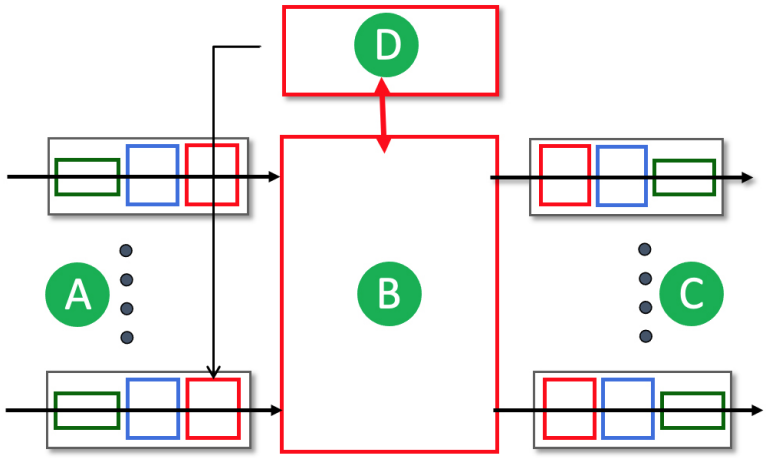
Started on	Tuesday, 6 February 2024, 10:01 PM
State	Finished
Completed on	Wednesday, 7 February 2024, 9:26 AM
Time taken	11 hours 25 mins
Grade	**0.00** out of 40.00 (**0**%)

Question 1

Not answered

Marked out of 1.00

4.2-1. What's inside a router? Match the names of the principal router components (A,B,C,D below) with their function and whether they are in the network-layer data plane or control plane.



(D) is ... Drag answer here

(A) are ... Drag answer here

(B) is ... Drag answer here

(C) are ... Drag answer here

- output ports, operating primarily in the data plane.
- the switching fabric, operating primarily in the control plane.
- the routing processor, operating primarily in the control plane.
- output ports, operating primarily in the control plane.
- input ports, operating primarily in the control plane.
- input ports, operating primarily in the data plane.
- the switching fabric, operating primarily in the data plane.
- the routing processor, operating primarily in the data plane.

The correct answer is:

(D) is ...	the routing processor, operating primarily in the control plane.
(A) are ...	input ports, operating primarily in the data plane.
(B) is ...	the switching fabric, operating primarily in the data plane.

(C) are ... output ports, operating primarily in the data plane.

Question **2**

Not answered

Marked out of 1.00

4.2-4. Longest prefix matching. Consider the following forwarding table below. Indicate the output to link interface to which a datagram with the destination addresses below will be forwarded under longest prefix matching. (Note: The list of addresses is ordered below. If two addresses map to the same output link interface, map the first of these two addresses to the first instance of that link interface.) [Note: You can find more examples of problems similar to this here.]

Destination Address Range	Link interface
11001000 00010111 00010*** ********	0
11001000 00010111 00011000 ********	1
11001000 00010111 00011*** ********	2
otherwise	3

11001000 00010111 00010010 10101101	Drag answer here
11001000 00010111 00010001 01010101	Drag answer here
11001000 00010111 00011001 11001101	Drag answer here
11001000 00010111 00011101 01101101	Drag answer here
11001000 00010111 00011000 00001101	Drag answer here
11001000 00010111 00011000 11001111	Drag answer here
10001000 11100000 00011000 00001101	Drag answer here

- This is the second destination address in the list that maps to output port **0**.
- This is the first destination address in the list that maps to output port **3**.
- This is the second destination address in the list that maps to output port **1**.
- This is the first destination address in the list that maps to output port **0**.
- This is the first destination address in the list that maps to output port **2**.
- This is the first destination address in the list that maps to output port **1**.
- This is the second destination address in the list that maps to output port **3**.
- This is the second destination address in the list that maps to output port **2**.

The correct answer is:

11001000 00010111 00010010 10101101	This is the first destination address in the list that maps to output port **0**.
11001000 00010111 00010001 01010101	This is the second destination address in the list that maps to output port **0**.
11001000 00010111 00011001 11001101	This is the first destination address in the list that maps to output port **2**.
11001000 00010111 00011101 01101101	This is the second destination address in the list that maps to output port **2**.

11001000 00010111 00011000 00001101	This is the first destination address in the list that maps to output port **1**.
11001000 00010111 00011000 11001111	This is the second destination address in the list that maps to output port **1**.
10001000 11100000 00011000 00001101	This is the first destination address in the list that maps to output port **3**.

Question **3**

Not answered

Marked out of 1.00

4.3-2. The IPv4 header. Match each of the following fields in the IP header with its description, function or use.

Fragmentation offset field	Drag answer here
Datagram length field.	Drag answer here
Type-of-service field	Drag answer here
Header checksum field	Drag answer here
Version field	Drag answer here
Time-to-live field	Drag answer here
Upper layer field	Drag answer here
Payload/data field	Drag answer here

- This field contains the "protocol number" for the transport-layer protocol to which this datagram's payload will be demultiplexed - UDP
- This field is used for datagram fragmentation/reassembly.
- The value in this field is decremented at each router; when it reaches zero, the packet must be dropped.
- This field contains the IP protocol version number.
- This field *contains* a UDP or TCP segment, for example.
- This field contains the Internet checksum of this datagram's header fields.
- This field indicates the total number of bytes in datagram.
- This field contains ECN and differentiated service bits.

The correct answer is:

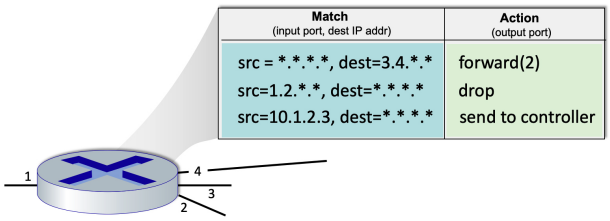
Fragmentation offset field	This field is used for datagram fragmentation/reassembly.
Datagram length field.	This field indicates the total number of bytes in datagram.
Type-of-service field	This field contains ECN and differentiated service bits.
Header checksum field	This field contains the Internet checksum of this datagram's header fields.
Version field	This field contains the IP protocol version number.
Time-to-live field	The value in this field is decremented at each router; when it reaches zero, the packet must be dropped.
Upper layer field	This field contains the "protocol number" for the transport-layer protocol to which this datagram's payload will be demultiplexed - UDP or TCP, for example.
Payload/data field	This field *contains* a UDP or TCP segment, for example.

Question **4**

Not answered

Marked out of 1.00

4.4-4. Match+action in Openflow 1.0. Consider the figure below that shows the generalized forwarding table in a router. Recall that a * represents a wildcard value. Now consider an arriving datagram with the IP source and destination address fields indicated below. For each source/destination IP address pair, indicate which rule is matched. Note: assume that a rule that is earlier in the table takes priority over a rule that is later in the table and that a datagram that matches none of the table entries is dropped.



Source: 10.1.34.56 Destination: 54.72.29.90 — Drag answer here

Source: 10.1.2.3 Destination: 7.8.9.2 — Drag answer here

Source: 65.92.15.27 Destination: 3.4.65.76 — Drag answer here

Source: 1.2.56.32 Destination:128.116.40.186 — Drag answer here

- No match to any rule.
- Rule 3, with action *send to controller*
- Rule 2, with action *drop*
- Rule 1, with action *forward(2)*

The correct answer is:

Source: 10.1.34.56 Destination: 54.72.29.90	No match to any rule.
Source: 10.1.2.3 Destination: 7.8.9.2	Rule 3, with action *send to controller*
Source: 65.92.15.27 Destination: 3.4.65.76	Rule 1, with action *forward(2)*
Source: 1.2.56.32 Destination:128.116.40.186	Rule 2, with action *drop*

Question **5**

Not answered

Marked out of 1.00

4.1-1. The network layer - where is it? Check all of the statements below about where (in the network) the network layer is implemented that are true.

- a. The network layer is implemented in wired Internet-connected devices but not wireless Internet-connected devices.
- b. The network layer is implemented in Ethernet switches in a local area network.
- c. The network layer is implemented in routers in the network core.
- d. The network layer is implemented in hosts at the network's edge.

The correct answers are: The network layer is implemented in hosts at the network's edge., The network layer is implemented in routers in the network core.

Question **6**

Not answered

Marked out of 1.00

4.1-2. Forwarding versus routing. Consider the travel analogy discussed in the textbook - some actions we take on a trip correspond to **forwarding** and other actions we take on a trip correspond to **routing**. Which of the following travel actions below correspond to ***forwarding***? The other travel actions that you don't select below then correspond to routing.

- a. A car stops at an intersection to “gas-up” and take a “bathroom break”
- b. A car takes highway 80 between New York and Chicago, rather than highway 87 to Albany and from there take Interstate 90 to Chicago.
- c. A car waits at light and then turns left at the intersection.
- d. A car takes the 3rd exit from a roundabout.
- e. A traveler decides to fly to Sydney through Singapore rather that Dubai.
- f. A climber decides to take the South Col Route to the top of Mt Everest rather than the Northeast Ridge route.

The correct answers are: A car takes the 3rd exit from a roundabout., A car waits at light and then turns left at the intersection., A car stops at an intersection to “gas-up” and take a “bathroom break”

Question **7**

Not answered

Marked out of 1.00

4.1-4. What type of control plane? We've seen that there are two approaches towards implementing the network control plane - a per-router control-plane approach and a software-defined networking (SDN) control-plane approach. Which of the following actions occur in a per-router control-plane approach? The other actions that you don't select below then correspond to actions in an SDN control plane.

- a. A router exchanges messages with another router, indicating the cost for it (the sending router) to reach a destination host.

- b. All routers in the network send information about their incoming and outgoing links to a logically centralized controller.
- c. A control agent in router receives a complete forwarding table, which it installs and uses to locally control datagram forwarding.
- d. Routers send information about their incoming and outgoing links to other routers in the network.

The correct answers are: A router exchanges messages with another router, indicating the cost for it (the sending router) to reach a destination host., Routers send information about their incoming and outgoing links to other routers in the network.

Question **8**

Not answered

Marked out of 1.00

4.1-5. Best effort service. Which of the following quality-of-service guarantees are part of the Internet's best-effort service model? Check all that apply.

- a. A guaranteed minimum bandwidth is provided to a source-to-destination flow of packets
- b. *None* of the other services listed here are part of the best-effort service model. Evidently, best-effort service really means no *guarantees* at all!
- c. In-order datagram payload delivery to the transport layer of those datagrams arriving to the receiving host.
- d. Guaranteed delivery time from sending host to receiving host.
- e. Guaranteed delivery from sending host to receiving host.

The correct answer is: *None* of the other services listed here are part of the best-effort service model. Evidently, best-effort service really means no *guarantees* at all!

Question **9**

Not answered

Marked out of 1.00

4.2-2. Where does destination address lookup happen? Where in a router is the destination IP address looked up in a forwarding table to determine the appropriate output port to which the datagram should be directed?

- a. Within the switching fabric.
- b. Within the routing processor.
- c. At the input port where a packet arrives.
- d. At the output port leading to the next hop towards the destination.

The correct answer is: At the input port where a packet arrives.

Question **10**

Not answered

Marked out of 1.00

4.2-3. Where does "match+action" happen? Where in a router does "match plus action" happen to determine the appropriate output port to which the arriving datagram should be directed?

- a. At the output port leading to the next hop towards the destination.
- b. Within the switching fabric.
- c. At the input port where a packet arrives.
- d. Within the routing processor.

The correct answer is: At the input port where a packet arrives.

Question **11**

Not answered

Marked out of 1.00

4.2-5. Packet dropping. Suppose a datagram is switched through the switching fabric and arrives to its appropriate output to find that there are no free buffers. In this case:

- a. Another packet will be removed (lost) from the buffer to make room for this packet.
- b. The packet will be dropped (lost).
- c. The packet will be sent back to the input port.
- d. The packet will either be dropped or another packet will be removed (lost) from the buffer to make room for this packet, depending on policy. But the packet will definitely not be be sent back to the input port.

The correct answer is: The packet will either be dropped or another packet will be removed (lost) from the buffer to make room for this packet, depending on policy. But the packet will definitely not be be sent back to the input port.

Question **12**

Not answered

Marked out of 1.00

4.2-6. HOL blocking. What is meant by Head of the Line (HOL) blocking?

- a. In a block error code, the first bytes of the code indicate the type of coding being used.
- b. A queued datagram receiving service at the front of a queue prevents other datagrams in queue from receiving service.
- c. A queued datagram waiting for service at the front of a queue prevents other datagrams in queue from moving forward in the queue.

The correct answer is: A queued datagram waiting for service at the front of a queue prevents other datagrams in queue from moving forward in the queue.

Question **13**

Not answered

Marked out of 1.00

4.3-1. What is the Internet Protocol? What are the principal components of the IPv4 protocol (check all that apply)?

- a. IPv4 datagram format.
- b. SDN controller protocols.
- c. Packet handling conventions at routers (e.g., segmentation/reassembly)
- d. Routing algorithms and protocols like OSPF and BGP.
- e. ICMP (Internet Control Message Protocol)
- f. IPv4 addressing conventions.

The correct answers are: IPv4 datagram format., IPv4 addressing conventions., Packet handling conventions at routers (e.g., segmentation/reassembly)

Question **14**

Not answered

Marked out of 1.00

4.3-3. What is an IP address actually associated with? Which of the following statements is true regarding an IP address? (Zero, one or more of the following statements is true).

- a. An IP address is associated with an interface.
- b. It is not necessary for a device using the IP protocol to actually have an IP address associated with it.
- c. If a router has more than one interface, then it has more that one IP address at which it can be reached.
- d. If a host has more than one interface, then it has more that one IP address at which it can be reached.

The correct answers are: An IP address is associated with an interface., If a host has more than one interface, then it has more that one IP address at which it can be reached., If a router has more than one interface, then it has more that one IP address at which it can be reached.

Question **15**

Not answered

Marked out of 1.00

4.3-4. What is a subnet? What is meant by an IP subnet? (Check zero, one or more of the following characteristics of an IP subnet).

- a. A set of devices that have a common set of leading high order bits in their IP address.
- b. A set of device interfaces that can physically reach each other without passing through an intervening router.
- c. A set of devices that always have a common first 16 bits in their IP address.
- d. A set of devices all manufactured by the same equipment maker/vendor.

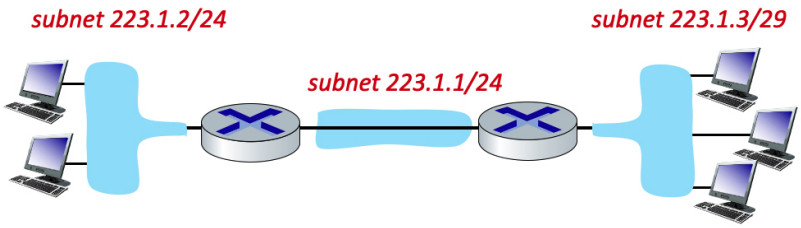
The correct answers are: A set of device interfaces that can physically reach each other without passing through an intervening router., A set of devices that have a common set of leading high order bits in their IP address.

Question **16**

Not answered

Marked out of 1.00

4.3-5a. Subnetting(a). Consider the three subnets in the diagram below.



What is the maximum # of interfaces in the 223.1.2/24 network?

- a. 2**32
- b. There's no a priori limit on the number of interfaces in this subnet.
- c. 256
- d. Two hosts, as shown in the figure.
- e. 128

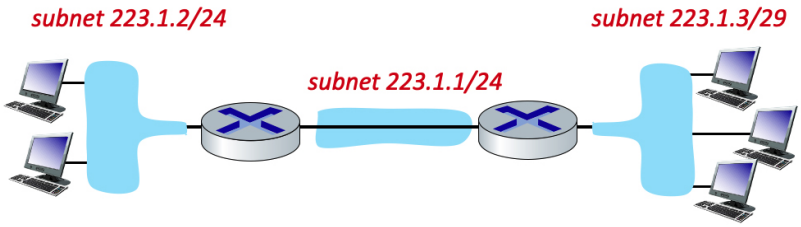
The correct answer is: 256

Question **17**

Not answered

Marked out of 1.00

4.3-5b. Subnetting(b). Consider the three subnets in the diagram below.



What is the maximum # of interfaces in the 223.1.3/29 network?

- a. 2**32
- b. There's no a priori limit on the number of interfaces in this subnet.
- c. 128
- d. Three hosts, as shown in the figure.
- e. 8

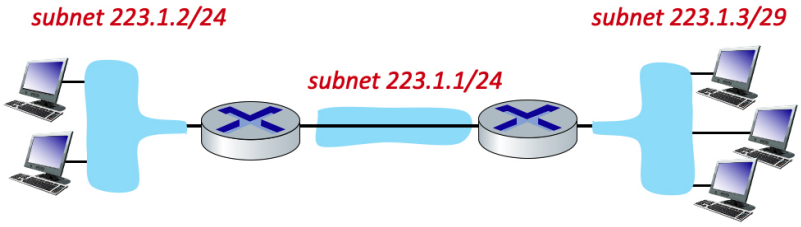
The correct answer is: 8

Question **18**

Not answered

Marked out of 1.00

4.3-5c. Subnetting(c). Consider the three subnets in the diagram below.



Which of the following addresses can ***not*** be used by an interface in the 223.1.3/29 network? Check all that apply.

- a. 223.1.3.2
- b. 223.1.3.28
- c. 223.1.3.6
- d. 223.1.2.6
- e. 223.1.3.16

The correct answers are: 223.1.3.16, 223.1.2.6, 223.1.3.28

Question **19**

Not answered

Marked out of 1.00

4.3-6. Plug-and-play. What is meant by saying that DHCP is a "plug and play" protocol?

- a. The network provides an Ethernet jack for a host's Ethernet adapter.
- b. The host needs to "plug" (by wire or wirelessly) into the local network in order to access ("play" in) the Internet
- c. No manual configuration is needed for the host to join the network.

The correct answer is: No manual configuration is needed for the host to join the network.

Question **20**

Not answered

Marked out of 1.00

4.3-7. DHCP request message. Which of the following statements about a DHCP request message are true (check all that are true). Hint: check out Figure 4.24 in the 7th and 8th edition of our textbook.

- a. The transaction ID in a DHCP request message will be used to associate this message with future DHCP messages sent from, or to, this client.
- b. A DHCP request message *may* contain the IP address that the client will use.
- c. A DHCP request message is optional in the DHCP protocol.
- d. A DHCP request message is sent broadcast, using the 255.255.255.255 IP destination address.
- e. A DHCP request message is sent from a DHCP server to a DHCP client.
- f. The transaction ID in a DCHP request message is used to associate this message with previous messages sent by this client.

The correct answers are: A DHCP request message is sent broadcast, using the 255.255.255.255 IP destination address., A DHCP request message *may* contain the IP address that the client will use., The transaction ID in a DHCP request message will be used to associate this message with future DHCP messages sent from, or to, this client.

Question **21**

Not answered

Marked out of 1.00

4.3-8. IPv4 versus IPv6. Which of the following fields occur ***ONLY*** in the IPv6 datagram header (i.e., appear in the IPv6 header but not in the IPv4 header)? Check all that apply.

- a. The header length field.
- b. The upper layer protocol (or next header) field.
- c. The header checksum field.
- d. The IP version number field.
- e. The options field.
- f. The time-to-live (or hop limit) field.
- g. 128-bit source and destination IP addresses.
- h. The flow label field.

The correct answers are: 128-bit source and destination IP addresses., The flow label field.

Question **22**

Not answered

Marked out of 1.00

4.3-9. Purpose of DHCP. What is the purpose of the Dynamic Host Configuration Protocol?

- a. To configure the interface speed to be used, for hardware like Ethernet, which can be used at different speeds.
- b. To get the 48-bit link-layer MAC address associated with a network-layer IP address.
- c. To configure the set of available open ports (and hence well-known services) for a server.
- d. To obtain an IP address for a host attaching to an IP network.

The correct answer is: To obtain an IP address for a host attaching to an IP network.

Question **23**

Not answered

Marked out of 1.00

4.3.10. Network Address Translation (NAT). Which one of the following operations is *not* performed by NAT.?

- a. Generating ACKs back to the TCP sender and then taking responsibility for reliably delivery the segment to its destination, possibly using a non-TCP reliable data transfer protocol.
- b. On an incoming datagram from the public Internet side of a NAT, changing the destination IP address of a datagram to a new destination IP address that is looked up in the NAT table, and (possibly after other actions), sending that IP datagram on to the LAN side of the NAT.
- c. On an outgoing datagram, changing the transport-layer port number of the transport-layer segment inside a datagram received from the LAN side of the NAT.
- d. On an outgoing datagram, changing the source IP address of a datagram received from the LAN side of the NAT

The correct answer is: Generating ACKs back to the TCP sender and then taking responsibility for reliably delivery the segment to its destination, possibly using a non-TCP reliable data transfer protocol.

Question **24**

Not answered

Marked out of 1.00

4.4-1. Destination-based match+action. Destination-based forwarding, which we studied in section 4.2, is a specific instance of match+action and generalized forwarding. Select the phrase below which best completes the following sentence:

"In destination-based forwarding, ..."

- a. ... after ***matching*** on the port number in the segment's header, the ***action*** taken is to forward the datagram to the output port associated with that port number.
- b. ... after ***matching*** on the destination IP address in the datagram header, the ***action*** taken is to forward the datagram to the output port associated with that destination IP address.
- c. ... after ***matching*** on the port number in the segment's header, the ***action*** taken is to decide whether or not to drop the datagram containing that segment.
- d. ... after ***matching*** on the URL contained in an HTTP GET request in the TCP segment within the IP datagram, the ***action*** taken is to determine the IP address of the server associated with that URL, and to forward the datagram to the output port associated with that destination IP address.
- e. ... after ***matching*** on the source and destination IP address in the datagram header, the ***action*** taken is to forward the datagram to the output port associated with that source and destination IP address pair.
- f. ... after ***matching*** on the destination IP address in the datagram header, the ***action*** taken is to decide whether or not to drop that datagram.
- g. ... after ***matching*** on the 48-bit link-layer destination MAC address, the ***action*** taken is to forward the datagram to the output port associated with that link-layer address.

The correct answer is: ... after ***matching*** on the destination IP address in the datagram header, the ***action*** taken is to forward the datagram to the output port associated with that destination IP address.

Question **25**

Not answered

Marked out of 1.00

4.4-2. Generalized match+action. Which of the following match+actions can be taken in the generalized OpenFlow 1.0 match+action paradigm that we studied in Section 4.4? Check all that apply.

- a. ... after ***matching*** on the port number in the segment's header, the ***action*** taken is to decide whether or not to drop that datagram containing that segment.
- b. ... after ***matching*** on the 48-bit link-layer destination MAC address, the ***action*** taken is to forward the datagram to the output port associated with that link-layer address.
- c. ... after ***matching*** on the port number in the segment's header, the ***action*** taken is to forward the datagram to the output port associated with that destination IP address.
- d. ... after ***matching*** on the destination IP address in the datagram header, the ***action*** taken is to decide whether or not to drop that datagram.
- e. ... after ***matching*** on the URL contained in an HTTP GET request in the TCP segment within the IP datagram, the ***action*** taken is to determine the IP address of the server associated with that URL, and to forward the datagram to the output port associated with that destination IP address.
- f. ... after ***matching*** on the destination IP address in the datagram header, the ***action*** taken is to forward the datagram to the output port associated with that destination IP address.
- g. ... after ***matching*** on the source and destination IP address in the datagram header, the ***action*** taken is to forward the datagram to the output port associated with that source and destination IP address pair.

The correct answers are: ... after ***matching*** on the destination IP address in the datagram header, the ***action*** taken is to forward the datagram to the output port associated with that destination IP address., ... after ***matching*** on the destination IP address in the datagram header, the ***action*** taken is to decide whether or not to drop that datagram., ... after ***matching*** on the port number in the segment's header, the ***action*** taken is to decide whether or not to drop that datagram containing that segment., ... after ***matching*** on the port number in the segment's header, the ***action*** taken is to forward the datagram to the output port associated with that destination IP address., ... after ***matching*** on the 48-bit link-layer destination MAC address, the ***action*** taken is to forward the datagram to the output port associated with that link-layer address., ... after ***matching*** on the source and destination IP address in the datagram header, the ***action*** taken is to forward the datagram to the output port associated with that source and destination IP address pair.

Question **26**

Not answered

Marked out of 1.00

4.4-3. What fields can be matched in generalized match+action. Which of the following fields in the frame/datagram/segment/application-layer message can be matched in OpenFlow 1.0? Check all that apply.

- a. IP destination address
- b. Upper layer protocol field
- c. Source and/or destination port number
- d. IP type-of-service field
- e. IP source address
- f. Number of bytes in the datagram
- g. Time-to-live field
- h. URL in HTTP message

The correct answers are: IP source address, IP destination address, Upper layer protocol field, Source and/or destination port number, IP type-of-service field

Question **27**

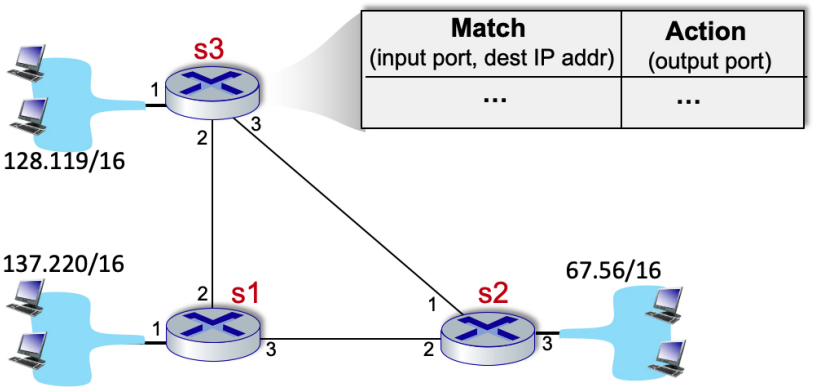
Not answered

Marked out of 1.00

4.4-5. Crafting network-wide forwarding using flow tables. Consider the network below. We want to specify the match+action rules **at s3** so that only the following network-wide behavior is allowed:

1. traffic from 128.119/16 and destined to 137.220/16 is forwarded on the direct link from s3 to s1;
2. traffic from 128.119/16 and destined to 67.56/16 is forwarded on the direct link from s3 to s2;
3. incoming traffic via port 2 or 3, and destined to 128.119/16 is forwarded to 128.119/16 via local port 1.
4. No other forwarding should be allowed. In particular s3 should not forward traffic arriving from 137.220/16 and destined for 67.56/16 and vice versa.

From the list of match+action rules below, select the rules to include in s3's flow table to implement this forwarding behavior. Assume that if a packet arrives and finds no matching rule, it is dropped.



- a. Input port: 2; Dest: 67.56/16 Action: forward(3)
- b. Input port: 2; Dest: 128.119/16 Action: forward(1)
- c. Input port:1 ; Dest: 137.220/16 Action: forward(2)
- d. Input port: 3; Dest: 137.220/16 Action: forward(2)
- e. Input port:1 ; Dest: 137.220/16 Action: forward(3)
- f. Input port: 1; Dest: 67.56/16 Action: forward(2)
- g. Input port: 1; Dest: 67.56/16 Action: forward(3)
- h. Input port: 3; Dest: 128.119/16 Action: forward(1)

The correct answers are: Input port:1 ; Dest: 137.220/16 Action: forward(2), Input port: 1; Dest: 67.56/16 Action: forward(3), Input port: 2; Dest: 128.119/16 Action: forward(1), Input port: 3; Dest: 128.119/16 Action: forward(1)

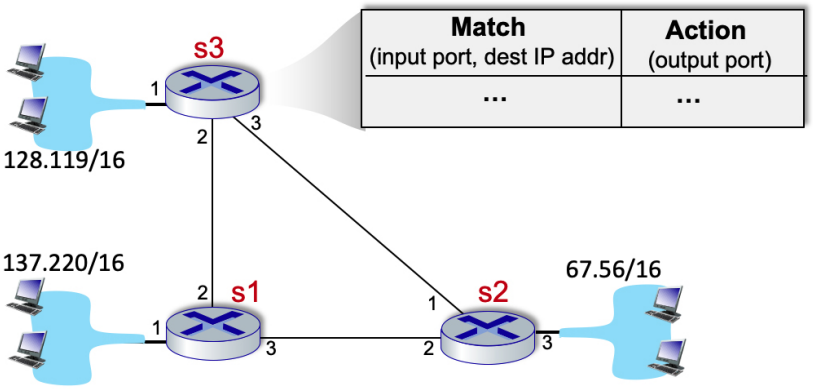
Question **28**

Not answered

Marked out of 1.00

4.4-6. Crafting network-wide forwarding using flow tables (more). Consider the network below. We want to specify the match+action rules ***at s3*** so that s3 ***acts only as a relay*** for traffic between 137.220/16 and 67.56/16. In particular s3 should not accept/forward and traffic to/from 128.119/16.

From the list of match+action rules below, select the rules to include in s3's flow table to implement this forwarding behavior. Assume that if a packet arrives and finds no matching rule, it is dropped.



- a. Input port:1 ; Dest: 137.220/16 Action: forward(3)
- b. Input port: 1; Dest: 67.56/16 Action: forward(2)
- c. Input port: 1; Dest: 67.56/16 Action: forward(3)
- d. Input port: 2; Dest: 67.56/16 Action: forward(3)
- e. Input port: 2; Dest: 128.119/16 Action: forward(1)
- f. Input port:1 ; Dest: 137.220/16 Action: forward(2)
- g. Input port: 3; Dest: 137.220/16 Action: forward(2)
- h. Input port: 3; Dest: 128.119/16 Action: forward(1)

The correct answers are: Input port: 2; Dest: 67.56/16 Action: forward(3), Input port: 3; Dest: 137.220/16 Action: forward(2)

Question **29**

Not answered

Marked out of 1.00

4.4-7. Generalized forwarding. What is meant by generalized forwarding (as opposed to destination-based forwarding) in a router or switch?

- a. None of the other answers is a correct definition of generalized forwarding.
- b. The decision about which output port to forward a packet to can be made based on the link-type of the outgoing port (e.g., Ethernet versus WiFi).
- c. Any of several actions (including drop (block), forward to a given interface, or duplicate-and-forward) can be made based on the contents of one or more packet header fields.
- d. In addition to performing forwarding, the device can generalize its services, also performing hop-by-hop reliable data transfer and per-hop congestion control.

The correct answer is: Any of several actions (including drop (block), forward to a given interface, or duplicate-and-forward) can be made based on the contents of one or more packet header fields.

Question **30**

Not answered

Marked out of 1.00

4.5-1. What's a "middlebox"? Which of the following network devices can be thought of as a "middlebox"? Check all that apply.

- a. HTTP cache
- b. Network Address Translation box
- c. HTTP load balancer
- d. IP router
- e. SDN controller
- f. WiFi base station

The correct answers are: Network Address Translation box, HTTP load balancer, HTTP cache

Question **31**

Not answered

Marked out of 1.00

4.5-2. The "thin waist" of the Internet. What protocol (or protocols) constitutes the "thin waist" of the Internet protocol stack? Check all that apply.

- a. HTTP
- b. IP
- c. DNS
- d. TCP
- e. Ethernet
- f. WiFi

The correct answer is: IP

Question **32**

Not answered

Marked out of 1.00

4.5-3. The end-to-end principle. Which of the statements below are true statements regarding the "end-to-end principle"? Check all that apply.

- a. The end-to-end argument advocates placing functionality at the network edge to optimize performance, such as end-end delay.
- b. The end-to-end argument allows that some redundant functionality might be placed both in-network and at the network edge in order to enhance performance.
- c. The end-to-end argument advocates placing functionality at the network edge because some functionality cannot be completely and correctly implemented in the network, and so needs to be placed at the edge in any case, making in-network implementation redundant.

The correct answers are: The end-to-end argument advocates placing functionality at the network edge because some functionality cannot be completely and correctly implemented in the network, and so needs to be placed at the edge in any case, making in-network implementation redundant., The end-to-end argument allows that some redundant functionality might be placed both in-network and at the network edge in order to enhance performance.

Question **33**

Not answered

Marked out of 1.00

4.5-4. The Internet hourglass. What is meant when it is said that the Internet has an “hourglass” architecture? See the picture below if you are unfamiliar with an "hourglass".

An hourglass

- a. The Internet protocol stack has a “thin waist” in the middle, like an hourglass. The Internet Protocol (IP) is the only network-layer protocol in the middle layer of the stack. Every other layer has multiple protocols at that layer.
- b. ... after ***matching*** on the source and destination IP address in the datagram header, the ***action*** taken is to forward the datagram to the output port associated with that source and destination IP address pair.
- c. Packets flow from top to bottom down the stack, like sand in an hour glass. Then, on the receiver side, if the hourglass is reversed, packets flow up the stack, like sand flowing in the opposite direction.

The correct answer is: The Internet protocol stack has a “thin waist” in the middle, like an hourglass. The Internet Protocol (IP) is the only network-layer protocol in the middle layer of the stack. Every other layer has multiple protocols at that layer.

Question **34**

Not answered

Marked out of 1.00

4.5-5. Federal Regulation and the Internet. In the US, which of the following services has been regulated by the Federal Communications Commission (FCC) going back into the 20th century?

- a. Neither telecommunications services (broadly) nor information services; the FCC's jurisdiction is only on over-the-air (e.g., wireless) links.
- b. Telecommunication services.
- c. Information services.
- d. Both telecommunications services and information services.

The correct answer is: Telecommunication services.

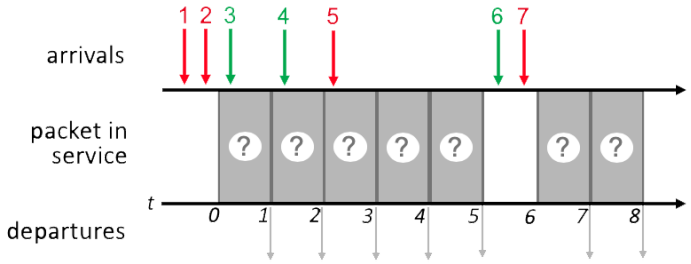
Question **35**

Not answered

Marked out of 1.00

4.2-7a. Packet scheduling (Scenario 1, FCFS). Consider the pattern of red and green packet arrivals to a router's output port queue, shown below. Suppose each packet takes one time slot to be transmitted, and can only begin transmission at the beginning of a time slot after its arrival. Indicate the sequence of departing packet numbers (at t = 1, 2, 3, 4, 5, 7, 8) under **FCFS** scheduling. Give your answer as 7 ordered digits (each corresponding to the packet number of a departing packet), with a single space between each digit, and no spaces before the first or after the last digit, e.g., in a form like 7 6 5 4 3 2 1).

[Note: You can find more examples of problems similar to this here.]



Answer:

The correct answer is: 1 2 3 4 5 6 7

Question **36**

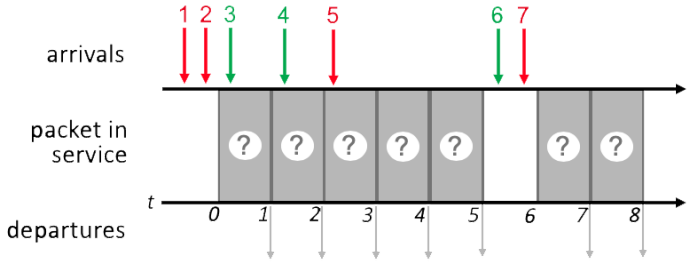
Not answered

Marked out of 1.00

4.2-7b. Packet scheduling (Scenario 1, Priority). Consider the pattern of red and green packet arrivals to a router's output port queue, shown below. Suppose each packet takes one time slot to be transmitted, and can only begin transmission at the beginning of a time slot after its arrival. Indicate the sequence of departing packet numbers (at t = 1, 2, 3, 4, 5, 7, 8) under **priority** scheduling, where red packets have higher priority.

Give your answer as 7 ordered digits (each corresponding to the packet number of a departing packet), with a single space between each digit, and no spaces before the first or after the last digit, e.g., in a form like 7 6 5 4 3 2 1).

[Note: You can find more examples of problems similar to this here.]



Answer:

The correct answer is: 1 2 3 5 4 7 6

Question **37**

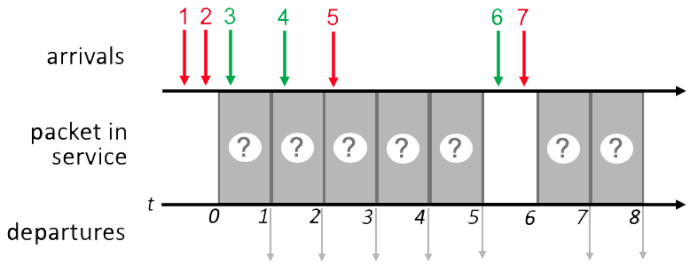
Not answered

Marked out of 1.00

4.2-7c. Packet scheduling (Scenario 1, RR). Consider the pattern of red and green packet arrivals to a router's output port queue, shown below. Suppose each packet takes one time slot to be transmitted, and can only begin transmission at the beginning of a time slot after its arrival. Indicate the sequence of departing packet numbers (at t = 1, 2, 3, 4, 5, 7, 8) under **round robin scheduling**, where red starts a round if there are both red and green packets ready to transmit after an empty slot.

Give your answer as 7 ordered digits (each corresponding to the packet number of a departing packet), with a single space between each digit, and no spaces before the first or after the last digit, e.g., in a form like 7 6 5 4 3 2 1).

[Note: You can find more examples of problems similar to this here.]



Answer:

The correct answer is: 1 3 2 4 5 7 6

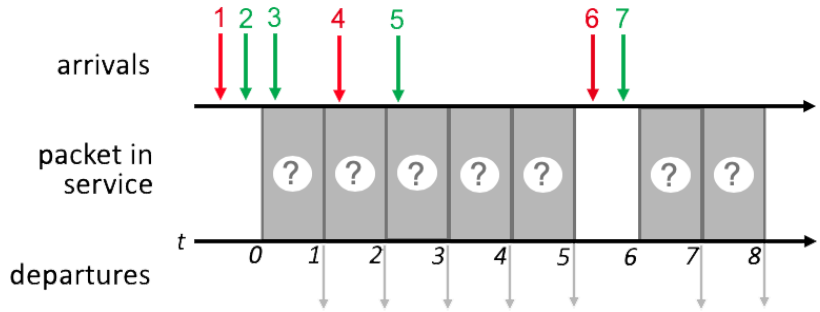
Question **38**

Not answered

Marked out of 1.00

4.2-8a. Packet scheduling (Scenario 2, FCFS). Consider the pattern of red and green packet arrivals to a router's output port queue, shown below. Suppose each packet takes one time slot to be transmitted, and can only begin transmission at the beginning of a time slot after its arrival. Indicate the sequence of departing packet numbers (at t = 1, 2, 3, 4, 5, 7, 8) under **FCFS** scheduling. Give your answer as 7 ordered digits (each corresponding to the packet number of a departing packet), with a single space between each digit, and no spaces before the first or after the last digit, e.g., in a form like 7 6 5 4 3 2 1).

[Note: You can find more examples of problems similar to this here.]



Answer:

The correct answer is: 1 2 3 4 5 6 7

Question **39**

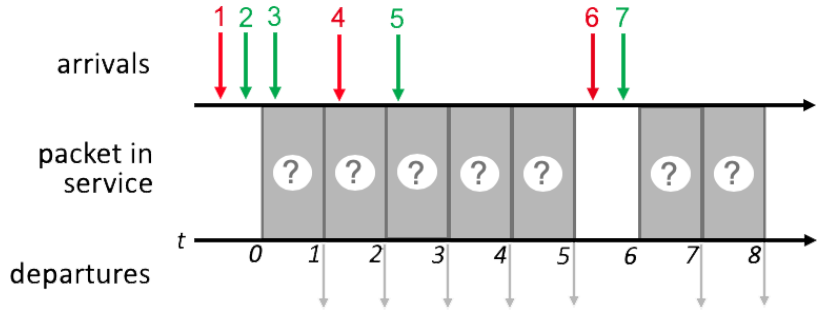
Not answered

Marked out of 1.00

4.2-8b. Packet scheduling (Scenario 2, Priority). Consider the pattern of red and green packet arrivals to a router's output port queue, shown below. Suppose each packet takes one time slot to be transmitted, and can only begin transmission at the beginning of a time slot after its arrival. Indicate the sequence of departing packet numbers (at t = 1, 2, 3, 4, 5, 7, 8) under **priority** scheduling, where red packets have higher priority.

Give your answer as 7 ordered digits (each corresponding to the packet number of a departing packet), with a single space between each digit, and no spaces before the first or after the last digit, e.g., in a form like 7 6 5 4 3 2 1).

[Note: You can find more examples of problems similar to this here.]



Answer:

The correct answer is: 1 2 4 3 5 6 7

Question **40**

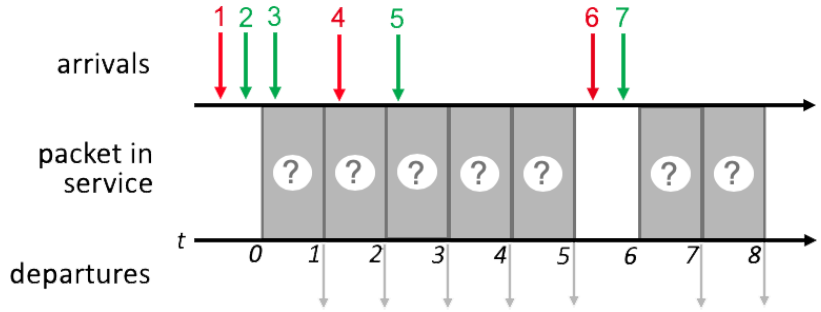
Not answered

Marked out of 1.00

4.2-8c. Packet scheduling (Scenario 2, RR). Consider the pattern of red and green packet arrivals to a router's output port queue, shown below. Suppose each packet takes one time slot to be transmitted, and can only begin transmission at the beginning of a time slot after its arrival. Indicate the sequence of departing packet numbers (at t = 1, 2, 3, 4, 5, 7, 8) under **round robin scheduling**, where red starts a round if there are both red and green packets ready to transmit after an empty slot.

Give your answer as 7 ordered digits (each corresponding to the packet number of a departing packet), with a single space between each digit, and no spaces before the first or after the last digit, e.g., in a form like 7 6 5 4 3 2 1).

[Note: You can find more examples of problems similar to this here.]



Answer:

The correct answer is: 1 2 4 3 5 6 7

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