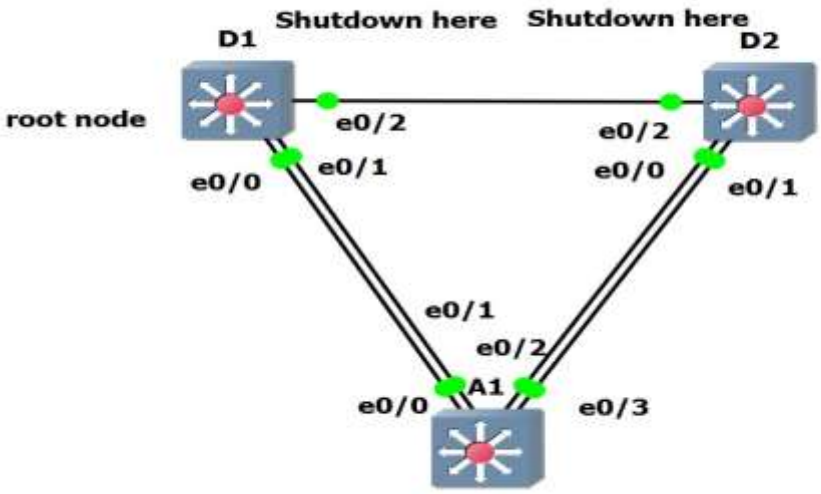
Practical No. 5A

Aim: Observe STP Topology Changes and Implement RSTP

**a)** Implement Advanced STP Modification and Mechanisms

Design of the network:




Configuring the devices:

D1:

```
D1#
D1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
D1(config)#hostname D1
D1(config)#spanning-tree mode pvst
D1(config)#banner #D1, STP Topology Changes and RSTP Lab#
D1(config)#line con 0
D1(config-line)#exec-timeout 0 0
D1(config-line)#logging synchronous
D1(config-line)#exit
```

```
D1(config)#interface range Et0/0 , Et0/1 , Et0/2
D1(config-if-range)#switchport trunk encapsulation dot1q
D1(config-if-range)#switchport mode trunk
D1(config-if-range)#no shutdown
D1(config-if-range)#exit
D1(config)#vlan 2
D1(config-vlan)#name SecondVLAN
D1(config-vlan)#exit
D1(config)#interface vlan 1
D1(config-if)#ip address 10.0.0.1 255.0.0.0
D1(config-if)#no shutdown
D1(config-if)#exit
D1(config)#
```

D2:

```
D2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
D2(config)#hostname D2
D2(config)#banner motd #D2, STP Topology Changes and RSTP Lab#
D2(config)#spanning-tree mode pvst
D2(config)#line con 0
D2(config-line)#exec-timeout 0 0
D2(config-line)#logging synchonous
Translating "synchonous"
                         ^
% Invalid input detected at '^' marker.

D2(config-line)#logging synchronous
D2(config-line)#exit
D2(config)#interface range Et0/0-2
D2(config-if-range)#switchport trunk encapsulation dot1q
D2(config-if-range)#switchport mode trunk
D2(config-if-range)#no shutdown
D2(config-if-range)#exit
D2(config)#vlan 2
D2(config-vlan)#name SecondVLAN
D2(config-vlan)#exit
D2(config)#interface vlan 1
D2(config-if)#ip address 10.0.0.2 255.0.0.0
D2(config-if)#no shut
D2(config-if)#exit
D2(config)#
*Nov 14 07:20:48.220: %LINK-3-UPDOWN: Interface Vlan1, changed state to up
*Nov 14 07:20:49.221: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up
D2(config)#exit
D2#
*Nov 14 07:20:52.504: %SYS-5-CONFIG_I: Configured from console by console
D2#
```

A1:

```
A1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
A1(config)#hostname A1
A1(config)#spanning-tree mode pvst
A1(config)#banner motd  #A1, STP Topology Changes and RSTP Lab#
A1(config)#line con 0
A1(config-line)#exec-timeout 0 0
A1(config-line)#logging synchronous
A1(config-line)#exit
A1(config)#interface range Et0/0-2
A1(config-if-range)#switchport trunk encapsulation dot1q
A1(config-if-range)#switchport mode trunk
A1(config-if-range)#no shutdown
A1(config-if-range)#exit
A1(config)#vlan 2
A1(config-vlan)#name SecondVLAN
A1(config-vlan)#exit
A1(config)#interface vlan 1
A1(config-if)#ip address 10.0.0.3 255.0.0.0
A1(config-if)#no shutdown exit
                           ^
% Invalid input detected at '^' marker.

A1(config-if)#n shutdown
% Ambiguous command:  "n shutdown"
A1(config-if)#no shutdown
A1(config-if)#exit
A1(config)#
*Nov 14 07:24:43.998: %LINK-3-UPDOWN: Interface Vlan1, changed state to up
*Nov 14 07:24:45.002: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up
A1(config)#
```

Discovering the default spanning-tree:

D1:

```
D2#show spanning-tree root

                                        Root    Hello Max Fwd
Vlan                Root ID             Cost    Time  Age Dly  Root Port
---------------- ------------------- --------- ----- --- ---  ------------
VLAN0001         32769 aabb.cc00.0100       100    2   20  15  Et0/2
VLAN0002         32770 aabb.cc00.0100       100    2   20  15  Et0/2
D2#
```

D2:

```
D1#show spanning-tree root

                                   Root    Hello Max Fwd
Vlan                Root ID        Cost    Time  Age Dly  Root Port
---------------- ------------------ --------- ----- --- ---  ------------
VLAN0001         32769 aabb.cc00.0100        0    2   20  15
VLAN0002         32770 aabb.cc00.0100        0    2   20  15
D1#
```

A1:

```
A1#show spanning-tree root

                                        Root    Hello Max Fwd
Vlan                Root ID             Cost    Time  Age Dly  Root Port
---------------- ------------------- --------- ----- --- ---  ------------
VLAN0001         32769 aabb.cc00.0100       100    2   20  15  Et0/0
VLAN0002         32770 aabb.cc00.0100       100    2   20  15  Et0/0
A1#
```

Changes the network:

A1:

```
VLAN0002
  Spanning tree enabled protocol ieee
  Root ID     Priority    32770
              Address     aabb.cc00.0100
              Cost        100
              Port        1 (Ethernet0/0)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32770  (priority 32768 sys-id-ext 2)
              Address     aabb.cc00.0300
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Et0/0               Root FWD 100       128.1    Shr
Et0/1               Altn BLK 100       128.2    Shr
Et0/2               Altn BLK 100       128.3    Shr
Et0/3               Altn BLK 100       128.4    Shr
```

D1:

```
D1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
D1(config)#interface Et 0/2
D1(config-if)#shutdown
D1(config-if)#
*Nov 14 07:27:11.588: %LINK-5-CHANGED: Interface Ethernet0/2, changed state to administratively down
*Nov 14 07:27:12.590: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/2, changed state to down
D1(config-if)#
```

Showing spanning-tree at root D2:

```
VLAN0002
  Spanning tree enabled protocol ieee
  Root ID    Priority    32770
             Address     aabb.cc00.0100
             Cost        200
             Port        1 (Ethernet0/0)
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32770  (priority 32768 sys-id-ext 2)
             Address     aabb.cc00.0200
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  15  sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Et0/0               Root FWD 100       128.1    Shr
Et0/1               Altn BLK 100       128.2    Shr
Et0/2               Desg FWD 100       128.3    Shr
```

Identify designated ports:

D1:

```
D1(config-if)#interface Et 0/2
D1(config-if)#no shutdown
D1(config-if)#exit
D1(config)#
*Nov 14 07:28:22.817: %LINK-3-UPDOWN: Interface Ethernet0/2, changed state to up
*Nov 14 07:28:23.831: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/2, changed state to up
D1(config)#
```

D2:

```
VLAN0002
  Spanning tree enabled protocol ieee
  Root ID    Priority    32770
             Address     aabb.cc00.0100
             Cost        100
             Port        3 (Ethernet0/2)
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32770  (priority 32768 sys-id-ext 2)
             Address     aabb.cc00.0200
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  15  sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Et0/0               Desg FWD 100       128.1    Shr
Et0/1               Desg LIS 100       128.2    Shr
Et0/2               Root FWD 100       128.3    Shr
```

A1:

```
A1#show spanning-tree

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    32769
              Address     aabb.cc00.0100
              Cost        100
              Port        1 (Ethernet0/0)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32769  (priority 32768 sys-id-ext 1)
              Address     aabb.cc00.0300
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  15  sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Et0/0               Root FWD 100       128.1    Shr
Et0/1               Altn BLK 100       128.2    Shr
Et0/2               Altn BLK 100       128.3    Shr
Et0/3               Altn BLK 100       128.4    Shr
Et1/0               Desg FWD 100       128.5    Shr
Et1/1               Desg FWD 100       128.6    Shr
Et1/2               Desg FWD 100       128.7    Shr
Et1/3               Desg FWD 100       128.8    Shr
Et2/0               Desg FWD 100       128.9    Shr
Et2/1               Desg FWD 100       128.10   Shr
Et2/2               Desg FWD 100       128.11   Shr
Et2/3               Desg FWD 100       128.12   Shr
Et3/0               Desg FWD 100       128.13   Shr
Et3/1               Desg FWD 100       128.14   Shr
Et3/2               Desg FWD 100       128.15   Shr
Et3/3               Desg FWD 100       128.16   Shr
```

```
VLAN0002
  Spanning tree enabled protocol ieee
  Root ID     Priority    32770
              Address     aabb.cc00.0100
              Cost        100
              Port        1 (Ethernet0/0)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32770  (priority 32768 sys-id-ext 2)
              Address     aabb.cc00.0300
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  15  sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Et0/0               Root FWD 100       128.1    Shr
Et0/1               Altn BLK 100       128.2    Shr
Et0/2               Altn BLK 100       128.3    Shr
Et0/3               Altn BLK 100       128.4    Shr
```

Implementing and observing Rapid Spanning Tree Protocol:

```
D2#
D2#debug spanning-tree events
Spanning Tree event debugging is on
D2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
D2(config)#interface Et0/2
D2(config-if)#shutdown
D2(config-if)#
*Nov 14 07:30:34.505: STP: VLAN0001 we are the spanning tree root
*Nov 14 07:30:34.506: STP: VLAN0002 we are the spanning tree root
D2(config-if)#
*Nov 14 07:30:36.508: %LINK-5-CHANGED: Interface Ethernet0/2, changed state to administratively down
*Nov 14 07:30:37.509: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/2, changed state to down
D2(config-if)#
*Nov 14 07:30:52.557: STP: VLAN0001 heard root 32769-aabb.cc00.0100 on Et0/1
*Nov 14 07:30:52.557:     supersedes 32769-aabb.cc00.0200
*Nov 14 07:30:52.557: STP: VLAN0001 new root is 32769, aabb.cc00.0100 on port Et0/1, cost 200
*Nov 14 07:30:52.558: STP: VLAN0001 sent Topology Change Notice on Et0/1
*Nov 14 07:30:52.558: STP: VLAN0001 new root port Et0/0, cost 200
*Nov 14 07:30:52.558: STP[1]: Generating TC trap for port Ethernet0/1
*Nov 14 07:30:52.558: STP: VLAN0001 Et0/1 -> blocking
D2(config-if)#
*Nov 14 07:30:54.162: STP: VLAN0002 heard root 32770-aabb.cc00.0100 on Et0/0
*Nov 14 07:30:54.162:     supersedes 32770-aabb.cc00.0200
*Nov 14 07:30:54.162: STP: VLAN0002 new root is 32770, aabb.cc00.0100 on port Et0/0, cost 200
*Nov 14 07:30:54.163: STP: VLAN0002 sent Topology Change Notice on Et0/0
*Nov 14 07:30:54.165: STP[2]: Generating TC trap for port Ethernet0/1
*Nov 14 07:30:54.165: STP: VLAN0002 Et0/1 -> blocking
*Nov 14 07:30:54.567: STP: VLAN0001 sent Topology Change Notice on Et0/0
D2(config-if)#
```

D1:

```
D1#show spanning-tree

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    32769
              Address     aabb.cc00.0100
              This bridge is the root
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32769  (priority 32768 sys-id-ext 1)
              Address     aabb.cc00.0100
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  15  sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Et0/0               Desg FWD 100       128.1    Shr
Et0/1               Desg FWD 100       128.2    Shr
Et0/2               Desg FWD 100       128.3    Shr
Et0/3               Desg FWD 100       128.4    Shr
Et1/0               Desg FWD 100       128.5    Shr
Et1/1               Desg FWD 100       128.6    Shr
Et1/2               Desg FWD 100       128.7    Shr
Et1/3               Desg FWD 100       128.8    Shr
Et2/0               Desg FWD 100       128.9    Shr
Et2/1               Desg FWD 100       128.10   Shr
Et2/2               Desg FWD 100       128.11   Shr
Et2/3               Desg FWD 100       128.12   Shr
Et3/0               Desg FWD 100       128.13   Shr
Et3/1               Desg FWD 100       128.14   Shr
Et3/2               Desg FWD 100       128.15   Shr
Et3/3               Desg FWD 100       128.16   Shr
```

```
VLAN0002
  Spanning tree enabled protocol ieee
  Root ID     Priority    32770
              Address     aabb.cc00.0100
              This bridge is the root
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32770  (priority 32768 sys-id-ext 2)
              Address     aabb.cc00.0100
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  15  sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Et0/0               Desg FWD 100       128.1    Shr
Et0/1               Desg FWD 100       128.2    Shr
Et0/2               Desg FWD 100       128.3    Shr
```

D2: Spanning-tree mode changes to Rapid spanning-tree mode:

```
D2(config-if)#
*Nov 14 07:30:34.505: STP: VLAN0001 we are the spanning tree root
*Nov 14 07:30:34.506: STP: VLAN0002 we are the spanning tree root
D2(config-if)#
*Nov 14 07:30:36.508: %LINK-5-CHANGED: Interface Ethernet0/2, changed state to administratively down
*Nov 14 07:30:37.509: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/2, changed state to down
D2(config-if)#
*Nov 14 07:30:52.557: STP: VLAN0001 heard root 32769-aabb.cc00.0100 on Et0/1
*Nov 14 07:30:52.557:     supersedes 32769-aabb.cc00.0200
*Nov 14 07:30:52.557: STP: VLAN0001 new root is 32769, aabb.cc00.0100 on port Et0/1, cost 200
*Nov 14 07:30:52.558: STP: VLAN0001 sent Topology Change Notice on Et0/1
*Nov 14 07:30:52.558: STP: VLAN0001 new root port Et0/0, cost 200
*Nov 14 07:30:52.558: STP[1]: Generating TC trap for port Ethernet0/1
*Nov 14 07:30:52.558: STP: VLAN0001 Et0/1 -> blocking
D2(config-if)#
*Nov 14 07:30:54.162: STP: VLAN0002 heard root 32770-aabb.cc00.0100 on Et0/0
*Nov 14 07:30:54.162:     supersedes 32770-aabb.cc00.0200
*Nov 14 07:30:54.162: STP: VLAN0002 new root is 32770, aabb.cc00.0100 on port Et0/0, cost 200
*Nov 14 07:30:54.163: STP: VLAN0002 sent Topology Change Notice on Et0/0
*Nov 14 07:30:54.165: STP[2]: Generating TC trap for port Ethernet0/1
*Nov 14 07:30:54.165: STP: VLAN0002 Et0/1 -> blocking
*Nov 14 07:30:54.567: STP: VLAN0001 sent Topology Change Notice on Et0/0
D2(config-if)#
```

A1:

```
A1#
A1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
A1(config)#spanning-tree mode rapid-pvst
A1(config)#
A1(config)#
A1(config)#exit
A1#ex
*Nov 14 07:33:07.776: %SYS-5-CONFIG_I: Configured from console by console
```

```
A1#show spanning-tree

VLAN0001
  Spanning tree enabled protocol rstp
  Root ID     Priority    32769
              Address     aabb.cc00.0100
              Cost        100
              Port        1 (Ethernet0/0)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32769  (priority 32768 sys-id-ext 1)
              Address     aabb.cc00.0300
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Et0/0               Root FWD 100       128.1    Shr Peer(STP)
Et0/1               Altn BLK 100       128.2    Shr Peer(STP)
Et0/2               Desg FWD 100       128.3    Shr Peer(STP)
Et0/3               Desg FWD 100       128.4    Shr Peer(STP)
Et1/0               Desg FWD 100       128.5    Shr
Et1/1               Desg FWD 100       128.6    Shr
Et1/2               Desg FWD 100       128.7    Shr
Et1/3               Desg FWD 100       128.8    Shr
Et2/0               Desg FWD 100       128.9    Shr
Et2/1               Desg FWD 100       128.10   Shr
Et2/2               Desg FWD 100       128.11   Shr
Et2/3               Desg FWD 100       128.12   Shr
Et3/0               Desg FWD 100       128.13   Shr
Et3/1               Desg FWD 100       128.14   Shr
Et3/2               Desg FWD 100       128.15   Shr
Et3/3               Desg FWD 100       128.16   Shr
```

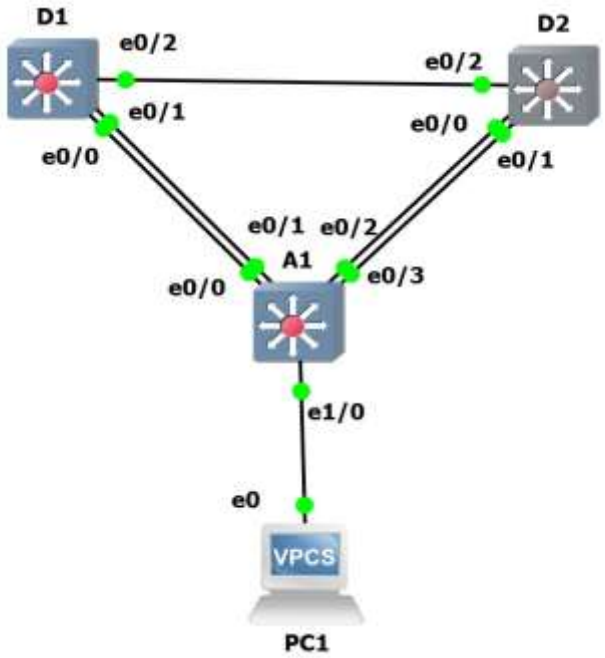
```
VLAN0002
  Spanning tree enabled protocol rstp
  Root ID     Priority    32770
              Address     aabb.cc00.0100
              Cost        100
              Port        1 (Ethernet0/0)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32770  (priority 32768 sys-id-ext 2)
              Address     aabb.cc00.0300
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Et0/0               Root FWD 100       128.1    Shr Peer(STP)
Et0/1               Altn BLK 100       128.2    Shr Peer(STP)
Et0/2               Desg FWD 100       128.3    Shr Peer(STP)
Et0/3               Desg FWD 100       128.4    Shr Peer(STP)
```

Implement MST

Design the network:




Configuring the switches:

D1:

```
D1#
D1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
D1(config)#hostname D1
D1(config)#spanning-tree mode rapid-pvst
D1(config)#line con 0
D1(config-line)#exec-timeout 0 0
D1(config-line)#logging synchronous
D1(config-line)#exit
D1(config)#int range Et0/0-2
D1(config-if-range)#switchport trunk encapsulation dot1q
D1(config-if-range)#switchport mode trunk
D1(config-if-range)#no shut
D1(config-if-range)#exit
D1(config)#vlan 2
D1(config-vlan)#name SecondVLAN
D1(config-vlan)#ex
D1(config)#vlan 3
D1(config-vlan)#name ThirdVLAN
D1(config-vlan)#ex
D1(config)#vlan 4
D1(config-vlan)#name FourthVLAN
D1(config-vlan)#ex
D1(config)#vlan 5
D1(config-vlan)#name FifthVLAN
D1(config-vlan)#ex
D1(config)#end
D1#w
*Nov 14 09:08:54.172: %SYS-5-CONFIG_I: Configured from console by console
D1#wr
```

D2:

```
D2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
D2(config)#hostname D2
D2(config)#spanning-tree mode rapid-pvst
D2(config)#line con 0
D2(config-line)#exec-timeout 0 0
D2(config-line)#logging synchronous
D2(config-line)#exit
D2(config)#int range Et0/0-2
D2(config-if-range)#switchport trunk encapsulation dot1q
D2(config-if-range)#switchport mode trunk
D2(config-if-range)#no shut
D2(config-if-range)#ex
D2(config)#vlan 2
D2(config-vlan)#name SecondVLAN
D2(config-vlan)#ex
D2(config)#vlan 3
D2(config-vlan)#name ThirdVLAN
D2(config-vlan)#ex
D2(config)#vlan 4
D2(config-vlan)#name FourthVLAN
D2(config-vlan)#vlan 5
D2(config-vlan)#ex
D2(config)#vlan 5
D2(config-vlan)#name FifthVLAN
D2(config-vlan)#ex
D2(config)#end
D2#
```

A1:

```
A1#
A1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
A1(config)#hostname A1
A1(config)#spanning-tree mode rapid-pvst
A1(config)#line con 0
A1(config-line)#exec-timeout 0 0
A1(config-line)#logging synchronous
A1(config-line)#exit
A1(config)#int range Et0/0-2
A1(config-if-range)#switchport trunk encapsulation dot1q
A1(config-if-range)#switchport mode trunk
A1(config-if-range)#no shut
A1(config-if-range)#ex
A1(config)#int Et1/0
A1(config-if)#ex
A1(config)#vlan 2
A1(config-vlan)#name SecondVLAN
A1(config-vlan)#ex
A1(config)#vlan 3
A1(config-vlan)#name ThirdVLAN
A1(config-vlan)#ex
A1(config)#vlan 4
A1(config-vlan)#name FourthVLAN
A1(config-vlan)#ex
A1(config)#vlan 5
A1(config-vlan)#name FifthVLAN
A1(config-vlan)#ex
A1(config)#end
A1#wr
```

Implement and observe MST:

Configure MST on D1 and D2:

```
D1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
D1(config)#spanning-tree mode mst
D1(config)#end
```

```
D1#show spanning-tree

MST0
  Spanning tree enabled protocol mstp
  Root ID     Priority    32768
              Address     aabb.cc00.0400
              This bridge is the root
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32768  (priority 32768 sys-id-ext 0)
              Address     aabb.cc00.0400
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Et0/0               Desg LRN 2000000   128.1    Shr Bound(PVST)
Et0/1               Desg LRN 2000000   128.2    Shr Bound(PVST)
Et0/2               Desg LRN 2000000   128.3    Shr Bound(PVST)
Et0/3               Desg LRN 2000000   128.4    Shr
Et1/0               Desg LRN 2000000   128.5    Shr
Et1/1               Desg LRN 2000000   128.6    Shr
Et1/2               Desg LRN 2000000   128.7    Shr
Et1/3               Desg LRN 2000000   128.8    Shr
Et2/0               Desg LRN 2000000   128.9    Shr
Et2/1               Desg LRN 2000000   128.10   Shr
Et2/2               Desg LRN 2000000   128.11   Shr
Et2/3               Desg LRN 2000000   128.12   Shr
Et3/0               Desg LRN 2000000   128.13   Shr
Et3/1               Desg LRN 2000000   128.14   Shr
Et3/2               Desg LRN 2000000   128.15   Shr
Et3/3               Desg LRN 2000000   128.16   Shr
```

```
D1#
D1#show spanning-tree mst

##### MST0    vlans mapped:   1-4094
Bridge        address aabb.cc00.0400  priority      32768 (32768 sysid 0)
Root          this switch for the CIST
Operational   hello time 2 , forward delay 15, max age 20, txholdcount 6
Configured    hello time 2 , forward delay 15, max age 20, max hops    20

Interface         Role Sts Cost      Prio.Nbr Type
----------------- ---- --- --------- -------- --------------------------------
Et0/0             Desg FWD 2000000   128.1    Shr Bound(PVST)
Et0/1             Desg FWD 2000000   128.2    Shr Bound(PVST)
Et0/2             Desg FWD 2000000   128.3    Shr Bound(PVST)
Et0/3             Desg FWD 2000000   128.4    Shr
Et1/0             Desg FWD 2000000   128.5    Shr
Et1/1             Desg FWD 2000000   128.6    Shr
Et1/2             Desg FWD 2000000   128.7    Shr
Et1/3             Desg FWD 2000000   128.8    Shr
Et2/0             Desg FWD 2000000   128.9    Shr
Et2/1             Desg FWD 2000000   128.10   Shr
Et2/2             Desg FWD 2000000   128.11   Shr
Et2/3             Desg FWD 2000000   128.12   Shr
Et3/0             Desg FWD 2000000   128.13   Shr
Et3/1             Desg FWD 2000000   128.14   Shr
Et3/2             Desg FWD 2000000   128.15   Shr
Et3/3             Desg FWD 2000000   128.16   Shr
```

A1:

```
A1#show spanning-tree root

                                        Root    Hello Max Fwd
Vlan                Root ID             Cost    Time  Age Dly  Root Port
---------------- ------------------- --------- ----- --- ---  ------------
VLAN0001         32768 aabb.cc00.0400       100    2   20  15  Et0/0
VLAN0002         32768 aabb.cc00.0400       100    2   20  15  Et0/0
VLAN0003         32768 aabb.cc00.0400       100    2   20  15  Et0/0
VLAN0004         32768 aabb.cc00.0400       100    2   20  15  Et0/0
VLAN0005         32768 aabb.cc00.0400       100    2   20  15  Et0/0
A1#
```

D2:

```
D2#show spanning-tree root

                                        Root    Hello Max Fwd
Vlan                Root ID             Cost    Time  Age Dly  Root Port
---------------- ------------------- --------- ----- --- ---  ------------
VLAN0001         32768 aabb.cc00.0400       100    2   20  15  Et0/2
VLAN0002         32768 aabb.cc00.0400       100    2   20  15  Et0/2
VLAN0003         32768 aabb.cc00.0400       100    2   20  15  Et0/2
VLAN0004         32768 aabb.cc00.0400       100    2   20  15  Et0/2
VLAN0005         32768 aabb.cc00.0400       100    2   20  15  Et0/2
D2#
```

Configuring A1 to use MST:

```
A1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
A1(config)#spanning-tree mode mst
A1(config)#
```

Create and verify an MST configuration:

```
D1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
D1(config)#spanning-tree mst configuration
D1(config-mst)#name CCNPv8
D1(config-mst)#
D1(config-mst)#revision 1
D1(config-mst)#
D1(config-mst)#
D1(config-mst)#instance 1 vlan 2
D1(config-mst)#
D1(config-mst)#instance 2 vlan 4
D1(config-mst)#
D1(config-mst)#ex
D1(config)#end
D1#
```

```
D1#show spanning-tree mst

##### MST0    vlans mapped:   1,3,5-4094
Bridge        address aabb.cc00.0400  priority      32768 (32768 sysid 0)
Root          this switch for the CIST
Operational   hello time 2 , forward delay 15, max age 20, txholdcount 6
Configured    hello time 2 , forward delay 15, max age 20, max hops    20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Et0/0            Desg LRN 2000000   128.1    Shr
Et0/1            Desg LRN 2000000   128.2    Shr
Et0/2            Desg LRN 2000000   128.3    Shr Bound(PVST)
Et0/3            Desg LRN 2000000   128.4    Shr
Et1/0            Desg LRN 2000000   128.5    Shr
Et1/1            Desg LRN 2000000   128.6    Shr
Et1/2            Desg LRN 2000000   128.7    Shr
Et1/3            Desg LRN 2000000   128.8    Shr
Et2/0            Desg LRN 2000000   128.9    Shr
Et2/1            Desg LRN 2000000   128.10   Shr
Et2/2            Desg LRN 2000000   128.11   Shr
Et2/3            Desg LRN 2000000   128.12   Shr
Et3/0            Desg LRN 2000000   128.13   Shr
Et3/1            Desg LRN 2000000   128.14   Shr
Et3/2            Desg LRN 2000000   128.15   Shr
Et3/3            Desg LRN 2000000   128.16   Shr
```

```
##### MST1    vlans mapped:   2
Bridge        address aabb.cc00.0400  priority      32769 (32768 sysid 1)
Root          this switch for MST1

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Et0/0            Desg LRN 2000000   128.1    Shr
Et0/1            Desg LRN 2000000   128.2    Shr
Et0/2            Desg FWD 2000000   128.3    Shr Bound(PVST)

##### MST2    vlans mapped:   4
Bridge        address aabb.cc00.0400  priority      32770 (32768 sysid 2)
Root          this switch for MST2

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Et0/0            Desg LRN 2000000   128.1    Shr
Et0/1            Desg LRN 2000000   128.2    Shr
Et0/2            Desg FWD 2000000   128.3    Shr Bound(PVST)

D1#
```

```
A1#show spanning-tree mst

##### MST0    vlans mapped:   1-4094
Bridge        address aabb.cc00.0600  priority      32768 (32768 sysid 0)
Root          address aabb.cc00.0400  priority      32768 (32768 sysid 0)
              port    Et0/0           path cost     2000000
Regional Root this switch
Operational   hello time 2 , forward delay 15, max age 20, txholdcount 6
Configured    hello time 2 , forward delay 15, max age 20, max hops    20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Et0/0            Root FWD 2000000   128.1    Shr Bound(RSTP)
Et0/1            Altn BLK 2000000   128.2    Shr Bound(RSTP)
Et0/2            Altn BLK 2000000   128.3    Shr Bound(PVST)
Et0/3            Altn BLK 2000000   128.4    Shr Bound(PVST)
Et1/0            Desg FWD 2000000   128.5    Shr
Et1/1            Desg FWD 2000000   128.6    Shr
Et1/2            Desg FWD 2000000   128.7    Shr
Et1/3            Desg FWD 2000000   128.8    Shr
Et2/0            Desg FWD 2000000   128.9    Shr
Et2/1            Desg FWD 2000000   128.10   Shr
Et2/2            Desg FWD 2000000   128.11   Shr
Et2/3            Desg FWD 2000000   128.12   Shr
Et3/0            Desg FWD 2000000   128.13   Shr
Et3/1            Desg FWD 2000000   128.14   Shr
Et3/2            Desg FWD 2000000   128.15   Shr
Et3/3            Desg FWD 2000000   128.16   Shr
```

Enter digest command in D1:

```
D1#
D1#show spanning-tree mst configuration digest
Name      [CCNPv8]
Revision  1     Instances configured 3
Digest          0x746D865FEAD726D8F401F9396B8B62DA
Pre-std Digest  0xDE5D7C8B79A99142EBC0A1C265ED7B05
D1#
```

```
D1#
D1#show spanning-tree mst configuration digest
Name      [CCNPv8]
Revision  1     Instances configured 3
Digest          0x746D865FEAD726D8F401F9396B8B62DA
Pre-std Digest  0xDE5D7C8B79A99142EBC0A1C265ED7B05
D1#
D1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
D1(config)#spanning-tree mst configuration
D1(config-mst)#show current
Current MST configuration
Name      [CCNPv8]
Revision  1     Instances configured 3

Instance  Vlans mapped
--------  ----------------------------------------------------------------
0         1,3,5-4094
1         2
2         4
-------------------------------------------------------------------------------
D1(config-mst)#revision 2
D1(config-mst)#instance 1 vlan 3
D1(config-mst)#instance 2 vlan 5
D1(config-mst)#show pending
Pending MST configuration
Name      [CCNPv8]
Revision  2     Instances configured 3

Instance  Vlans mapped
--------  ----------------------------------------------------------------
0         1,6-4094
1         2-3
2         4-5
-------------------------------------------------------------------------------
D1(config-mst)#
```

D2:

```
D2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
D2(config)#spanning-tree mst configuration
D2(config-mst)#name CCNPv8
D2(config-mst)#revision 2
D2(config-mst)#instance 1 vlan 2
D2(config-mst)#instance 2 vlan 4
D2(config-mst)#instance 1 vlan 3
D2(config-mst)#instance 2 vlan 5
D2(config-mst)#ex
D2(config)#end
D2#
*Nov 14 09:27:28.658: %SYS-5-CONFIG_I: Configured from console by console
D2#
```

A1:

```
A1#
A1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
A1(config)#spanning-tree mst configuration
A1(config-mst)#name CCNPv8
A1(config-mst)#revision 2
A1(config-mst)#instance 1 vlan 2
A1(config-mst)#instance 2 vlan 4
A1(config-mst)#instance 1 vlan 3
A1(config-mst)#instance 2 vlan 5
A1(config-mst)#ex
A1(config)#end
A1#
*Nov 14 09:28:58.849: %SYS-5-CONFIG_I: Configured from console by console
A1#
```

```
A1#show spanning-tree mst

##### MST0    vlans mapped:   1,6-4094
Bridge        address aabb.cc00.0600  priority      32768 (32768 sysid 0)
Root          address aabb.cc00.0400  priority      32768 (32768 sysid 0)
              port    Et0/0           path cost     0
Regional Root address aabb.cc00.0400  priority      32768 (32768 sysid 0)
                                      internal cost 2000000   rem hops 19
Operational   hello time 2 , forward delay 15, max age 20, txholdcount 6
Configured    hello time 2 , forward delay 15, max age 20, max hops    20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Et0/0            Root FWD 2000000   128.1    Shr
Et0/1            Altn BLK 2000000   128.2    Shr
Et0/2            Desg LRN 2000000   128.3    Shr Bound(PVST)
Et0/3            Desg LRN 2000000   128.4    Shr Dispute Bound(PVST)
Et1/0            Desg LRN 2000000   128.5    Shr
Et1/1            Desg LRN 2000000   128.6    Shr
Et1/2            Desg LRN 2000000   128.7    Shr
Et1/3            Desg LRN 2000000   128.8    Shr
Et2/0            Desg LRN 2000000   128.9    Shr
Et2/1            Desg LRN 2000000   128.10   Shr
Et2/2            Desg LRN 2000000   128.11   Shr
Et2/3            Desg LRN 2000000   128.12   Shr
Et3/0            Desg LRN 2000000   128.13   Shr
Et3/1            Desg LRN 2000000   128.14   Shr
Et3/2            Desg LRN 2000000   128.15   Shr
Et3/3            Desg LRN 2000000   128.16   Shr
```

```
##### MST1    vlans mapped:   2-3
Bridge        address aabb.cc00.0600  priority      32769 (32768 sysid 1)
Root          address aabb.cc00.0400  priority      32769 (32768 sysid 1)
              port    Et0/0           cost          2000000   rem hops 19

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Et0/0            Root FWD 2000000   128.1    Shr
Et0/1            Altn BLK 2000000   128.2    Shr
Et0/2            Desg FWD 2000000   128.3    Shr Bound(PVST)
Et0/3            Desg FWD 2000000   128.4    Shr Bound(PVST)

##### MST2    vlans mapped:   4-5
Bridge        address aabb.cc00.0600  priority      32770 (32768 sysid 2)
Root          address aabb.cc00.0400  priority      32770 (32768 sysid 2)
              port    Et0/0           cost          2000000   rem hops 19

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Et0/0            Root FWD 2000000   128.1    Shr
Et0/1            Altn BLK 2000000   128.2    Shr
Et0/2            Desg FWD 2000000   128.3    Shr Bound(PVST)
Et0/3            Desg FWD 2000000   128.4    Shr Bound(PVST)
```

Controlling the Root Bridge:

D1:

```
D1#
D1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
D1(config)#spanning-tree mst 1 root primary
D1(config)#spanning-tree mst 2 root secondary
D1(config)#
```

A1:

```
A1#show spanning-tree root

                                        Root    Hello Max Fwd
MST Instance            Root ID         Cost    Time  Age Dly  Root Port
---------------- ------------------- --------- ----- --- ---  ------------
MST0             32768 aabb.cc00.0400         0    2   20  15  Et0/0
MST1             24577 aabb.cc00.0400   2000000    2   20  15  Et0/0
MST2             28674 aabb.cc00.0400   2000000    2   20  15  Et0/0
A1#
```

On A1, issue the commands show spanning-tree vlan 1 and show spanning-tree blocked-ports.

```
A1#show spanning-tree mst 1

##### MST1    vlans mapped:   2-3
Bridge        address aabb.cc00.0600  priority      32769 (32768 sysid 1)
Root          address aabb.cc00.0400  priority      24577 (24576 sysid 1)
              port    Et0/1           cost          100       rem hops 19

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Et0/0            Altn BLK 2000000   128.1    Shr
Et0/1            Root FWD 100       128.2    Shr
Et0/2            Desg BLK 2000000   128.3    Shr Bound(PVST)
Et0/3            Desg LRN 2000000   128.4    Shr Bound(PVST)
```

```
A1#
A1#show spanning-tree blockedports

Name                 Blocked Interfaces List
-------------------- ------------------------------------
MST0                 Et0/1
MST1                 Et0/1
MST2                 Et0/1

Number of blocked ports (segments) in the system : 3
```

On A1, shutdown interfaces F0/1 and F0/2, assigning new port cost of 1000 to F0/2 using spanning-tree mst 1 cost value command and then issuing the no shutdown command on the ports.

```
A1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
A1(config)#int range Et0/0-1
A1(config-if-range)#shut
A1(config-if-range)#exit
*Nov 14 09:32:33.656: %SPANTREE-2-PVSTSIM_FAIL: Blocking root port Et0/2: Inconsitent inferior PVST BPDU received on VLAN 1, claiming root 32768:aabb.cc00.0400
A1(config-if-range)#exit
A1(config)#
*Nov 14 09:32:35.636: %LINK-5-CHANGED: Interface Ethernet0/0, changed state to administratively down
*Nov 14 09:32:35.646: %LINK-5-CHANGED: Interface Ethernet0/1, changed state to administratively down
*Nov 14 09:32:36.654: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/0, changed state to down
*Nov 14 09:32:36.654: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/1, changed state to down
A1(config)#int
% Incomplete command.

A1(config)#int Et0/1
A1(config-if)#spanning-tree mst 1 cost 100
A1(config-if)#int range Et0/0-1
A1(config-if-range)#no shut
A1(config-if-range)#ex
A1(config)#
*Nov 14 09:33:25.015: %LINK-3-UPDOWN: Interface Ethernet0/0, changed state to up
*Nov 14 09:33:25.015: %LINK-3-UPDOWN: Interface Ethernet0/1, changed state to up
*Nov 14 09:33:26.020: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/0, changed state to up
*Nov 14 09:33:26.020: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/1, changed state to up
A1(config)#
```

Verifying that this impacts root port selection on A1 using the show spanning-tree vlan 1 and show spanning-tree blockedports commands.

```
A1#show spanning-tree mst 1

##### MST1    vlans mapped:   2-3
Bridge        address aabb.cc00.0600  priority      32769 (32768 sysid 1)
Root          address aabb.cc00.0400  priority      24577 (24576 sysid 1)
              port    Et0/1           cost          100       rem hops 19

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Et0/0            Altn BLK 2000000   128.1    Shr
Et0/1            Root FWD 100       128.2    Shr
Et0/2            Desg FWD 2000000   128.3    Shr Bound(PVST)
Et0/3            Desg FWD 2000000   128.4    Shr Bound(PVST)

A1#show spanning-tree blockedports

Name                 Blocked Interfaces List
-------------------- ------------------------------------
MST0                 Et0/1
MST1                 Et0/0
MST2                 Et0/1

Number of blocked ports (segments) in the system : 3
```

```
A1#
A1#show spanning-tree mst 2

##### MST2    vlans mapped:   4-5
Bridge        address aabb.cc00.0600  priority      32770 (32768 sysid 2)
Root          address aabb.cc00.0400  priority      28674 (28672 sysid 2)
              port    Et0/0           cost          2000000   rem hops 19

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Et0/0            Root FWD 2000000   128.1    Shr
Et0/1            Altn BLK 2000000   128.2    Shr
Et0/2            Desg FWD 2000000   128.3    Shr Bound(PVST)
Et0/3            Desg FWD 2000000   128.4    Shr Bound(PVST)

A1#
```

```
D2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
D2(config)#int range Et0/0-1
D2(config-if-range)#shut
D2(config-if-range)#ex
D2(config)#
*Nov 14 09:34:35.233: %LINK-5-CHANGED: Interface Ethernet0/0, changed state to administratively down
*Nov 14 09:34:35.238: %LINK-5-CHANGED: Interface Ethernet0/1, changed state to administratively down
*Nov 14 09:34:36.237: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/0, changed state to down
*Nov 14 09:34:36.246: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/1, changed state to down
D2(config)#int Et0/1
D2(config-if)#spanning-tree mst 2 port-priority 64
D2(config-if)#ex
D2(config)#int range Et0/0-1
D2(config-if-range)#no shut
D2(config-if-range)#ex
D2(config)#
```

On A1, issue the show spanning-tree mst 2 command and you will see that F0/4 is now the selected root port.

```
A1#show spanning-tree mst 2

##### MST2    vlans mapped:   4-5
Bridge        address aabb.cc00.0600  priority      32770 (32768 sysid 2)
Root          address aabb.cc00.0400  priority      28674 (28672 sysid 2)
              port    Et0/0           cost          2000000   rem hops 19

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Et0/0            Root FWD 2000000   128.1    Shr
Et0/1            Altn BLK 2000000   128.2    Shr
Et0/2            Desg FWD 2000000   128.3    Shr Bound(PVST)
Et0/3            Desg FWD 2000000   128.4    Shr Bound(PVST)
```