6 adresses manually

c)

```
Router#show ipv6 interface GigabitEthernet0/0
GigabitEthernet0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::FA72:EAFF:FEB1:D0D0
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:DB8:ACAD:A::1, subnet is 2001:DB8:ACAD:A::/64
  Joined group address(es):
    FF02::1
    FF02::1:FF00:1
    FF02::1:FFB1:D0D0
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ICMP unreachables are sent
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds (using 30000)
  ND NS retransmit interval is 1000 milliseconds
```

```
Router#show ipv6 interface
GigabitEthernet0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::1
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:DB8:ACAD:A::1, subnet is 2001:DB8:ACAD:A::/64
  Joined group address(es):
    FF02::1
    FF02::1:FF00:1
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ICMP unreachables are sent
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds (using 30000)
  ND NS retransmit interval is 1000 milliseconds
GigabitEthernet0/1 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::1
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:DB8:ACAD:1::1, subnet is 2001:DB8:ACAD:1::/64
  Joined group address(es):
    FF02::1
 --More--
*Nov  6 10:23:51.987: DHCPD: checking for expir    FF02::1:FF00:1
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ICMP unreachables are sent
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds (using 30000)
  ND NS retransmit interval is 1000 milliseconds
```

4) b)

```
Windows PowerShell
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PS C:\Users\student> ipconfig /all

Konfiguracja IP systemu Windows

   Nazwa hosta . . . . . . . . . . . . : Lab3-01
   Sufiks podstawowej domeny DNS . . :
   Typ węzła . . . . . . . . . . . . . : Hybrydowy
   Routing IP włączony . . . . . . . . : Nie
   Serwer WINS Proxy włączony. . . . . : Nie

Karta Ethernet LAN:

   Sufiks DNS konkretnego połączenia :
   Opis. . . . . . . . . . . . . . . . : Kontroler Marvell Yukon 88E8056 PCI-E Gigabit Ethernet Controller
   Adres fizyczny. . . . . . . . . . . : 00-26-18-8B-A4-B3
   DHCP włączone . . . . . . . . . . . : Tak
   Autokonfiguracja włączona . . . . . : Tak
   Adres IPv6. . . . . . . . . . . . . : 2001:db8:acad:a:70b1:2fc4:fb7e:caff(Preferowane)
   Tymczasowy adres IPv6 . . . . . . . : 2001:db8:acad:a:15c4:fb30:9db2:b443(Preferowane)
   Adres IPv6 połączenia lokalnego . . : fe80::70b1:2fc4:fb7e:caff%11(Preferowane)
   Adres IPv4. . . . . . . . . . . . . : 192.168.10.12(Preferowane)
   Maska podsieci. . . . . . . . . . . : 255.255.255.0
   Dzierżawa uzyskana. . . . . . . . . : 06 November 2019 12:08:03
   Dzierżawa wygasa. . . . . . . . . . : 07 November 2019 12:08:03
   Brama domyślna. . . . . . . . . . . : fe80::1%11
                                         192.168.10.1
   Serwer DHCP . . . . . . . . . . . . : 192.168.10.1
   Serwery DNS . . . . . . . . . . . . : 192.168.11.5
   NetBIOS przez Tcpip . . . . . . . . : Włączony

Karta tunelowa isatap.{160D234C-3793-457A-8EDD-E2E5639CE6A0}:

   Stan nośnika . . . . . . . . . . . .: Nośnik odłączony
   Sufiks DNS konkretnego połączenia :
   Opis. . . . . . . . . . . . . . . . : Karta Microsoft ISATAP
   Adres fizyczny. . . . . . . . . . . : 00-00-00-00-00-00-00-E0
   DHCP włączone . . . . . . . . . . . : Nie
   Autokonfiguracja włączona . . . . . : Tak
PS C:\Users\student>
```

4) c)

```
C:\>ping 192.168.10.11

Pinging 192.168.10.11 with 32 bytes of data:

Request timed out.
Reply from 192.168.10.11: bytes=32 time=1ms TTL=127
Reply from 192.168.10.11: bytes=32 time=2ms TTL=127
Reply from 192.168.10.11: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.10.11:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 2ms, Average = 1ms
```