UNSW SYDNEY

CANDIDATE

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TEST

COMP3331/9331 Mid-term Exam Term 1 2023

Subject code	--
Evaluation type	--

Test opening time	27.03.2023 09:15
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Grade deadline	--
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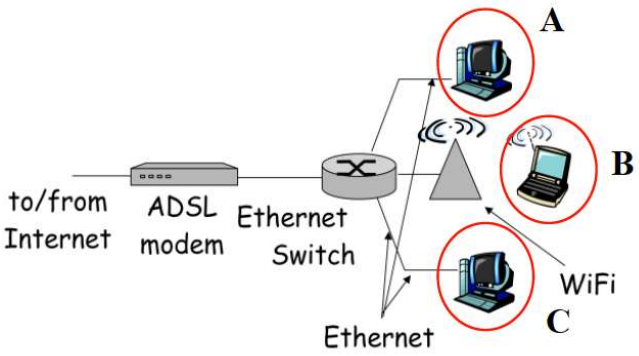
Question	Status	Marks	Question type
i			Information or resources
1	Correct	1.5/1.5	Multiple Choice
2	Answered	0.5/0.5	Text area
3	Answered	0.75/0.75	Text area
4	Answered	1.25/1.25	Text area
5	Wrong	0/1	Multiple Choice
6	Answered	4/4	Essay
7	Answered	1/1.5	Essay
8	Answered	1.5/1.5	Essay
9	Correct	1/1	Inline Choice
10	Unanswered	0/3	Essay
11	Wrong	0/3	Numeric Entry
12	Correct	1/1	Multiple Choice

1



Consider the home network shown in the figure above comprised of 3 hosts. Suppose that the ADSL modem has a connection to the Internet that supports **10 Mbps** downstream transmission rate and **2Mbps** upstream transmission rate. Suppose that the Ethernet network can support a transmission rate of **10Gbps** (both upstream and downstream) and the WiFi network can support a transmission rate of **20Mbps** (both upstream and downstream). Assume that the rest of the Internet (not shown in the figure) has ample capacity and can support any transmission rate (both upstream and downstream). Hosts A and C are connected through Ethernet while Host B is connected through WiFi.

Answer the following three questions (0.5 mark for each)

1) What is the maximum throughput that any host in this home network can experience when downloading a large file from the Internet?

Select one alternative:

- 10Gbps
- 20Mbps
- 2Mbps
- 3.33Mbps
- 10Mbps ✓

2) What is the maximum throughput that any host in this home network can experience when downloading a large file from any other host in the same home network?

Select one alternative:

- 2Mbps
- 3.33Mbps
- 10Mbps
- 20Mbps
- 10Gbps ✓

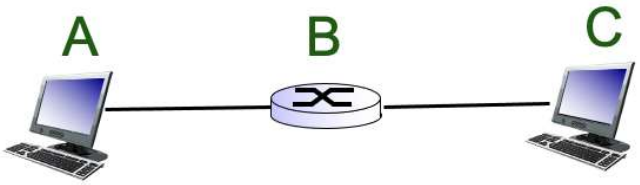
3) If all hosts in the home network are downloading large files from the Internet simultaneously and each host gets an equal share of the available bandwidth, what is the maximum throughput that any host in the home network can experience?

Select one alternative:

- 10Mbps
- 3.33Mbps
- 0.66Mbps
- 6.66Mbps
- 3.33Gbps

Maximum marks: 1.5

Suppose host A has **M** Bytes to send to host C along the path through packet switch B which employs store and forwarding switching.



Assume that there is no processing delay and no queuing delay at any node. The propagation delay and the transmission rate of link A-B is **T** seconds and **R** bits per second, respectively. The propagation delay and the transmission rate of link B-C is **T** seconds and **R** bits per second, respectively. Suppose that the header added to each packet (irrespective of the size of the packet) is always **N** Bytes. Assume that there is no other traffic on the network. No acknowledgements are sent.

Answer the following three questions.

2 How much time does it take to send all M Bytes of data as **one packet** from Host A to Host C? Write the final expression in the space provided. You are not required to provide a justification.

Fill in your answer here

2*T+2*(M+N)/R

Maximum marks: 0.5

3

Divide the M Bytes into two equal parts, assuming M is exactly divisible by 2. How much time does it take to send all the data as **two packets** from Host A to Host C? The packets are sent back-to-back (i.e. immediately after each other). Write the final expression in the space provided. You are not required to provide any justification.

Fill in your answer here

2*T+4*(M/2+N)/R

Maximum marks: 0.75

4 Divide the M Bytes into K equal parts, assuming M is exactly divisible by K. How much time does it take to send all the data as **K packets** from Host A to Host C? The packets are sent back-to-back (i.e. immediately after each other). Write the final expression in the space provided. You are not required to provide any justification.

Fill in your answer here

2*T+2*k(M/k+N)/R

Maximum marks: 1.25

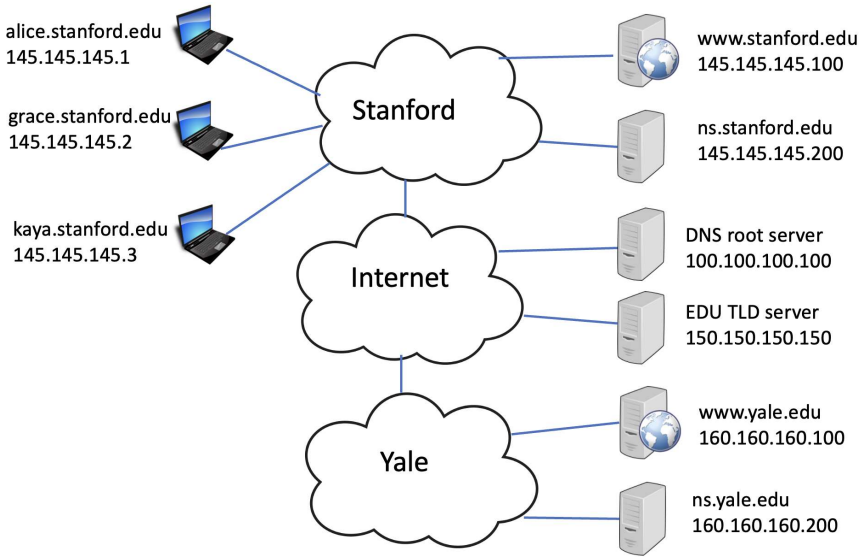
5 How many iterative DNS queries, would a local DNS server need to send when trying to resolve a type A DNS query for stanford.edu?

Select one alternative:

- At most 3 ✔
- Exactly 3
- At most 1 ✖
- More than 3

Maximum marks: 1

Consider the network shown in the figure below.



Three users, Alice, Grace and Kaya, are logged into their workstations, respectively called alice.stanford.edu, grace.stanford.edu, and kaya.stanford.edu, all located within the Stanford network.

Stanford offers a web server www.stanford.edu and a local DNS name server ns.stanford.edu, which is also the authoritative server for all stanford.edu domains.

Yale offers a web server www.yale.edu and a local DNS name server ns.yale.edu, which is also the authoritative server for all yale.edu domains.

Make the following assumptions:

- All DNS caches (including at all DNS servers and workstations) are initially empty.
- All DNS requests are resolved **recursively** (iterative queries are **never** used).
- If a root DNS server and EDU TLD server are required to be queried, then the depicted servers are to be used: 100.100.100.100 (root) and 150.150.150.150 (EDU TLD)
- Each HTTP message fits in a single TCP segment.
- The web browsers on the workstations and web servers use persistent HTTP connections (HTTP 1.1).
- No CDNs are in use and there are no HTTP/Web proxies installed anywhere in the network.
- The browser caches on all workstations are empty.

Answer the following 3 questions.

6 Alice uses her web browser to access the URL http://www.yale.edu/index.html. This page embeds two images, the first with URL http://www.yale.edu/image1.jpg and the second with URL http://www.stanford.edu/image2.jpg.

List all packets that are exchanged in the entire network, including any TCP connection setup packets, by completing a Table similar to one shown below. For each packet, show the source and destination IP address, the transport-layer protocol, the application-layer protocol (if relevant), and the purpose of the packet, as in the example. You may assume that the last ACK in the TCP connection setup is piggybacked (combined) with the first data segment of the application message. You do NOT have to show the TCP connection closure process.

Here is an example which shows the details for a packet that is not related to this question.

Packet Number	Source IP Address	Destination IP Address	Transport Protocol	Application Protocol	Purpose
1	3.3.3.3	4.4.4.4	TCP	HTTP	Get request for www.toolband.com

The menu of the answer window below has an option to create a table. Create a table with 6 columns (as shown in the example above) and several rows (e.g, a large number like 25, you may not require all 25 rows). Each row should depict a packet. The packets should be listed in the chronological sequence in which they are generated.

Fill in your answer here

Packet Number	Source IP Address	Destination IP Address	Transport Protocol	Application Protocol	Purpose
1	145.145.145.1	145.145.145.200	UDP	DNS	Type A query for 160.160.160.100
2	145.145.145.200	100.100.100.100	UDP	DNS	Type A query for 160.160.160.100
3	100.100.100.100	160.160.160.200	UDP	DNS	Type A query for 160.160.160.100
4	160.160.160.200	145.145.145.200	UDP	DNS	Type A response for 160.160.160.100
5	145.145.145.200	145.145.145.1	UDP	DNS	Type A response for 160.160.160.100
6	145.145.145.1	160.160.160.100	TCP		Connection request(SYN)
7	160.160.160.100	145.145.145.1	TCP		Connection response(SYN ACK)
8	145.145.145.1	160.160.160.100	TCP	HTTP	Get request for http://www.yale.edu/index.html
9	160.160.160.100	145.145.145.1	TCP	HTTP	Get response for http://www.yale.edu/index.html
10	145.145.145.1	160.160.160.100	TCP	HTTP	Get request for http://www.yale.edu/image1.jpg
11	160.160.160.100	145.145.145.1	TCP	HTTP	Get response for http://www.yale.edu/image1.jpg
12	145.145.145.1	145.145.145.200	UDP	DNS	Type A query for 145.145.145.100
13	145.145.145.200	145.145.145.1	UDP	DNS	Type A response for 145.145.145.100
14	145.145.145.1	145.145.145.100	TCP		Connection request(SYN)
15	145.145.145.100	145.145.145.1	TCP		Connection response(SYN ACK)
16	145.145.145.1	145.145.145.100	TCP	HTTP	Get request for http://www.stanford.edu/image2.jpg
17	145.145.145.100	145.145.145.1	TCP	HTTP	Get response for http://www.stanford.edu/image2.jpg

Words: 163

Maximum marks: 4

7 (a) What are the minimum number of sockets on Alice's workstation that are necessary for fulfiling the scenario in the previous question?

(b) What kind of sockets are they?

(c) Which of the packets that you listed in the Table in your answer for the previous question are sent and received over each socket (use the packet numbers from the table).

Fill in your answers here

(a) 2

(b) HTTP and DNS

(c) DNS sent: 1,2,3,12 DNS received: 4, 5,13 HTTP sent: 8,12,16,
HTTP received: 9, 12, 17

Words: 22

Maximum marks: 1.5

8 After Alice has viewed http://www.yale.edu/index.html, Grace wants to access the same URL. Kaya is a malicious user who guesses exactly when Grace tries to access http://www.yale.edu/index.html. She wants to trick Grace and make Grace access a web server running on her (i.e., Kaya's) own workstation, thinking that she is accessing the Yale web server. How can Kaya do that by sending DNS traffic to Grace? You may assume that DNSSEC or other security mechanisms are not employed in the the Stanford network. Explain the attack in sufficient detail.

Fill in your answer here

1. Kaya need to listen Grace's workstation, catch him when Grace is sending the DNS queries.

2. Kaya sent a fake DNS response to Grace's workstation. A fake response for http://www.yale.edu/index.html

3. Then Kaya can connect Grace's workstation after Grace's workstation get the fake response

Words: 45

Maximum marks: 1.5

9 Doro joins a BitTorrent torrent to download a file and connects to 4 peers – Tarja, Randy, Jesse, and Rob. The file Doro wishes to download is divided into 4 chunks. Each peer tracks its availability of chunks using a vector of 4 bits. When the bit value is 1, the peer holds the chunk on the disk. When the bit value is 0, the chunk is not on the peer's disk. For example, (1, 0, 1, 0) indicates chunks 1 and 3 are available at this particular peer.

The vectors of Tarja, Randy, Jesse and Rob are shown below:

Tarja: (0, 1, 1, 1)
Randy: (1, 1, 0, 0)
Jesse: (0, 1, 1, 1)
Rob: (0, 1, 1, 0)

Assume that Tarja, Randy, Jesse and Rob are not interested in the file anymore and stop downloading the remaining chunks but continue to participate in the torrent and service requests for chunks.

What is the order in which Doro requests the chunks for downloading the file. Select the appropriate options below.

The first chunk to be requested is Chunk 1 ✓ (Chunk 1, Chunk 2, Chunk 3, Chunk 4).

The second chunk to be requested is Chunk 4 ✓ (Chunk 1, Chunk 2, Chunk 3, Chunk 4)

The third chunk to be requested is Chunk 3 ✓ (Chunk 1, Chunk 2, Chunk 3, Chunk 4)

The fourth chunk to be requested is Chunk 2 ✓ (Chunk 1, Chunk 2, Chunk 3, Chunk 4)

Maximum marks: 1

10 Host A communicates with Host B using the Go-Back-N protocol with sender window size N = 3. The communication channel between A and B may drop data packets but not ACKs. The communication channel can neither reorder nor corrupt data packets and ACKs.

A sends a file to B. It does so by splitting the file in 6 packets with sequence numbers from 0 to 5.

The file transfer is successful. In the entire duration of the file transfer, A receives only the following ACKs (and in that order) from B: ACK0, ACK1, ACK1, ACK2, ACK3, ACK3, ACK4, ACK5.

You may assume that there are never any premature timeouts at Host A.

NOTE: THIS QUESTION IS NOT ABOUT TCP. IT FOCUSES ON THE CONCEPTUAL GO-BACK-N PROTOCOL.

Answer the following 2 questions:

Q1) Note down the sequence number of packets sent by host A in the order in which they were sent, including any retransmissions in the space provided below. No explanation is required.

An example answer (which does not match this question) could be:
Pkt 0
Pkt 1
Pkt 1
Pkt 2
Pkt 3
Pkt 3

In the above, Pkt 1 and Pkt 3 are retransmitted.

Q2) How many timeout events are encountered during the file transfer?

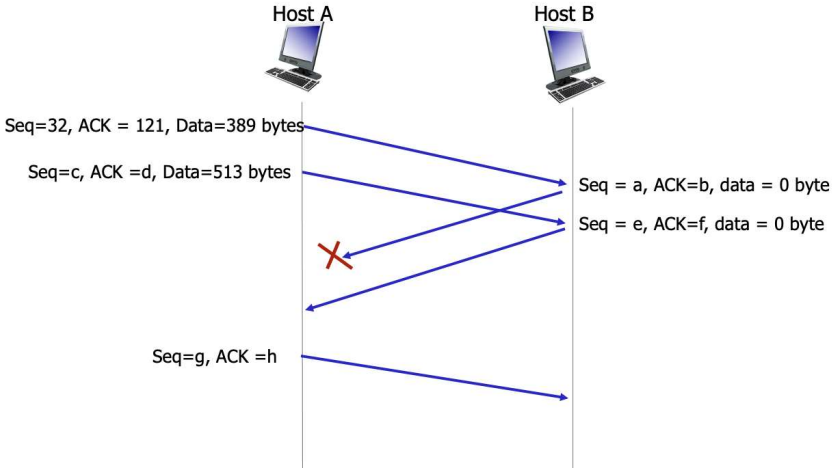
Hint: We recommend that you draw a timing diagram depicting the transmission of packets and ACKs (similar to the lecture notes and textbook). You are NOT required to include this diagram in your answer.

Fill in both answers here

Words: 0

Maximum marks: 3

11 Consider the exchange of TCP segments between Hosts A and B shown in the figure below. The TCP connection establishment process is not shown. The figure depicts all segments exchanged between the two hosts (i.e. no other segments beyond those shown are exchanged). Host A sends two data segments (with sequence numbers **32** and **c**, respectively). Host B responds with an ACK for each segment (with sequence numbers **a** and **e**, respectively). The first ACK is lost, the second ACK is received by Host A.



Answer the following questions. Simply note the numeric answers in the space provided. No explanations are required.

What is a? 422 ✗ (121)

What is b? 542 ✗ (421)

What is c? 422 ✗ (421)

What is d? 422 ✗ (121)

What is e? ✗ (121)

What is f? ✗ (934)

Host A transmits a third segment (with sequence number **g**) a few moments after receiving the ACK from Host B. You will need to figure out whether this segment is a retransmission of either of the two previously transmitted data segments or a fresh segment containing new data. Based on this, answer the following questions. Simply note the numeric answers in the space provided. No explanations are required.

What is g? ✗ (934)

What is h? ✗ (121)

Maximum marks: 3

12 The only active socket on your computer is a TCP listening socket, bound to port number 80 (i.e. this socket is in the LISTEN state).Which of the following packets will your computer successfully accept? You may assume that the all packets are well-formed and are not corrupted.

Select one alternative:

- Any TCP segment with destination port 80
- Any packet with destination port 80
- Any TCP SYN segment with source port 80
- Any TCP segment with source port 80
- Any TCP SYN segment with destination port 80 ✓

Maximum marks: 1