Final Exam

Name:

Part 1: T/F 5 points). Highlight the correct answer line this

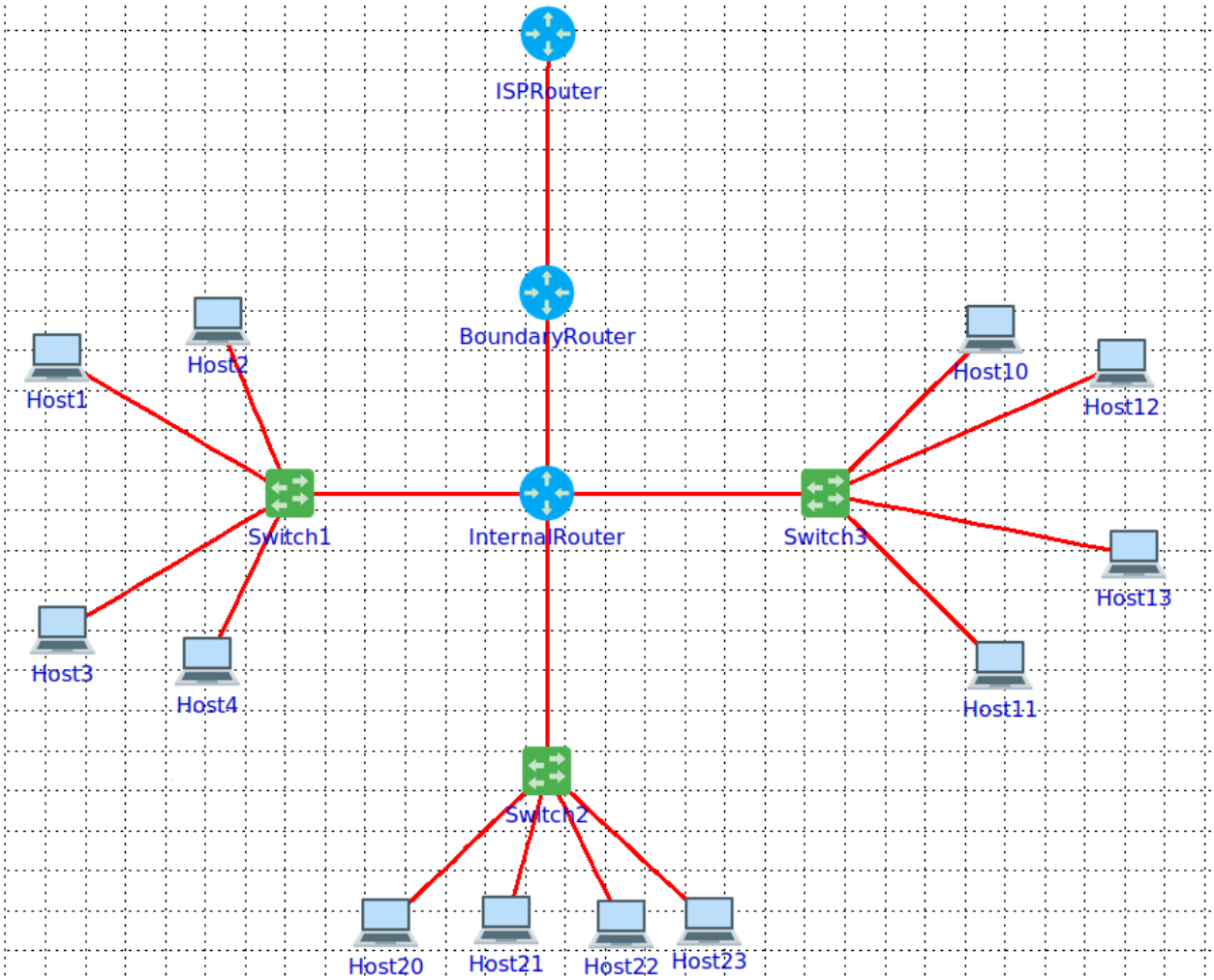
1) T F The combined overhead of TCP and IP protocol headers is at least 40 bytes
2) T F The network part of the address 192.168.1.2/16 is 192.168.0.0
3) T F If my router at home has a public address of 128.1.2.3, that will be used as the source NAT IP.
4) T F Collision occurs in multi-access networks if a node receives two or more signals at the same time
5) T F Clock synchronization is not needed in slotted Aloha
6) T F MAC addresses are 32-bits long
7) T F The MAC addresses on links connected to the same switch have to share some octets
8) T F Before I ping google.com from my laptop at home, I must do an ARP to get the MAC to IP address mapping of the google.com server
9) T F The Ethernet frame has space for two MAC addresses while the IEEE 802.11 frame has space for 4 MAC addresses
10) T F The RTS/CTS exchange in IEEE 802.11 is the CA part of CSMA/CA

Part 2: Addressing and subnets (5 points)

Assign addresses to each of the links below using addresses in the subnet 10.0.0.0/16. Carve off pieces within this large subnet and assign smaller subnets to groupings of hosts as appropriate. Use the table below. Example entry in the table is:

This is an example

Link end 1	Link end 2	Address	Subnet
Node 1	Node 2	10.0.0.1	10.0.0.0/24



Instructions:

a. Do links from hosts first in alphabetical order
b. Do links from Internal Router
c. No need to do link from Boundary Router, ISP router or switches
d. Total links should be 16 (0.25pts each)

Link end 1	Link end 2	Address	Subnet
Host1	Switch1	10.0.1.2	10.0.1.0/24
Host2	Switch1	10.0.1.3	10.0.1.0/24
Host3	Switch1	10.0.1.4	10.0.1.0/24
Host4	Switch1	10.0.1.5	10.0.1.0/24
Host10	Switch3	10.0.3.2	10.0.3.0/24
Host11	Switch3	10.0.3.3	10.0.3.0/24
Host12	Switch3	10.0.3.4	10.0.3.0/24
Host13	Switch3	10.0.3.5	10.0.3.0/24
Host20	Switch2	10.0.2.2	10.0.2.0/24
Host21	Switch2	10.0.2.3	10.0.2.0/24
Host22	Switch2	10.0.2.4	10.0.2.0/24
Host23	Switch2	10.0.2.5	10.0.2.0/24
BoundaryRouter	InternalRouter	10.0.0.2	10.0.0.0/24
Switch1	InternalRouter	10.0.0.3	10.0.0.0/24
Switch2	InternalRouter	10.0.0.4	10.0.0.0/24
Switch3	InternalRouter	10.0.0.5	10.0.0.0/24

Choose the right answer(s):

1. (0.5pts) The possible routing protocols between Internal Router and Boundary Router are:
    a. OSPFv2
    b. OSPFv3
    c. RIP
    d. BGP

2. (0.5pts) The possible routing protocols between ISP Router and Boundary Router are:
    a. OSPFv2
    b. OSPFv3
    c. RIP
    d. BGP

Part 3: Short answer questions (5 points)

1. (1pt) Suppose the information content of a packet is the bit pattern 1010101010101011 and an even parity scheme is used. What would be the value of the checksum field in the single parity bit scheme?
    a. 1

2. (1pt) Order the following protocols in the order they occur when a node is trying to connect to a Wi-Fi home network and then ping google.com

    a. DHCP
    b. WLAN Association and Authentication
    c. ARP
    d. DNS
    e. ICMP

    Order as: protocol 1 → protocol 2 → .. etc.

    b->a->c->d->e
    WLAN Association -> DHCP -> ARP -> DNS -> ICMP

3. (1.5pt) Identify which of these protocols belongs to the datalink layer and which belongs to the network layer

Protocol	Layer
IEEE 802.11	Link
ARP	Link
ICMP	Network
OSPF	Network
BGP	Network
DHCP	Application

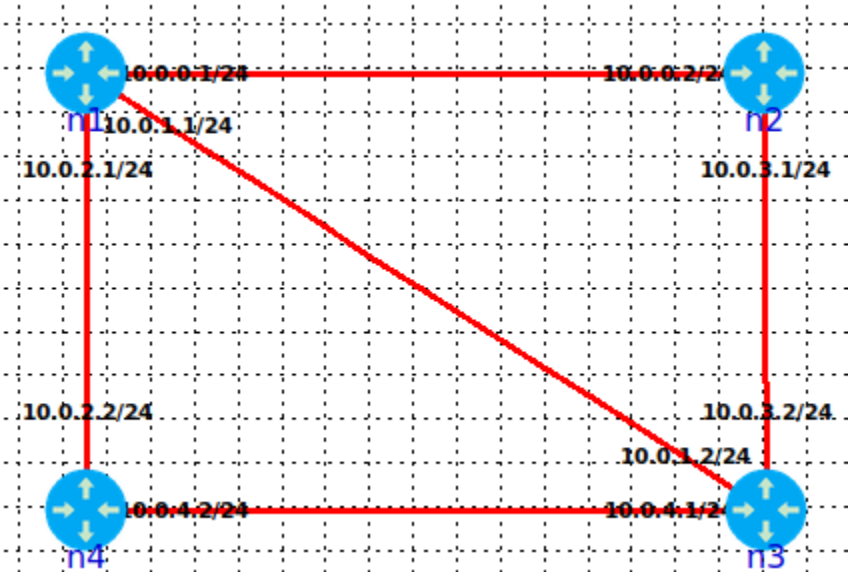
4. (0.5pts) Which route will a packet destined to 10.0.0.1 take if the routing table at the router forwarding it had the following entries:
    a. 10.0.0.0/8 via 10.0.1.3
    b. 10.0.0.0/16 via 10.0.2.3
    c. 10.0.0.0/24 via 10.0.3.3
    d. 10.0.0.0/30 via 10.0.4.3

5. (1pts) Both switches and routers have forwarding tables. Fill in the following table to define what the forwarding base for each is (i.e., what information they look in a packet to make forwarding decisions), and what their forwarding decision will be:

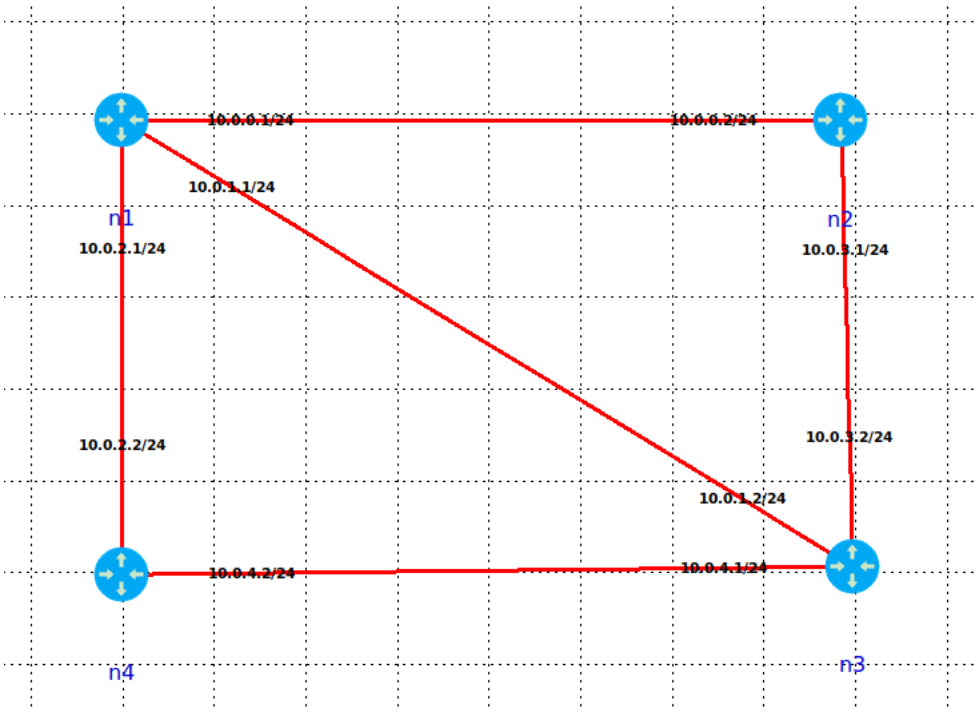
	Filter	**Forwarding**
Switch	MAC address	Exact MAC address
Router	IP	Longest match

Note, do not consider an SDN switch like the one we used with OVS. Only consider a classical not programmable switch (i.e., the CORE default switch).

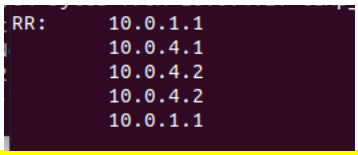
Part 4: CORE (5 points)



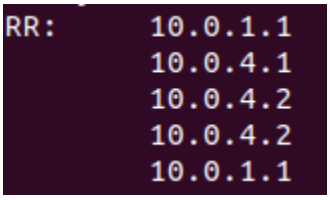
1) Define the CORE scenario above. Each node is a router. Make sure the IP address assignment is as shown.
   a. Make sure to turn off OSPFv3 on all routers. Only OSPFv2 should be enabled
   b. Start the scenario

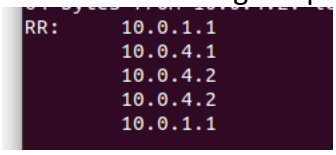


   c.
2) Run the command ping -R -c 1 10.0.4.2 from n1
3) Show a screenshot of the route recorded next to RR

a. 

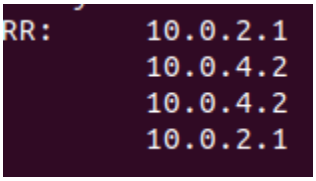
4) You can only use cost value of 100 in the rest of this question
5) (1pt) Using vtysh, change the cost of 1 link in OSPF to cause the route to be as shown below:



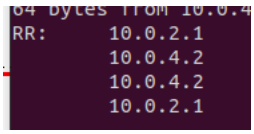
   a. Which link did you choose?
      i. Link from n1 to n4
   b. What command did you run in vtysh? If this was the default behavior and you did not have to change any costs, indicate so.
      i. Configure terminal
      ii. Interface eth2
      iii. Ip ospf cost 100
   c. Show the RR from running the ping command again
      i. 

   d. Reset cost by tunning the command: no ip ospf cost, on the link you set the cost on

6) (1pt) Using vtysh, change the cost of 1 link in OSPF to cause the route to be as shown below:

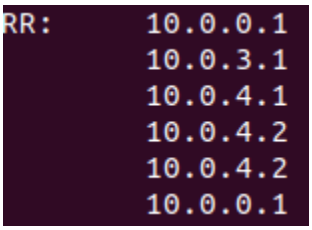


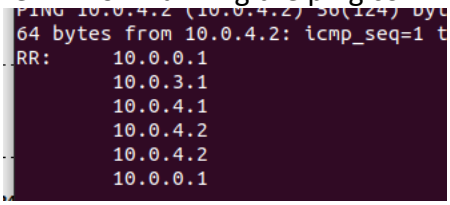
   a. Which link did you choose?
      i. Link from n1 to n3
   b. What command did you run in vtysh? If this was the default behavior and you did not have to change any costs, indicate so.
      i. Configure terminal
      ii. Interface eth1
      iii. Ip ospf cost 100
   c. Show the RR from running the ping command again

i. 

d. Reset cost by tunning the command: no ip ospf cost, on the link you set the cost on

7) (1pt) Using vtysh, change the cost of at most 2 links in OSPF to cause the route to be as shown below:

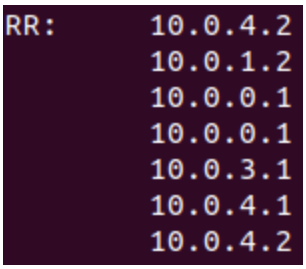


a. Which links did you choose?
   i. Link from n1 to n3 and link from n1 to n4
b. What command did you run in vtysh? If this was the default behavior and you did not have to change any costs, indicate so.
   i. Interface eth1
   ii. Ip ospf cost 100
   iii. Interface eth2
   iv. Ip ospf cost 100
c. Show the RR from running the ping command again
   i. 

d. Do not reset the cost

8) (1pt) What do you think is the path for the ICMP reply message coming back from n4 to n1 in 2, 5, 6, and 7?
   a. Just simply through the link from n4 to n1
   b. Justify your answer
      i. This link has the lowest cost
      ii. The message in RR shows that there is only one hop in return route. Indicating a direct link.

9) (1pt) Using vtysh, change the cost of at 1 link in OSPF to cause the route back to n1 to be as shown below:



a. Which link did you choose?
    i. The link from n4 to n1
b. What command did you run in vtysh?
    i. Configure terminal
    ii. Interface eth0
    iii. Ip ospf cost 100