



Lab 4

Routing Protocol using Packet Tracer

Name : MUHAMMAD ISKANDAR ZULQARNAIN BIN MOHD ISHAK

Section: 11

Metric No. : A19EC0098

Introduction

You are given a Packet Tracer file with a network topology shown in Figure 1 below, which requires some work on IP addressing and routing protocol configuration. You must follow all the steps carefully and answer the given questions.

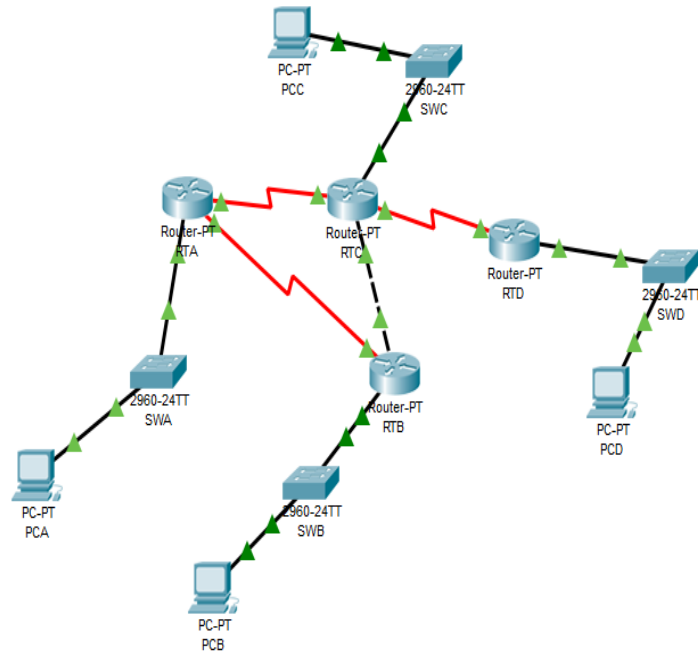


Figure 1

Task 1: IP addressing

Step 1: Fill in Table 1 (on next page) with the correct information. Note: The information may be found under the **Config** tab of each router (refer to Figure2).

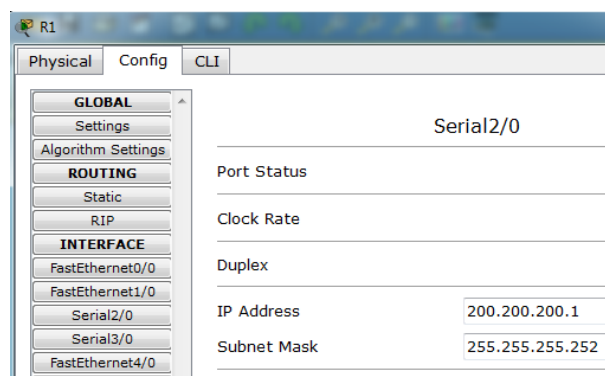


Figure 2

Table 1

#	Device Name	Interface	IP Address	Subnet Mask
1	RTA	Se2/0	172.16.230.5	255.255.255.252
2		Se3/0	172.16.230.1	255.255.255.252
3		Fa0/0	172.16.224.255	255.255.254.0
4	RTB	Se2/0	172.16.230.2	255.255.255.252
5		Fa0/0	172.16.230.9	255.255.255.252
6		Fa1/0	172.16.226.11	255.255.254.0
7	RTC	Se2/0	172.16.230.6	255.255.255.252
8		Se3/0	172.16.230.13	255.255.255.252
9		Fa0/0	172.16.230.10	255.255.255.252
10		Fa1/0	172.16.228.11	255.255.255.0
10	RTD	Se2/0	172.16.230.14	255.255.255.252
11		Fa0/0	172.16.229.222	255.255.255.0

Step 2: Based on the result and observation in **Step 1**, answer the following questions:

- How many different subnets are there? 8
- What is the network address of each of these subnets? (*Hint: Given the IP address and the subnet mask, you can calculate the network address using logical **AND** operation*). Complete Table 2 below.

Table 2

Subnet #	Network Address	Broadcast Address	Range of usable addresses
1	172.16.224.0	172.16.225.255	172.16.224.1 - 172.16.225.254
2	172.16.230.0	172.16.230.3	172.16.230.1 - 172.16.230.2
3	172.16.226.0	172.16.227.255	172.16.226.1 – 172.16.227.254
4	172.16.230.4	172.16.230.7	172.16.230.5 – 172.16.230.6
5	172.16.230.12	172.16.230.15	172.16.230.13 – 172.16.230.14
6	172.16.230.8	172.16.230.11	172.16.230.9 – 172.16.230.10
7	172.16.228.0	172.16.228.255	172.16.228.1 – 172.16.228.254
8	172.16.229.0	172.16.229.255	172.16.229.1-172.16.229.254

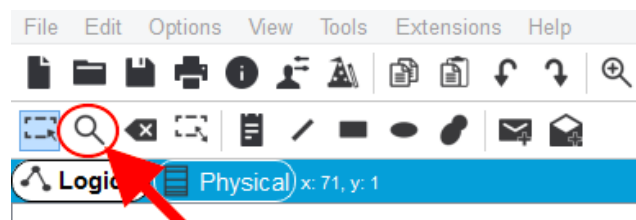
- c. Provided that all PC will use the last usable address in its subnet, fill in Table 3 below with the correct information.

Table 3

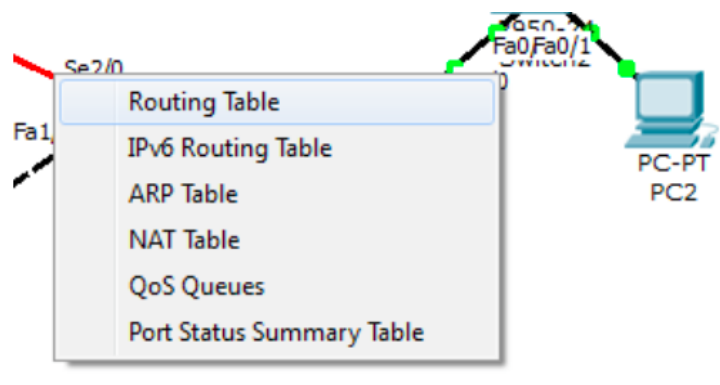
#	Device Name	IP Address	Subnet Mask	Default Gateway
1	PCA	172.16.225.254	255.255.254.0	172.16.224.255
2	PCB	172.16.227.254	255.255.254.0	172.16.226.11
3	PCC	172.16.228.254	255.255.255.0	172.16.228.11
4	PCD	172.16.229.254	255.255.255.0	172.16.229.222

Step 3: Complete the IP addressing information on all the PCs in the topology. (Hint: Click on the PC, choose the **Desktop** tab, then click **IP Configuration**).

Step 4: Open the routing table for each router. (Hint: you can use the 'magnifying glass' icon from the secondary toolbar, then point & click to a router and choose 'Routing Table'. See Figure 3 below.)



(a)



(b)

Figure 3

Step 5: Copy the image of the routing table for each router. (Hint: You can use Window's 'Print Scrn' command OR 'Snipping Tool' to copy / screenshot the image.)

a) RTA

Routing Table for RTA				
Type	Network	Port	Next Hop IP	Metric
C	172.16.224.0/23	FastEthernet0/0	---	0/0
C	172.16.230.0/30	Serial3/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0

b) RTB

Routing Table for RTB				
Type	Network	Port	Next Hop IP	Metric
C	172.16.226.0/23	FastEthernet1/0	---	0/0
C	172.16.230.0/30	Serial2/0	---	0/0
C	172.16.230.8/30	FastEthernet0/0	---	0/0

c) RTC

Routing Table for RTC				
Type	Network	Port	Next Hop IP	Metric
C	172.16.228.0/24	FastEthernet1/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0
C	172.16.230.8/30	FastEthernet0/0	---	0/0
C	172.16.230.12/30	Serial3/0	---	0/0

d) RTD

Routing Table for RTD				
Type	Network	Port	Next Hop IP	Metric
C	172.16.229.0/24	FastEthernet0/0	---	0/0
C	172.16.230.12/30	Serial2/0	---	0/0

Step 6: Answer the questions below:

- a. Do all the routers have the same information in its routing table?

No. Each router has their own routing table.

- b. What is the difference that can be seen?

Network address of the routers.

- c. Can all the PCs ping each other successfully? (Fill in the Table 4 below)

Table 4

#	Ping between devices	Successful ☑	Unsuccessful ☒
1	PCA-PCB		X
2	PCA-PCC		X
3	PCA-PCD		X
4	PCB-PCC		X
5	PCB-PCD		X
6	PCC-PCD		X

- d. Reflection: what is the reason for your answer in (c)?

They are unsuccessful because they are not interconnected to each other to establish the connection.

Task 2: Dynamic routing configuration – RIP

Dynamic routing allows the network to be more flexible to changes. It can help the routers adapt to the changes in the pathways without much intervention from network administrators.

In this part of the lab, you will learn how to configure RIP routing protocol, and see how changes happen in the routing tables.

Step 1: Choose Router RTA. Click the **CLI** tab. Copy the following text into the command line interface.

```
RTA>enable
RTA#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
RTA(config)#router rip
RTA(config-router)#version 2
RTA(config-router)#network 172.16.0.0
RTA(config-router)#no auto-summary
RTA(config-router)#exit
RTA(config)#exit
RTA#
%SYS-5-CONFIG_I: Configured from console by console

RTA#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
RTA#
```

When asked this
just press ENTER

Task 1.1:

(a) Copy (OR paste image / screenshot) of the RTA routing table here.

Routing Table for RTA				
Type	Network	Port	Next Hop IP	Metric
C	172.16.224.0/23	FastEthernet0/0	---	0/0
C	172.16.230.0/30	Serial3/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0

Step 2: Choose Router RTB. Click the **CLI** tab. Copy the following text into the command line interface.

```
RTB>enable
RTB#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
RTB(config)#router rip
RTB(config-router)#version 2
RTB(config-router)#network 172.16.0.0
RTB(config-router)#no auto-summary
RTB(config-router)#exit RTB(config)#exit
RTB#
%SYS-5-CONFIG_I: Configured from console by console

RTB#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
RTB#
```

When asked this just press ENTER

Task 2.1:

(a) Copy (OR paste image / screenshot) of the RTA and RTB routing table below:

Routing Table for RTA					Routing Table for RTB				
Type	Network	Port	Next Hop IP	Metric	Type	Network	Port	Next Hop IP	Metric
C	172.16.224.0/23	FastEthernet0/0	---	0/0	R	172.16.224.0/23	Serial2/0	172.16.230.1	120/1
R	172.16.226.0/23	Serial3/0	172.16.230.2	120/1	C	172.16.226.0/23	FastEthernet1/0	---	0/0
C	172.16.230.0/30	Serial3/0	---	0/0	C	172.16.230.0/30	Serial2/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0	R	172.16.230.4/30	Serial2/0	172.16.230.1	120/1
R	172.16.230.8/30	Serial3/0	172.16.230.2	120/1	C	172.16.230.8/30	FastEthernet0/0	---	0/0

(b) **Reflection:** what difference do you see between routing tables of RTA and RTB?

The Next Hop IP for RTA and RTA are different as their IP are 172.16.230.2 and 172.16.230.1 respectively. However, their network address remains the same.

Step 3: Copy the same configuration instructions to RTC and RTD (as indicated in **Step 2**)

Routing Table for RTC					Routing Table for RTD				
Type	Network	Port	Next Hop IP	Metric	Type	Network	Port	Next Hop IP	Metric
R	172.16.224.0/23	Serial2/0	172.16.230.5	120/1	R	172.16.224.0/23	Serial2/0	172.16.230.13	120/2
R	172.16.226.0/23	FastEthernet0/0	172.16.230.9	120/1	R	172.16.226.0/23	Serial2/0	172.16.230.13	120/2
C	172.16.228.0/24	FastEthernet1/0	---	0/0	R	172.16.228.0/24	Serial2/0	172.16.230.13	120/1
R	172.16.230.0/30	Serial2/0	172.16.230.5	120/1	C	172.16.229.0/24	FastEthernet0/0	---	0/0
R	172.16.230.0/30	FastEthernet0/0	172.16.230.9	120/1	R	172.16.230.0/30	Serial2/0	172.16.230.13	120/2
C	172.16.230.4/30	Serial2/0	---	0/0	R	172.16.230.4/30	Serial2/0	172.16.230.13	120/1
C	172.16.230.8/30	FastEthernet0/0	---	0/0	R	172.16.230.8/30	Serial2/0	172.16.230.13	120/1
C	172.16.230.12/30	Serial3/0	---	0/0	C	172.16.230.12/30	Serial2/0	---	0/0

Step 4: Answer the questions below.

- a. Do all the routers have the same information in its routing table?

No.

- b. Write down routing table information (Next Hop IP, Metric) for RTC and RTD to the network 172.16.224.0/23

Router	Next Hop IP	Metric
RTC	172.16.230.5	120/1
RTC	172.16.230.9	120/1
RTD	172.16.230.13	120/2

- c. What is the difference that can be seen? Why is this?

The Next Hop IP and metric are different due to different port used. RTC used FastEthernet 1/0 and Serial 2/0 while RTD used FastEthernet 0/0 and Serial 2/0 port.

- d. Can all the PCs ping each other successfully? (Fill in the Table 5 below)

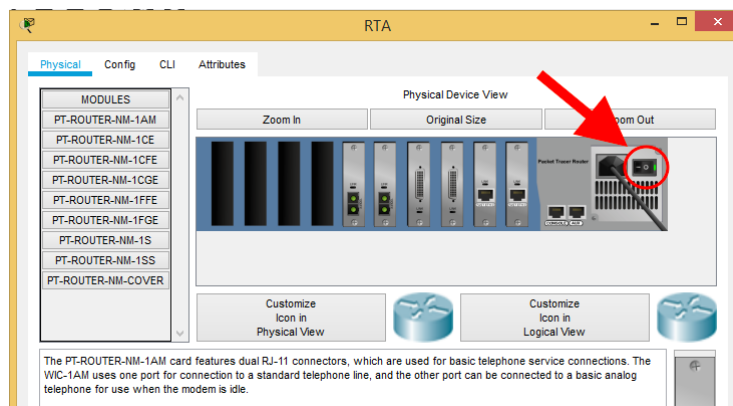
Table 5

#	Ping between devices	Successful ☑	Unsuccessful ☒
1	PCA-PCB	/	
2	PCA-PCC	/	
3	PCA-PCD	/	
4	PCB-PCC	/	
5	PCB-PCD	/	
6	PCC-PCD	/	

- e. Reflection: what is the reason for your answer in (d)?

All routers are configured accordingly via switches and they eventually connected to each other. This allows the communication and ping between devices.

Step 5: Switch **off** router RTA. (Hint: Click on the RTA router (i.e. using the 'Select' tool => ) , on the **Physical** tab, click the **ON/OFF switch** to turn ON or OFF, as shown below:)



What are the changes noted in the routing tables?

Ans: The routing table goes blank.

Routing Table for RTA				
Type	Network	Port	Next Hop IP	Metric

Step 6: Switch **on** router RTA. What are the changes noted in the routing tables?

Ans: The routing table data appears back.

Routing Table for RTA				
Type	Network	Port	Next Hop IP	Metric
C	172.16....	Fas...	---	0/0
R	172.16....	Seri...	172....	120/1
R	172.16....	Seri...	172....	120/1
R	172.16....	Seri...	172....	120/2
C	172.16....	Seri...	---	0/0
C	172.16....	Seri...	---	0/0
R	172.16....	Seri...	172....	120/1
R	172.16....	Seri...	172....	120/1
R	172.16....	Seri...	172....	120/1

Step 7: Reflection: What have you learned in this task?

Ans: The router configuration is saved in NVRAM where settings are preserved even no power.

Task 3: Dynamic routing configuration – OSPF

Make sure that you have all the routing tables on display on one side (as before). As you go through the steps, look at the changes happening in the routing tables.

Step 1: For all the routers, click the **CLI** tab and copy the following text into the command line interface.

```
Router>enable  
Router#configure terminal  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#no router rip  
Router(config)#exit  
Router#  
%SYS-5-CONFIG_I: Configured from console by console  
  
Router#copy running-config startup-config  
Destination filename [startup-config]?  
Building configuration...  
[OK]  
Router#
```

Step 2: Copy and paste the image of the routing table for each router below:

Routing Table for RTA					Routing Table for RTB				
Type	Network	Port	Next Hop IP	Metric	Type	Network	Port	Next Hop IP	Metric
C	172.16.224.0/23	FastEthernet0/0	---	0/0	C	172.16.226.0/23	FastEthernet1/0	---	0/0
C	172.16.230.0/30	Serial3/0	---	0/0	C	172.16.230.0/30	Serial2/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0	C	172.16.230.8/30	FastEthernet0/0	---	0/0

Routing Table for RTC					Routing Table for RTD				
Type	Network	Port	Next Hop IP	Metric	Type	Network	Port	Next Hop IP	Metric
C	172.16.228.0/24	FastEthernet1/0	---	0/0	C	172.16.229.0/24	FastEthernet0/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0	C	172.16.230.12/30	Serial2/0	---	0/0
C	172.16.230.8/30	FastEthernet0/0	---	0/0					
C	172.16.230.12/30	Serial3/0	---	0/0					

Step 3: For Router RTA, Click the **CLI** tab. Copy the following text into the command line interface.

```
RTA>enable
RTA# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
RTA(config)#router ospf 1
RTA(config-router)#network 172.16.224.0 0.0.1.255 area 0
RTA(config-router)#network 172.16.230.0 0.0.0.3 area 0
RTA(config-router)#network 172.16.230.4 0.0.0.3 area 0
RTA(config-router)#end
RTA#
%SYS-5-CONFIG_I: Configured from console by console

RTA# copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
RTA#
```

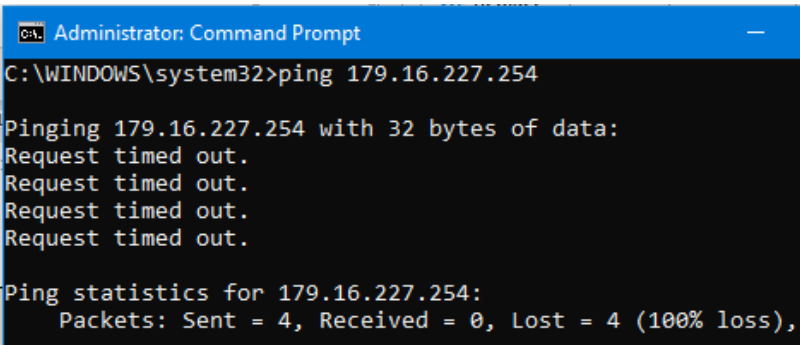
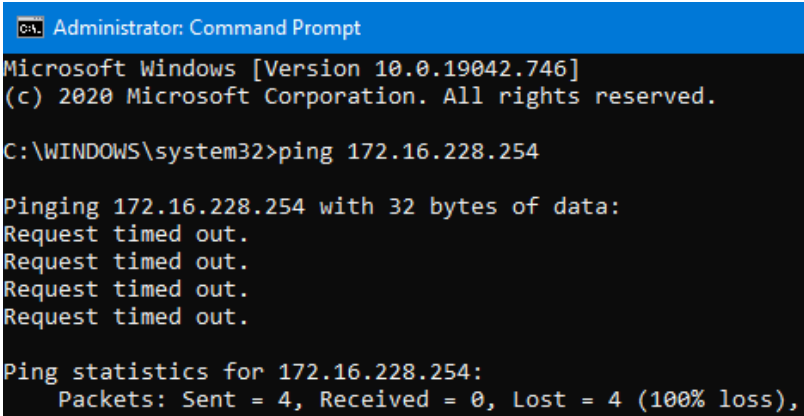
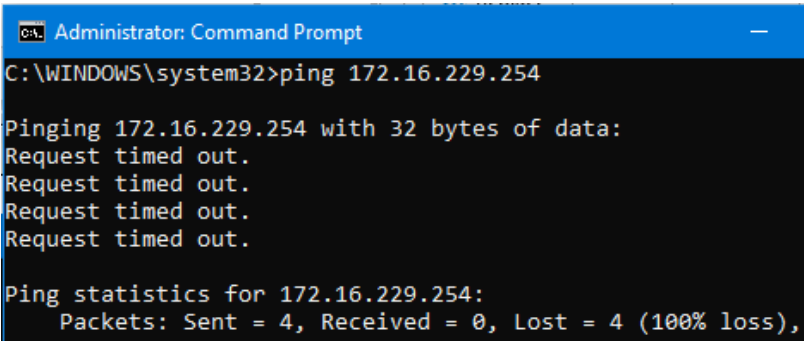
Task 3.1: Copy and paste the image of RTA's routing table below:

Routing Table for RTA				
Type	Network	Port	Next Hop IP	Metric
C	172.16.224.0/23	FastEthernet0/0	---	0/0
C	172.16.230.0/30	Serial3/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0

Task 3.2:

- Does RTA have a path to ALL the different subnet?
Yes
- Try pinging the different PCs and jot down your results. (Fill in the Table 6 below)

Table 6

#	Ping between devices	Successful ☑	Unsuccessful ☒
1	PCA-PCB 		X
2	PCA-PCC 		X
3	PCA-PCD 		X

Step 4: Configure the other routers with OSPF routing algorithm.

Step 4.1: For Router RTB, Click the **CLI** tab. Copy the following text into the command line interface.

```
RTA>enable  
RTB# configure terminal  
Enter configuration commands, one per line. End with CNTL/Z.  
RTB(config)#router ospf 1  
RTB(config-router)#network 172.16.226.0 0.0.1.255 area 0  
RTB(config-router)#network 172.16.230.0 0.0.0.3 area 0  
RTB(config-router)#network 172.16.230.8 0.0.0.3 area 0  
RTB(config-router)#end  
RTB#  
%SYS-5-CONFIG_I: Configured from console by console  
  
RTB# copy running-config startup-config  
Destination filename [startup-config]?  
Building configuration...  
[OK]  
RTB#
```

Step 4.2: For Router RTC, Click the **CLI** tab. Copy the following text into the command line interface.

```
RTC>enable  
RTC# configure terminal  
Enter configuration commands, one per line. End with CNTL/Z.  
RTC(config)#router ospf 1  
RTC(config-router)#network 172.16.228.0 0.0.0.255 area 0  
RTC(config-router)#network 172.16.230.4 0.0.0.3 area 0  
RTC(config-router)#network 172.16.230.8 0.0.0.3 area 0  
RTC(config-router)#network 172.16.230.12 0.0.0.3 area 0  
RTC(config-router)#end  
RTC#  
%SYS-5-CONFIG_I: Configured from console by console  
  
RTC# copy running-config startup-config  
Destination filename [startup-config]?  
Building configuration...  
[OK]  
RTC#
```

Step 4.3: For Router RTD, Click the **CLI** tab. Copy the following text into the command line interface.

```
RTD>enable
RTD# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
RTD(config)#
RTD(config)#router ospf 1
RTD(config-router)#network 172.16.229.0 0.0.0.255 area 0
RTD(config-router)#network 172.16.230.12 0.0.0.3 area 0
RTD(config-router)#end
RTD#
%SYS-5-CONFIG_I: Configured from console by console

RTD# copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
RTD#
```

Step 5: Copy the image of the routing table for each router and paste it here.

Routing Table for RTB					Routing Table for RTC				
Type	Network	Port	Next Hop IP	Metric	Type	Network	Port	Next Hop IP	Metric
O	172.16.224.0/23	Serial2/0	172.16.230.1	110/65	O	172.16.224.0/23	Serial2/0	172.16.230.5	110/65
C	172.16.226.0/23	FastEthernet1/0	---	0/0	O	172.16.226.0/23	FastEthernet0/0	172.16.230.9	110/2
O	172.16.228.0/24	FastEthernet0/0	172.16.230.10	110/2	C	172.16.228.0/24	FastEthernet1/0	---	0/0
O	172.16.229.0/24	FastEthernet0/0	172.16.230.10	110/66	O	172.16.229.0/24	Serial3/0	172.16.230.14	110/65
C	172.16.230.0/30	Serial2/0	---	0/0	O	172.16.230.0/30	FastEthernet0/0	172.16.230.9	110/65
O	172.16.230.4/30	FastEthernet0/0	172.16.230.10	110/65	C	172.16.230.4/30	Serial2/0	---	0/0
C	172.16.230.8/30	FastEthernet0/0	---	0/0	C	172.16.230.8/30	FastEthernet0/0	---	0/0
O	172.16.230.12/30	FastEthernet0/0	172.16.230.10	110/65	C	172.16.230.12/30	Serial3/0	---	0/0

Routing Table for RTD				
Type	Network	Port	Next Hop IP	Metric
O	172.16.224.0/23	Serial2/0	172.16.230.13	110/129
O	172.16.226.0/23	Serial2/0	172.16.230.13	110/66
O	172.16.228.0/24	Serial2/0	172.16.230.13	110/65
C	172.16.229.0/24	FastEthernet0/0	---	0/0
O	172.16.230.0/30	Serial2/0	172.16.230.13	110/129
O	172.16.230.4/30	Serial2/0	172.16.230.13	110/128
O	172.16.230.8/30	Serial2/0	172.16.230.13	110/65
C	172.16.230.12/30	Serial2/0	---	0/0

Step 6: Switch off router RTA. What are the changes noted in the routing tables?

The table goes blank.

Routing Table for RTA				
Type	Network	Port	Next Hop IP	Metric

Step 7: Switch on router RTA. Wait a few minutes. What are the changes noted in the routing tables?

The routing table data appears back.

Routing Table for RTA				
Type	Network	Port	Next Hop IP	Metric
C	172.16.224.0/23	FastEthernet0/0	---	0/0
C	172.16.230.0/30	Serial3/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0

Step 8: Reflection: What have you learned in this task?

OSPF configuration bring the connection back to normal without new configuration again if one router is switched off.