ETHERNET AND ARP QUIZ

Question 1

Correct

Mark 3.00 out of 3.00

⚑ Flag question

Based on the contents of the Ethernet frame containing the first byte of the HTTP response message to the GET. Fill in the answers to the questions below.

1. What is the value of the Ethernet source address? `a0:1c:8d:54:2d:5f` ✔

2. Is this the address of your computer? No ✔

3. Or does it belong to gaia.cs.umass.edu? No ✔

4. What device has this as its Ethernet address? Router ✔ (Hint: answer as follows

Server or Switch or Router. Just type the option that you think is correct)

Question 2

Partially correct

Mark 3.33 out of 5.00

⚑ Flag question

Answer the following questions, based on the contents of the Ethernet frame containing the first byte of the HTTP response message.

1. What is the destination address in the Ethernet frame? 30:e3:7a:54:3f:6c ✔

2. Is this the Ethernet address of your computer? (assuming you captured this trace on your computer)

Yes ✔

3. Give the hexadecimal value for the two-byte Frame type field. 0800 ✘

4. What upper layer protocol does this correspond to?

IPv4 ✔

5. How many bytes from the very start of the Ethernet frame does the ASCII "O" in "OK" (i.e., the HTTP response code) appear in the Ethernet frame? Do not count any preamble bits in your count, i.e., assume that the Ethernet frame begins with the Ethernet frame's destination address.

68 ✔

6. How many Ethernet frames (each containing an IP datagram, each containing a TCP segment) carry data that is part of the complete HTTP "OK 200 ..." reply message?

2 ✔

Find the ARP reply message that was sent in response to the ARP request from your computer in the trace provided. (Hint: you can use the first ARP request and response pair in this case)

What is the value of the opcode field within the ARP reply message received by your computer?

2 ✔

What is the protocol size in the response frame? 4 ✔

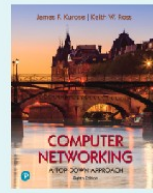# IP PROTOCOL QUIZ

Question 1

Correct

Mark 0.50 out of 0.50

⚑ Flag question

Remember, these questions **must** be answered using the give trace files for the IP lab.

If a question uses the phrasing "your browser" this refers to the browser used when the trace file was generated.

Q01: What is the IP address of the client computer (source) that is initiating the traceroute to gaia.cs.umass.edu?

Enter the IP address in dotted decimal notation (include each dot, and omit any leading zeros for any byte, e.g., 10.1.216.54):

Answer: 146.141.56.165 ✔

Question 2

Correct

Mark 0.50 out of 0.50

⚑ Flag question

Q02: What is the value in the time-to-live (TTL) field in the header of this IPv4 datagram (i.e., the datagram containing the first UDP segment sent by your computer via the `traceroute` command to gaia.cs.umass.edu)?

Answer: 1 ✔

Question 3

Correct

Mark 0.50 out of 0.50

⚑ Flag question

Q03: What is the value in the upper-layer protocol field in the header of this IPv4 datagram (i.e., the datagram containing the first UDP segment sent by your computer via the `traceroute` command to gaia.cs.umass.edu)?

Enter the upper-layer protocol field value (digits only, no commas), with no leading 0's:

Answer: 17 ✔

Question 4

Correct

Mark 0.50 out of 0.50

⚑ Flag question

Q04: How many bytes are in the header of this IPv4 datagram (i.e., the number of bytes, excluding the payload, in the datagram containing the first UDP segment sent by your computer via the `traceroute` command to gaia.cs.umass.edu)?

Enter the number of bytes (digits only, no commas), with no leading 0's:

Answer: 20 ✔

Q05: How many bytes of payload are in this datagram, and how did you determine this? Choose one of the following answers.

◉ a. 36 bytes. The Internet header is 20 bytes long, and I see that the total length of the IP ✔ datagram is 56 byes.

○ b. 56 bytes

○ c. 20 bytes. The length of an IP datagram payload is always 20 bytes.

○ d. 28 bytes

○ e. There's not enough information to answer this question.

Q06: Has this IP datagram been fragmented? Explain how you determined whether or not the datagram has been fragmented. Choose one of the following answers.

○ a. Yes. The fragment offset field bit in the IP header has a non-zero value.

○ b. Yes. The "more fragments" bit in the IP header is set. (i.e., has value 1).

○ c. No. The "fragment offset" field in the IP header has value 0.

◉ d. No. The "more fragments" bit in the IP header is not set. (i.e., has value 0).✔

Q07: Next, let's look at the *sequence* of UDP segments being sent to 128.119.245.12.The display filter that you can enter to do this is "ip.src==146.141.56.165 and ip.dst==128.119.245.12 and udp and !icmp" (use this display filter for questions 7 - 9). Which fields in the IP datagram *always* change from one datagram to the next within this series of UDP segments?

(Select all that apply, there is negative marking for incorrect choices!)

☐ a. Destination IP

☐ b. Source IP

☐ c. Differentiated Services

☐ d. Time to Live

☐ e. Version

☑ f. Header Checksum✔

☑ g. Identification✔

☐ h. Header length

☐ i. Upper Layer Protocol

Q08: Which fields in this sequence of IP datagrams (containing UDP segments) stay constant?

(Select all that apply, there **is** negative marking for incorrect choices!)

- ☐ a. Time to Live
- ☑ b. Upper Layer Protocol✔
- ☑ c. Source IP✔
- ☑ d. Version✔
- ☐ e. Header Checksum
- ☐ f. Identification
- ☑ g. Header length✔
- ☑ h. Destination IP✔
- ☑ i. Differentiated Services✔

Q10: What is the value upper layer protocol specified in the IP datagrams returned from the routers?

Answer: | 1 | ✔

Use your knowledge of DNS and nslookup to answer this question. What is the canonical name for the name IPv6 server for www.youtube.com.

Answer: | youtube-ui.l.google.com | ✔

Question 12

Incorrect

Mark 0.00 out of 1.00

⚑ Flag question

In the IP lab locate the packet that sends the following command;

traceroute gaia.cs.umass.edu 3000

What is the packet number for this packet?

Answer: 252 ✖

Question 13

Correct

Mark 1.00 out of 1.00

⚑ Flag question

Having located the packet that sends the following command in the trace;

traceroute gaia.cs.umass.edu 3000

How many IP fragments does this command generate?

○ A. It is not possible to determine this answer because the information provided is not sufficient to suppy the answer.

○ B. 4

○ C. 1

○ D. 2

◉ E. 3 ✔

TEST 1

Consider the network shown in the figure below, with three links, each with the specified transmission rate and link length. Assume the length of a packet is 4M bits. The speed of light propagation delay on each link is 10^2 m/sec (physics works differently here)

Transmission rate: 10 Gbps
Link Length: 2 Km

Transmission rate: 10 Kbps
Link Length: 1 Km

Transmission rate: 1Gbps
Link Length: 100 Km
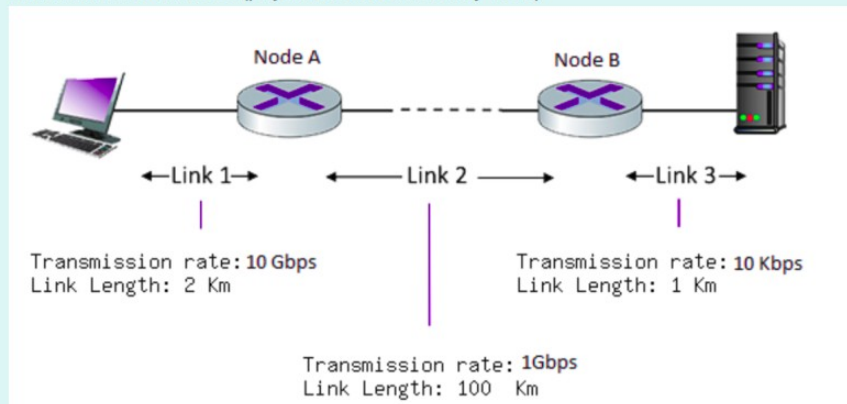
What is the delay to transfer the packet from the left end system to the one on the right? There is only nodal processing delay at Node A and B of 0.1 seconds each, there is no queuing delay (unlimited buffer space).

Your answer must be given and rounded to 4 decimal places.

Answer: 1430.2044 ✔

The correct answer is: 1430.2044

Select all the layers in the TCP/IP model that typically do **not** add additional header information to an application layer message.

(Select all that apply, there **is** negative marking for incorrect choices!)

- ☐ a. Network Layer
- ☐ b. Transport Layer
- ☑ c. Physical Layer ✔
- ☐ d. Link Layer
- ☑ e. Application Layer ✔

The correct answers are:
Application Layer,

Physical Layer

What is the purpose of a cookie value in the HTTP GET request?

- ⦿ a. The cookie value encodes a default set of preferences that the user has previously specified ✖ for this web site.

- ○ b. The cookie value indicates whether the user wants to use HTTP/1, HTTP/1.1, or HTTP/2 for this GET request.

- ○ c. The cookie value itself doesn't mean anything. It is just a value that was returned by a web server to this client during an earlier interaction.

- ○ d. The cookie value encodes the format of the reply preferred by the client in the response to this GET request.

- ○ e. The cookie value is an encoding of a user email address associated with the GET request.

The correct answer is: The cookie value itself doesn't mean anything. It is just a value that was returned by a web server to this client during an earlier interaction.

Match the function of a layer in the Internet protocol stack to its its name in the pulldown menu.

Transfer of data between one process and another process (typically on different hosts). | Application Layer ⬍ |
✖

Protocols that are part of a distributed network application. | Transport layer ⬍ |
✖

Delivery of datagrams from a source host to a destination host (typically). | Network layer ⬍ |
✔

Transfer of a bit into and out of a transmission media. | Physical layer ⬍ |
✔

Transfer of data between neighboring network devices. | Link layer ⬍ |
✔

The correct answer is: Transfer of data between one process and another process (typically on different hosts). → Transport layer, Protocols that are part of a distributed network application. → Application Layer, Delivery of datagrams from a source host to a destination host (typically). → Network layer, Transfer of a bit into and out of a transmission media. → Physical layer, Transfer of data between neighboring network devices. → Link layer

Match the description of a security defense with its name.

Provides confidentiality by encoding contents

| Encryption ⇕ |

✔

Proving you are who you say you are.

| Authentication ⇕ |

✔

Limiting use of resources or capabilities to given users.

| Access control ⇕ |

✔

Specialized "middleboxes" filtering or blocking traffic, inspecting packet contents inspections

| Firewall ⇕ |

✔

Used to detect tampering/changing of message contents, and to identify the originator of a message.

| Digital signatures ⇕ |

✔

The correct answer is: Provides confidentiality by encoding contents → Encryption, Proving you are who you say you are. → Authentication, Limiting use of resources or capabilities to given users. → Access control, Specialized "middleboxes" filtering or blocking traffic, inspecting packet contents inspections → Firewall, Used to detect tampering/changing of message contents, and to identify the originator of a message. → Digital signatures

Which of the characteristics below are associated with a client-server approach to structuring network applications (as opposed to a P2P approach)?

(Select all that apply, there **is** negative marking for incorrect choices!)

☐ a. A process requests service from those it contacts and will provide service to processes that contact it.

☑ b. HTTP uses this application structure.✔

☐ c. There is *not* a server that is always on.

☑ d. There is a server with a well known server IP address.✔

☑ e. There is a server that is always on.✔

The correct answers are: There is a server that is always on., There is a server with a well known server IP address., HTTP uses this application structure.

Match the function of a server to a given type of DNS server in the DNS server hierarchy.

Replies to DNS query by local host, by contacting other DNS servers to answer the query.

Local DNS server	⬍

✔

Provides authoritative hostname to IP mappings for organization's named hosts.

Authoritative DNS server	⬍

✔

Highest level of the DNS hierarchy, knows how to reach servers responsible for a given domain (e.g., *.com, *.edu).

DNS root servers	⬍

✔

Responsible for a domain (e.g., *.com, *.edu); knows how to contact authoritative name servers.

Top Level Domain (TLD) servers	⬍

✔

The correct answer is: Replies to DNS query by local host, by contacting other DNS servers to answer the query. → Local DNS server. Provides authoritative hostname to IP mappings for organization's named hosts. → Authoritative DNS server, Highest level of the DNS hierarchy, knows how to reach servers responsible for a given domain (e.g., *.com, *.edu). → DNS root servers, Responsible for a domain (e.g., *.com, *.edu); knows how to contact authoritative name servers. → Top Level Domain (TLD) servers
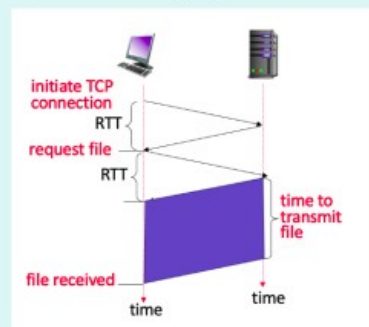
2.2-5 Download delays for 100 objects (HTTP 1.0). Consider an HTTP 1.0 client and server. The RTT delay between the client and server is 2 seconds. Suppose the time a server needs to transmit an object into its outgoing link is 3 seconds, as shown below for the first of these 100 requests.

You can assume that any other HTTP message not containing an object sent by the client and server has a negligible (zero) transmission time. Suppose the client makes 100 requests, one after the other, waiting for a reply to a request before sending the next request.

Using HTTP 1.0, how much time elapses between the client transmitting the first request, and the receipt of the last requested object?

- ○ a. 300 secs
- ○ b. 500 secs
- ◉ c. 700 secs ✔
- ○ d. 203 secs
- ○ e. 502 secs

The correct answer is: 700 secs

This question is based on the provided Test 1 Trace file.

Locate the response for the query for the nslookup query shown below. (please just write the packet number without any other text)

**nslookup -type=A www.nyu.edu**

Answer: 192 ✔

The correct answer is: 192

1.4-10 Link Utilization (a). Consider the scenario below where 4 TCP senders are connected to 4 receivers. The servers transmit to the receiving hosts at the fastest rate possible (i.e., at the rate at which the bottleneck link between a server and its destination is operating at 100% utilization, and is fairly shared among the connections passing through that link).
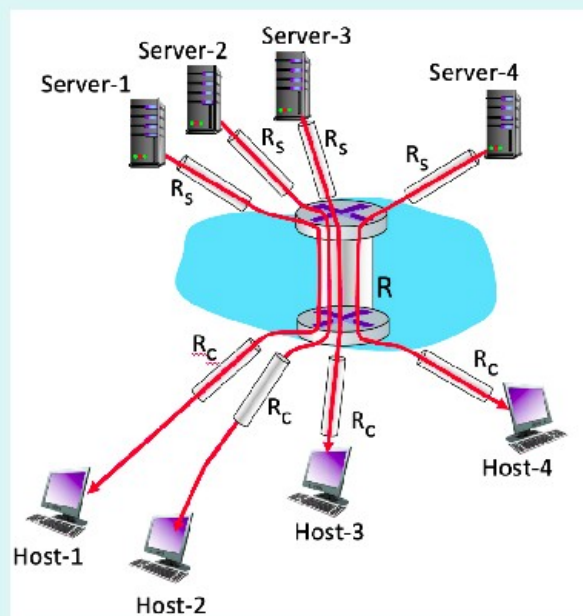
Suppose that R = 1 Gbps and R_c is 300 Mbps and R_s is 200 Mbps. Assuming that the servers are sending at their maximum rate possible, calculate the link utilizations for the client links (whose rate is R_c) below. Enter your answer as a decimal, of the form 1.00 (if the utilization is 1, or 0.xx if the utilization is less than 1, rounded to the closest xx).

The utilization of the client links, whose rate is R_c, is: [A]

Answer: 0.67 ✔

The correct answer is: 0.67

Suppose that the local DNS server caches all information coming in from all root, TLD, and authoritative DNS servers for 20 time units. (Thus, for example, when a root server returns the name and address of a TLD server for .com, the cache remembers that this is the TLD server to use to resolve a .com name). Assume also that the local cache is initially empty, that iterative DNS queries are always used, that DNS requests are just for name-to-IP-address translation, that 1 time unit is needed for each server-to-server or host-to-server (one way) request/response, and that there is only one authoritative name server (each) for any .edu or .com domain.
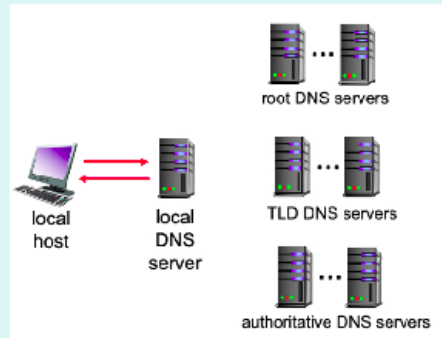
Consider the following DNS requests, made by the local host at the given times:

- *t=0*, the local host requests that the name gaia.cs.umass.edu be resolved to an IP address.
- *t=1*, the local host requests that the name icann.org be resolved to an IP address.
- *t=5*, the local host requests that the name cs.umd.edu be resolved to an IP address.
- *t=10*, the local host *again* requests that the name gaia.cs.umass.edu be resolved to an IP address.
- *t=12*, the local host requests that the name cs.mit.edu be resolved to an IP address.
- *t=30*, the local host *again* requests that the name gaia.cs.umass.edu be resolved to an IP address.

Which of the requests require 6 time units to be resolved? (Multiple answers allowed, negative marking for wrong answers)

- ☐ a. The request at *t=30*.
- ☑ b. The request at *t=5*. ✔
- ☐ c. The request at *t=0*.
- ☐ d. The request at *t=10*.
- ☐ e. The request at *t=1*.
- ☑ f. The request at *t=12*. ✔

The correct answers are: The request at *t=5*., The request at *t=12*.

This question is based on the provided Test 1 Trace file.

Locate the packet number for the following nslookup command to trigger a DNS query

nslookup type=a www.unza.zm

- ○ A. 104
- ○ B. 191
- ○ C. 291
- ○ D. 648
- ◉ E. 289 ✔

The correct answers are:
104,

191,

291,

289,

648

This question is based on the provided Test 1 Trace file.

Locate the response to the query and answer the question that follows;

nslookup -type=a www.utc.ac.za

What is the authoritative name server for the uct.ac.za domain ?

- ◉ A. srvslsweb002.uct.ac.za ✔
- ○ B. srvslsweb001.uct.ac.za
- ○ C. ns2.uct.ac.za
- ○ D. ns.name1.uct.ac.za
- ○ E. ns1.uct.ac.za

The correct answer is:
srvslsweb002.uct.ac.za

2.2-3 HTTP 1.1 GET with an embedded object. Suppose an HTTP client makes a request to the gaia.cs.umass.edu web server. The client has never before requested a given base object, nor has it communicated recently with the gaia.cs.umass.edu server. You can assume, however, that the client host knows the IP address of gaia.cs.umass.edu.

Suppose also that after downloading the base file, the browser encounters a jpeg object in the base html file that is stored on gaia.cs.umass.edu, and therefore makes another GET request to gaia.cs.umass.edu for that referenced jpeg object.

How many round trip times (RTTs) are needed from when the client first makes the request to when the base page and the jpeg file are completely downloaded, assuming the time needed by the server to transmit the base file, or the jpeg file into the server's link is (each) equal to 1/2 RTT and that the time needed to transmit the HTTP GET into the client's link is zero? **You should assume that persistent HTTP 1.1 is being used.** (You should take into account any TCP setup time required before an HTTP GET is actually sent by the client, the time needed for the server to transmit the requested object, and any propagation delays not accounted for in these amounts of time.)

- ⃝ a.   1 RTT
- ⃝ b.   2.5 RTT
- ⦿ c.   4 RTT ✔
- ⃝ d.   2 RTT
- ⃝ e.   5 RTT

The correct answer is: 4 RTT

Which of the characteristics below are associated with the technique of *packet switching*?

(Select all that apply, there **is** negative marking for incorrect choices!)

- ☑ a.   Resources are used on demand, not reserved in advance. ✔
- ☐ b.   This technique was the basis for the telephone call switching during the 20th century and into the beginning of this current century.
- ☑ c.   This technique is used in the Internet. ✔
- ☐ d.   Frequency Division Multiplexing (FDM) and Time Division Multiplexing (TDM) are two approaches for implementing this technique.
- ☐ e.   Congestion loss and variable end-end delays are possible with this technique.
- ☐ f.   Reserves resources needed for a call from source to destination.
- ☑ g.   Data may be queued before being transmitted due to other user's data that's also queueing ✔ for transmission.

The correct answers are: Resources are used on demand, not reserved in advance., Data may be queued before being transmitted due to other user's data that's also queueing for transmission., Congestion loss and variable end-end delays are possible with this technique., This technique is used in the Internet.

This question uses the provide Test 1 Trace file.

Locate the standard response query to the nslookup command below and answer the question that follows.

nslookup type=A nyu.edu

What is the correct combination of questions, answer resource records, and additional resource records?

- ○ A. 0, 1, 0
- ○ B. 1, 0, 1
- ○ C. 0, 1, 1
- ◉ D. 1, 1, 1 ✔
- ○ E. 1, 1, 0

The correct answer is:
1, 1, 1

What do we mean when we say "HTTP is stateless"? In answering this question, assume that cookies are not used.

○ a. We say this when an HTTP server is not operational.

○ b. The HTTP protocol is not licensed in any country.

○ c. An HTTP client does not remember the identities of the servers with which it has interacted.

○ d. An HTTP *client* does not remember anything about what happened during earlier steps in interacting with any HTTP server.

◉ e. An HTTP *server* does not remember anything about what happened during earlier steps in interacting with this HTTP client. ✔

The correct answer is: An HTTP *server* does not remember anything about what happened during earlier steps in interacting with this HTTP client.

Cable Internet access relies on a

○ a. coupled broadcast medium

○ b. dedicated broadcast medium

○ c. uncoupled broadcast medium

◉ d. shared broadcast medium ✔

The correct answer is:
shared broadcast medium

2.2-1 Simple HTTP GET request response time. Suppose an HTTP client makes a request to the gaia.cs.umass.edu web server. The client has never before requested a given base object, nor has it communicated recently with the gaia.cs.umass.edu server. You can assume, however, that the client host knows the IP address of gaia.cs.umass.edu.

How many round trip times (RTTs) are needed from when the client first makes the request to when the base page is completely downloaded, assuming the time needed by the server to transmit the base file into the server's link is equal to 1/2 RTT and that the time needed to transmit the HTTP GET into the client's link is zero? (You should take into account any TCP setup time required before the HTTP GET is actually sent by the client, the time needed for the server to transmit the requested object, and any propagation delays not accounted for in these amounts of time.)

- a.   3.5 RTT
- b.   0 RTT
- c.   1.5 RTT
- d.   2.5 RTT ✔
- e.   0.5 RTT

The correct answer is: 2.5 RTT

1.4-4 Maximum end-end throughput (b). Consider the scenario shown below, with 10 different servers (four shown) connected to 10 different clients. The pairs share a common middle hop with a transmission capacity of R = 200 Mbps. Each link from a server has to the shared link has a transmission capacity of R_S = 25 Mbps. Each link from the shared middle link on the next link to a client has a transmission capacity of R_C = 50 Mbps. Lastly, note that Host-1 and Host-2 (connected to servers Server-1 and Server-2, as shown) have an additional intervening router, and a link on the path with capacity R_e = 10 Mbps.
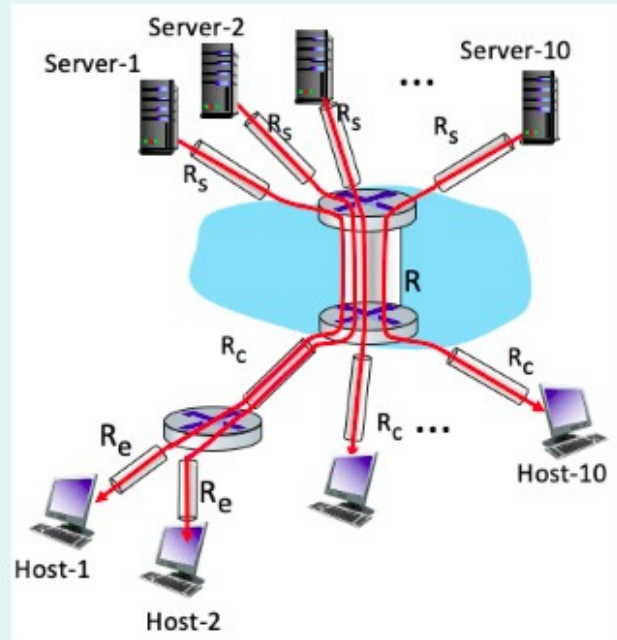
The servers transmit to the receiving hosts at the fastest rate possible (i.e., at the rate at which the bottleneck link between a server and its destination is operating at 100% utilization, and is fairly shared among the connections passing through that link).

What is the maximum throughput achieved on the Server-1 to Host-1 connection, assuming the values of R_S, R_C, R and R_e given above?

○ a. 25 Mbps

◉ b. 10 Mbps ✗

○ c. 40 Mbps

○ d. 50 Mbps

○ e. 30 Mbps

The correct answer is: 30 Mbps

Correct

Mark 1.00 out of 1.00

⚑ Flag question

Which of the characteristics below are associated with a P2P approach to structuring network applications (as opposed to a client-server approach)?

(Select all that apply, there **is** negative marking for incorrect choices!)

- ☐ a. HTTP uses this application structure.
- ☐ b. There is a server that is always on.
- ☑ c. There is *not* a server that is always on. ✔
- ☐ d. There is a server with a well known server IP address.
- ☑ e. A process requests service from those it contacts and will provide service to processes that ✔ contact it.

The correct answers are: There is *not* a server that is always on., A process requests service from those it contacts and will provide service to processes that contact it.

Correct

Mark 1.00 out of 1.00

⚑ Flag question

Match the description of each component of packet delay to its name in the pull down list.

Time need for bits to physically propagate through the transmission medium from end one of a link to the other.

| Propagation delay ⬍ |
✔

Time needed to perform an integrity check, lookup packet information in a local table and move the packet from an input link to an output link in a router.

| Processing delay ⬍ |
✔

Time spent transmitting packets bits into the link.

| Transmission delay ⬍ |
✔

Time spent waiting in packet buffers for link transmission.

| Queueing delay ⬍ |
✔

The correct answer is: Time need for bits to physically propagate through the transmission medium from end one of a link to the other. → Propagation delay, Time needed to perform an integrity check, lookup packet information in a local table and move the packet from an input link to an output link in a router. → Processing delay, Time spent transmitting packets bits into the link. → Transmission delay, Time spent waiting in packet buffers for link transmission. → Queueing delay

In the context of packet queueing delay, which of the following functions is the best choice for modeling the relationship between **traffic intensity** and the **average queuing delay.** Let x be the **traffic intensity.**

- a. $\frac{1}{1-\sqrt{x}}$
- ⦿ b. $\frac{1}{1-\sqrt{x}} - 1$ ✔
- c. $\sin x$
- d. e^x
- e. $\frac{1}{1+\sqrt{x}} - 1$

The correct answer is:
$\frac{1}{1-\sqrt{x}} - 1$

Check all of the phrases below that state a true property of a *local* DNS server.

(Select all that apply, there **is** negative marking for incorrect choices!)

- ☑ a. The local DNS server can decrease the name-to-IP-address resolution time experienced by ✔ a querying local host over the case when a DNS is resolved via querying into the DNS hierarchy.

- ☐ b. The local DNS server holds hostname-to-IP translation records, but not other DNS records such as MX records.

- ☐ c. The local DNS server record for a remote host is sometimes different from that of the authoritative server for that host.

- ☐ d. The local DNS server is only contacted by a local host if that local host is unable to resolve a name via iterative or recursive queries into the DNS hierarchy.

The correct answer is: The local DNS server can decrease the name-to-IP-address resolution time experienced by a querying local host over the case when a DNS is resolved via querying into the DNS hierarchy.

The Domain Name Service is a very fundamental service on the Internet, it is said that without DNS the Internet cannot function. However, as we are aware the Internet is subject to attacks from various bad actors whose intention is to disrupt services or compromise data. Within the hierarchy of DNS servers, you are required to identify the DNS server hierarchy level which is, a) most vulnerable to Distributed Denial of Service attacks and b) whose attack can have serious impact on the functioning of the internet. Choose one from the options given below.

- ○ A. Local Names Servers
- ⦿ B. Top Level Domain Servers✔
- ○ C. Authoritative Names Servers
- ○ D. Root Domain Name Servers
- ○ E. All of the above

The correct answer is:
Top Level Domain Servers

Which of the following are advantages of using a web cache?

(Select all that apply, there **is** negative marking for incorrect choices!)

- ☐ a. Caching allows an origin server to more carefully track which clients are requesting and receiving which web objects.
- ☑ b. Overall, caching requires fewer devices/hosts to satisfy a web request, thus saving on server/cache costs. ✖
- ☑ c. Caching generally provides for a faster page load time at the client, if the web cache is in the client's institutional network, because the page is loaded from the nearby cache rather than from the distant server. ✔
- ☐ d. Caching uses less bandwidth coming into an institutional network where the client is located, if the cache is also located in that institutional network.

The correct answers are: Caching generally provides for a faster page load time at the client, if the web cache is in the client's institutional network, because the page is loaded from the nearby cache rather than from the distant server., Caching uses less bandwidth coming into an institutional network where the client is located, if the cache is also located in that institutional network.

Which of the following pieces of information will appear in a server's application-level HTTP reply message? Use any of the server responses from the tasks for lab2 (do not click this link!).

(Select all that apply, there **is** negative marking for incorrect choices!)

- ☑ a. A checksum ✖
- ☑ b. A response phrase associated with a response code ✔
- ☐ c. The server's IP address
- ☐ d. The name of the Web server (e.g., gaia.cs.umass.edu)
- ☐ e. A sequence number
- ☑ f. A response code ✔

The correct answers are: A response code, A response phrase associated with a response code

1.4-3 End-to-end delay. Consider the scenario shown below, with 10 different servers (four shown) connected to 10 different clients over ten three-hop paths. The pairs share a common middle hop with a transmission capacity of R = 200 Mbps. Each link from a server has to the shared link has a transmission capacity of R_S = 25 Mbps. Each link from the shared middle link to a client has a transmission capacity of R_C = 50 Mbps.
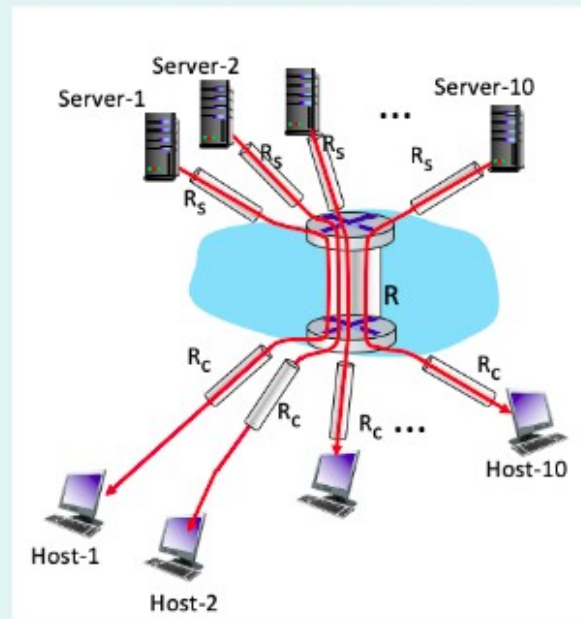
Now consider the three-hop path from Server-10 to host-10, assuming the values of R_S, R_C, and R given above. Assume also that a packet is 1000 bits long, and that each link has a propagation delay of 100 microseconds (1 microsec = 0.000001 sec). You can assume that queueing delay and nodal processing delays are zero. What is the total amount of time from when a server starts sending a packet until a host completely receives that packet?

- ◉ a. 365 microseconds ✔
- ○ b. 735 microseconds
- ○ c. 325 microseconds
- ○ d. 450 microseconds
- ○ e. 555 microseconds
- ○ f. 350 microseconds

The correct answer is: 365 microseconds

TEST 2

Question 1

Correct

Mark 1.00 out of 1.00

⚑ Flag question

The transport layer sits on top of the network layer, and provides its services using the services provided to it by the network layer. Thus it's important that we know what is meant by the network layer's "best effort" delivery service. True or False:

The network layer's best-effort delivery service means that IP makes its "best effort" to deliver segments between communicating hosts, but it makes no guarantees. In particular, it does not guarantee segment delivery, it does not guarantee orderly delivery of segments, and it does not guarantee the integrity of the data in the segments.

◉ a. Correct! The network layer's best effort service doesn't really provide much service at all, does it? ✔

○ b. Nope. The network layer's best effort service doesn't really provide much service at all, does it?

The correct answer is: Correct! The network layer's best effort service doesn't really provide much service at all, does it?

Question 2

Correct

Mark 0.50 out of 0.50

⚑ Flag question

Q04.4: How did gaia.cs.umass.edu determine the value used in the Acknowledgment number field for the third data-carrying segment?

○ a. Since no payload data has yet to be transmitted, there is no data to be ACKed, and so the value in this field is 0.

◉ b. The value of the ACK number field is the sequence number of the next expected byte of data to be received at the server on the client-to-server direction of this connection -- one higher that the sequence number used as the sequence number in the initial SYN segment sent from client to server. ✔

○ c. Since no payload data has yet to be transmitted, there is no data to be ACKed, and so the value in this field is not important.

○ d. All options given here are correct

The correct answer is: The value of the ACK number field is the sequence number of the next expected byte of data to be received at the server on the client-to-server direction of this connection -- one higher that the sequence number used as the sequence number in the initial SYN segment sent from client to server.

Compute the Internet checksum value for these two 16-bit words: `11110101  11010011` and `10110011  01000100`

○ a. `01101110 11010101`

◉ b. `01010110 11100111` ✔

○ c. `01011110 11000101`

○ d. `01010110 11101000`

The correct answer is: `01010110  11100111`

True or False: It is possible for two TCP segments with source port 80 to be sent by the sending host to different clients.

◉ a. True ✔

○ b. False

The correct answer is: True

Check all of the services below that are provided by the UDP protocol.

(Select all that apply, there **is** negative marking for incorrect choices!)

☐ a. A byte stream abstraction, that does not preserve boundaries between message data sent in different socket send calls at the sender.

☑ b. A message abstraction, that preserves boundaries between message data sent in different ✔ socket send calls at the sender.

☐ c. In-order data delivery

☐ d. A flow-control service that ensures that a sender will not send at such a high rate so as to overflow receiving host buffers.

☐ e. A guarantee on the maximum amount of time needed to deliver data from sender to receiver.

☐ f. Reliable data delivery.

☐ g. A guarantee on the *minimum* amount of throughput that will be provided between sender and receiver.

☐ h. A congestion control service to ensure that multiple senders do not overload network links.

The correct answer is: A message abstraction, that preserves boundaries between message data sent in different socket send calls at the sender.

Q06.4: What is the value of the measured RTT for the client-to-server data-containing segment that carries the 75,230th byte in its payload and its ACK?

Enter the time value in the format shown in *Time* field/column in the Wireshark display, with six decimal places of precision, including a decimal point and a leading integer value to the left of the decimal point, e.g., 0.02712

Answer: 0.002075 ✖

The correct answer is: 0.2233971

Question 7

Correct

Mark 0.50 out of 0.50

⚑ Flag question

Q09.2: How can you determine whether or not there are retransmitted segments in the trace?

- ○ a. If I found no timeouts in the trace.
- ○ b. If I found no negative acknowledgments (NAKs) in the trace.
- ⦿ c. Check the sequence numbers for segments sent from the client to gaia.cs.umass.edu and ✔ find out if they are all increasing, with no repeats.

The correct answer is: Check the sequence numbers for segments sent from the client to gaia.cs.umass.edu and find out if they are all increasing, with no repeats.

Question 8

Correct

Mark 0.50 out of 0.50

⚑ Flag question

Q04.2: Locate the SYNACK segment for the SYN segment from the earlier question. What is it in this TCP segment that identifies the segment as a SYNACK segment?

- ⦿ a. The SYN bit and the ACK bit are both set to 1 in the "Flag" field in the TCP header.✔
- ○ b. The second segment in a TCP connection (from server to client) is always a SYNACK segment, so this segment is recognized as a SYNACK segment even though there is no explicit marking in this segment to indicate it is a SYNACK segment.
- ○ c. The TCP options field in the TCP header contains the ASCII characters "SYNACK", indicating that this is a SYNACK segment
- ○ d. The SYNACK bit is set to 1 in the "Flag" field in the TCP header.

The correct answer is: The SYN bit and the ACK bit are both set to 1 in the "Flag" field in the TCP header.

3.2-4 Multiplexing/Demultiplexing: TCP port numbers. True or False: When multiple TCP clients send TCP segments to the same destination port number at a receiving host, those segments (from different senders) will always be directed to the same socket at the receiving host.

- ○ a. False✔
- ○ b. True

The correct answer is: False

Next, answer the following questions, based on the contents of the Ethernet frame containing the first byte of the HTTP response message.

Q09.1: Are there any retransmitted segments in the trace file?

- ○ a. Yes, just one.
- ○ b. None of the options above are correct
- ○ c. Yes, more than one, in fact.
- ○ d. No.✔

The correct answer is: No.

What are advantages of the *streams* concept in QUIC? Recall that QuicK UDP Internet Connections (QUIC) is also referred to as HTTP3 and is a hybrid between TCP (borrows some TCP behaviors' and attributes) and UDP(i.e. UDP carries the traffic)

(Select all that apply, there **is** negative marking for incorrect choices!)

- ☑ a. Streams allow concurrent retrieval of web objects, while avoiding Head of the Line (HOL) ✔ blocking.

- ☑ b. Since each stream has its own error control, if one stream experiences an error (e.g., lost or ✔ damaged segment), the other streams are unaffected.

- ☑ c. With N streams, the overall throughput can be increased by a factor of N, since each stream ✘ has its own separate congestion control.

The correct answers are: Streams allow concurrent retrieval of web objects, while avoiding Head of the Line (HOL) blocking., Since each stream has its own error control, if one stream experiences an error (e.g., lost or damaged segment), the other streams are unaffected.

Use the pulldown menu to match a congestion control approach to how the sender detects congestion.

The sender infers segment loss from the absence of an ACK from the receiver.

| delay-based ⇕ |

✘

Bits are set at a congested router in a sender-to-receiver datagram, and bits are in the returned to the sender in a receiver-to sender ACK, to indicate congestion to the sender.

| network-assisted ⇕ |

✔

The sender measures RTTs and uses the current RTT measurement to infer the level of congestion.

| end-end ⇕ |

✘

The correct answer is: The sender infers segment loss from the absence of an ACK from the receiver. → end-end, Bits are set at a congested router in a sender-to-receiver datagram, and bits are in the returned to the sender in a receiver-to sender ACK, to indicate congestion to the sender. → network-assisted, The sender measures RTTs and uses the current RTT measurement to infer the level of congestion. → delay-based

Suppose we want to implement the following rule: Router r2 should act as a firewall, only allowing TCP traffic into the 22.33/16 network from any network. Specify a single flow table row entry to implement this rule, indicating the column entries for the row below. The * is a wildcard match, which matches everything.

In this question the correct interface is interface 3 i.e. action forward 3.

In the "dest. IP" column, the flow table entry should be: | 22.33/16 ⬍ | ✔

In the "protocol" column, the flow table entry should be: | TCP ⬍ | ✔

In the "source IP" column, the flow table entry should be: | * ⬍ | ✔

In the "action" column, the flow table entry should be: | forward(3) ⬍ | ✔

The correct answer is: In the "dest. IP" column, the flow table entry should be: → 22.33/16, In the "protocol" column, the flow table entry should be: → TCP, In the "source IP" column, the flow table entry should be: → *, In the "action" column, the flow table entry should be: → forward(3)

True or False: When multiple UDP clients send UDP segments to the same destination port number at a receiving host, those segments (from different senders) will always be directed to the same socket at the receiving host.
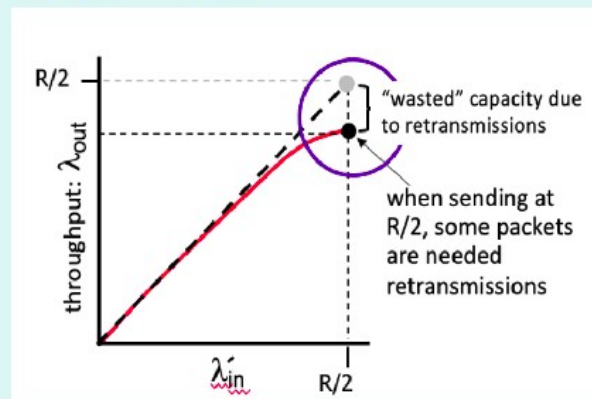
- ◉ a. True✔
- ○ b. False

The correct answer is: True

Consider the figure below, which shows the application-to-application throughput achieved when two senders are competing at a shared bottleneck link. Suppose that when the overall arrival rate, λ_{in}' (for each sender) is close to R/2, the throughput to the application layer (at each receiver), λ_{out}, is equal to 0.8 * λ_{in}'.

What fraction of the packets transmitted at the sender are retransmissions?

- ⦿ a. .20 ✔
- ○ b. .80
- ○ c. .50
- ○ d. 0

The correct answer is: .20

3.6-1 Congestion control versus flow control. Consider the five images below. Indicate which of these images suggest the need for *flow* control (the others would suggest the need for congestion control).

- ☑ a. A talking head ✔
- ☐ b. Car traffic
- ☐ c. A crowd of people
- ☐ d. A penguin crowd
- ☑ e. A glass overflowing ✔

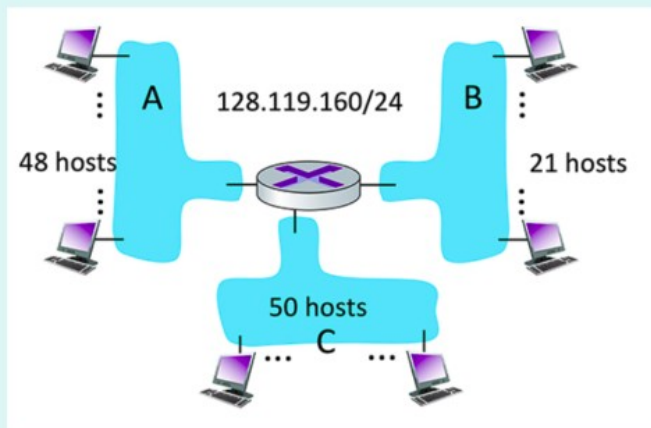The correct answers are: A glass overflowing, A talking head

Consider the three subnets below, each in the larger 128.119.160/24 network. The following questions are concerned with subnet addressing. Answer each question by selecting a matching answer. Each answer can be used to answer only *one* question.

(the /x indicates how many bits out of the 32 bit address form part of the network identity or subnet mask)

How many bits are needed to be able to address all of the host in subnet A?

| 6 | ⬍ |

✔

What is the maximum number of hosts possible in the larger 128.119.160/24 network?

| 256 | ⬍ |

✔

Suppose that subnet A has a CIDRized subnet address range of 128.119.160.128/26 (hint: 128 is 1000 0000 in binary); Subnet B has an CIDRied subnet address range of 128.119.160.64/26. We now want a valid CIDRized IP subnet address range for subnet C of the form 128.119.160.*x*/26. What is a valid value of *x*? (CIDR stands for Classless Interdomain Routing based on RFC 4632)

| 0 | ⬍ |

✔

The correct answer is: How many bits are needed to be able to address all of the host in subnet A? → 6, What is the maximum number of hosts possible in the larger 128.119.160/24 network? → 256, Suppose that subnet A has a CIDRized subnet address range of 128.119.160.128/26 (hint: 128 is 1000 0000 in binary); Subnet B has an CIDRied subnet address range of 128.119.160.64/26. We now want a valid CIDRized IP subnet address range for subnet C of the form 128.119.160.*x*/26. What is a valid value of *x*? (CIDR stands for Classless Interdomain Routing based on RFC 4632) → 0