UBC Okanagan
COSC 328: Introduction to Networks
Midterm Exam

Name: _____
Univ. ID: _____
Time: 90 minutes

Date: Friday, October 29th, 2021

Instructor: Dr. Mohamed Abdelpakey

a place of mind

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RULES GOVERNING FORMAL EXAMINATIONS

The following are the rules governing formal examinations:

1. Write your name and student number.
2. The exam is open book (only course materials and written notes are permitted), internet search is NOT permitted
3. Your file should be submitted to Canvas.
4. You are not permitted to consult with anyone during the exam.
5. This exam will be marked out of 80 but will be weighted to be 30% of the overall grade.

Q1	/20
Q2	/20
Q3	/20
Q4	/20
Total	/80 will be scaled to 30%

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Instructions:

- Review the entire exam paper before answering questions. Complete the questions you feel most comfortable with first and then attempt the more difficult ones later.
- Students must follow any additional examination rules or directions communicated by the instructor or invigilator.

I. [20 marks] True/False

0- The code number of this course is COSC328
A. True
B. False

[1] 1. TCP as a service is a connection-oriented communication.

A. True
B. False

[1] 2. In UDP socket programming, there are 2 sockets on the server for communication, one for welcoming and the other for the each unique client.

A. True
B. False

[1] 3. Netflix has distributed CDN servers to stream videos

A. True
B. False

[1] 4. In client-server paradigm: The server could be on or off.

A. True
B. False

[1] 5. Packet queuing happens if arrival rate (in bps) to link exceeds transmission rate (bps) of link for some period of time.

A. True
B. False

[1] 6. In packet switching, store-and-forward provides delay, while in circuit switching we don't have such delay

A. True
B. False

[1] 7. When we say "network edges", we mean hosts and servers.

A. True
B. False

[1] 8. Application Layer exists in router and internet core devices

A. True
B. False

[1] 9. Network layer functions are mainly forwarding and buffer management

A. True
B. False

[1] 10. A Subnet is device interfaces that can physically reach each other without passing through an intervening router

A. True
B. False

[1] 11. IPV4 consists of 4 bytes

A. True
B. False

[1] 12. Subnet Mask can be represented as 255.255.255.0

A. True
B. False

[1] 13. In class "B" IP address, the first 16 bits indicate the network address

A. True
B. False

[1] 14. TCP demultiplexes using ONLY the destination port number

A. True
B. False

[1] 15. One of the disadvantages of UDP is the large header size it uses

A. True
B. False

[1] 16. In selective repeat, receiver Acknowledges all correctly received packets in one shot. In other words, it sends one ACK for all correctly received packets.

A. True
B. False

[1] 17. To smooth out the estimated Round Trip Time (RTT), we use exponential weighted moving average

A. True
B. False

[1] 18. TCP uses the "fast retransmit" to allow the sender to resend the unACKed segment in case of the sender receives ONLY 2 duplicate ACKs.

A. True
B. False

[1] 19. In cumulative ACK, the receiver sends the ACK for the packet with the largest seq # that it has received in order

A. True
B. False

[1] 20. In TCP, retransmissions can be triggered by timeout events

A. True
B. False

II. [20 marks] MCQ (you can choose one or more options)

[2] 1. Networks are designed based on this philosophy

A. Keep the complexity of the network at the client-side
B. Keep the complexity on the switches
C. Keep the complexity at the edges
D. None of the above

[2] 2. In networks, a rout or path is a sequence of

A. Links
B. Routers
C. Bits
D. packets

[2] 3. In circuit switching, there is a waste of bandwidth due to

A. Clients can share the same frequency band
B. Idle time
C. Setup time needed for establishing a call
D. A complicated protocol that circuit-switching uses

[2] 4. The network communication can be divided into:

A. ISO/OSI reference model with 5 layers
B. Internet stack protocol with seven layers
C. ISO/OSI with seven layers
D. Internet stack protocol with five layers
E. C and D

[2] 5. In TCP fairness, "K" TCP sessions share same bottleneck link of bandwidth "R", and each should have average rate of

A. R/K
B. K/R
C. K^2/R
D. K*R

[2] 6. Which of these is NOT applicable for IP protocol?

A. Connectionless
B. Offer reliable service
C. Offer unreliable service
D. None of the above

[2] 7. Which of the following is NOT correct

A. There is a copy of the forwarding table at each input port
B. There is only one input port in each router that has all components shown in the figure
C. The red component in the figure acts like a decentralized switch
D. Routers apply 3/5 layers of the internet protocol stack

[2] 8. In scheduling policies, priority and round robin classify the arriving traffic based on their:

A. Class
B. Round Trip Time (RTT)
C. Any header field can be used for classification.
D. None of the above

[2] 9. The IP address has a fixed structure of

A. The subnet part
B. The subnet part and the physical medium type in decimal numbers
C. The host part
D. Host part and number of connected devices to the network

[2] 10. Given the host address **10101100. 00011011. 01101000. 11001010** and the subnet mask **11111111. 11111111. 11110000. 00000000** what is the network address?

A. 10111100. 10011011. 01101000. 11001010
B. 10101100. 00011011. 01101000. 11101010
C. 10101100. 00011011. 01100000. 00000000
D. 10101100. 00011011. 01100011. 00000000
E. None of the above

III. [20 marks] Short Answer

1. Name two key-differences between Circuit switching and packet switching

In packet switching, the resources for sending are used on demand for a session message whereas with circuit switching, the sending resources are reserved for the duration of the session.

With packet switching, session messages may have to wait a queueing delay, and with circuit switching there is no queueing delay.

2. How can a host identify a network process (network application) when sending/receiving from another host?

By looking at the message header, a host can identify the network application when sending and receiving from another host.

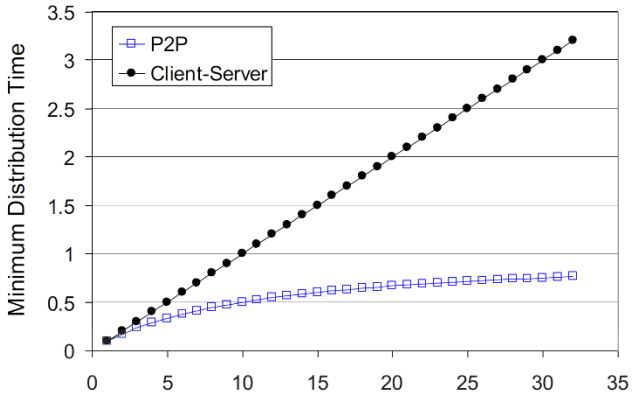
3. How to map between IP address and name (e.g., Google), and vice versa ? very briefly explain the technique that is used for this

DNS is what is used to map between an IP address and a name and vice versa. The user must run the client side of the DNS application. Then the browser extracts the hostname from the URL, which is then passed to the client side of the application. Then the client sends a query of the hostname to DNS server, DNS server then receives reply with IP address of hostname. In other words, the client must use a DNS application to map IP addresses to names.

4. Briefly explain the peer-to-peer architecture and give an example.

P2P architecture can be described as sharing one large file from one server to many hosts (peers). Each of these peers can redistribute portions of the file it has already received to any of the other peers. This takes a workload off of the server. An example of this would be if I was hosting a file on my torrent website, let's say it's a rare movie that is quite long so it's a big file, then my friends want to view the movie so they use their bittorrent application to download parts of the file. As more of my friends download more of the file, eventually, the download rate increases as more peers host the file on their machines and take a load off the server. However, suppose my friends aren't comfortable keeping their connections open, they can stop seeding the file and the download rate will increase again as less peers host the file (seed it).

5. What can be interpreted from the following graph, which shows the minimum distribution time that is required to distribute a file of size x to u clients? N shows the number of clients in the P2P or client-server architectures.



The graph shows me that in order to distribute a file of size x, the time a client-server architecture would take grows linearly as more clients download the same file. Whereas with P2P architecture, the time it takes to download the same file grows much less gradually and is therefore a better alternative when many users (>4) are attempting to download the same file.

6. Consider the three following 16-bit words

   Word1 0110 0110 0110 0000

   word2 0101 0101 0101 0101

   word3 1000 1111 0000 1100

   What is the correct checksum value for this data if it was transmitted in a single UDP segment? (Show you work)

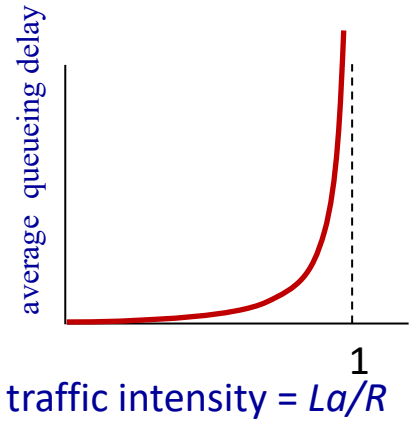
w1+w2 = 1011101110110101

+w3 = 0100101011000010

overflow! Apply 1s compliment

checksum= 1011010100111101

7. In the following diagram, explain what happens as the traffic intensity approaches 1 where
R: link bandwidth (bps), *L:* packet length (bits), a: average packet arrival rate



If La/R is >1 then the bits arrive faster than the rate they can be transmitted and the queuing delay will approach infinity.

8. Name the layers of the internet protocol stack. Start from the upper layer. Order is important. (You can draw a diagram to show the layers)

upper to lower:

1) Application
2) Transport
3) Network
4) Link
5) Physical

9. Explain forwarding and routing, the main functions of the network layer .

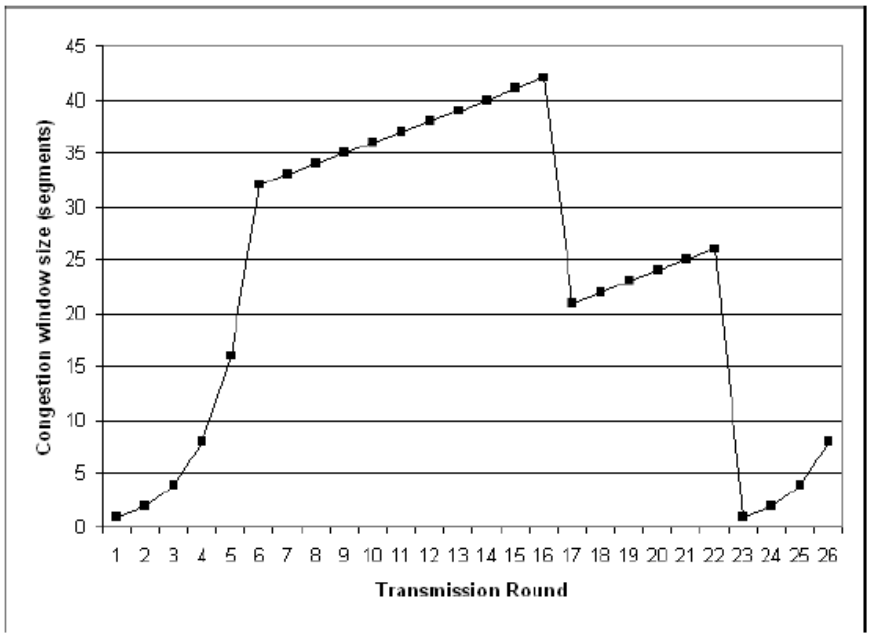
Routing is a network wide process that determines end to end paths that packets take from source to destination. This function operates on longer time scales in software. Forwarding is the router-based action of transferring packets from input links to appropriate output links. This functionality operates within the hardware and has shorter time-scales

10. Explain how the process of inserting "data532" as a domain name record to DNS (i.e., data532.com)

To insert "data532" as a domain name record, one needs to resgister the domain name with a registrar. The registrar will verify the uniqueness of this name. Once this is done, the names and IP addresses of the primary and secondary authoritative DNS servers for "data532" need to be given to the registrar as well. The registrar will then make sure that type NS and type A records are entered into the TLD servers. Further, type A resource, and type MX needs to be entered for the webserver and mailserver respectively on the authoritative DNS.

IV. [20] Long Answer (Problems)

1. Consider the following plot of TCP window size as a function of time.



A. Identify the intervals of time when TCP slow start is operating.

1,2,3,4,5-23,24,25,26

B. Identify the intervals of time when TCP congestion avoidance is operating.

6-16, 17-23

C. After the 16th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout? **Justify your answer**

Triple duplicate ACK because the next cwnd size is half the size of the previous one. A timeout would result in starting at 0 again.

D. After the 22nd transmission round, is segment loss detected by a triple duplicate ACK or by a timeout? **Justify your answer**

Timeout because the cwnd size resets to 0 after the event.

E. What is the initial value of Threshold (approximately) at the first transmission round? **Justify your answer**

32 because this is where slowstart turns into congestion avoidance thus meaning that the threshold is achieved @ cwnd size 32

F. What is the value of Threshold approximately at the 18th transmission round?

21

G. What is the value of Threshold at the 24th transmission round?

13

H. Assuming a packet loss is detected after the 26th round by the receipt of a triple duplicate ACK, what will be the value of the congestion-window size and of Threshold?

Best Of Luck:)