

CSci 353 - Introduction to Internetworking
Midterm Exam
Spring 2021

(7:00pm - 7:40pm, Monday, March 15)

Instructor: Bill Cheng

Teaching Assistant: none

*(This exam is open book and open notes.
Remember what you have promised in your signed pledge.)*

Time: 40 minutes

Name (please print)

Total: 22 points

Signature

Instructions

1. This is the first page of your exam. The previous page is a title page and does not have a page number.
2. Read problem descriptions carefully. You may not receive any credit if you answer the wrong question. Furthermore, if a problem says “*in N words or less*”, use that as a hint that N words or less are expected in the answer (your answer can be longer if you want). Please note that points may get *deducted* if you put in wrong stuff in your answer.
3. Write answers to all problems on the answers file.
4. Show all work (if applicable). If you cannot finish a problem, your written work may help us to give you partial credit. We may not give full credit for answers only (i.e., for answers that do not show any work). Grading can only be based on what you wrote and cannot be based on what’s on your mind when you wrote your answers.
5. Please do *not* just draw pictures to answer questions (unless you are specifically asked to draw pictures). Pictures will not be considered for grading unless they are clearly explained with words, equations, and/or formulas.
6. For problems that have multiple parts, please answer all parts and clearly *label* which part you are providing answers for.
7. Please ignore minor spelling and grammatical errors. They do not make an answer invalid or incorrect.
8. During the exam, please only ask questions to *clarify* problems. Questions such as “would it be okay if I answer it this way” will not be answered (unless it can be answered to the whole class). Also, you are suppose to know the definitions and abbreviations/acronyms of *all technical terms*. We cannot “clarify” them for you. We also will **not** answer any question for multiple choice problems since that would often give answers away.
9. Every multiple choice question has only one correct (or best) answer. Even if a multiple choice question, grammatically speaking, asks you to choose multiple answers, you should still choose only **one answer**. If you select two answers, the most you can get is half the credit. If you select more than two answers, you will get no credit.
10. When we grade your exam, we must assume that you wrote what you meant and you meant what you wrote. So, please write your answers accordingly.
11. Note that more *efficient* or *better* solutions to problems may receive more points (if applicable).

(Q1) (1 point) What is the packet transmission delay for a packet of size is 6 KB (kilo-bytes, where a kilo is a thousand) over a link with link capacity/bandwidth of 1.5 Mbps (mega-bits per second, where a mega is a million)? Please choose **one closest** answer.

- (1) 0.032 milliseconds
- (2) 32 milliseconds
- (3) 0.04 seconds
- (4) 0.32 seconds
- (5) 4 milliseconds

Answer (just give numbers): _____

(Q2) (1 point) Which of the following statement is correct about **physical media**? (You are suppose to know the meaning of all these terms. Please do not ask us to clarify what they mean.)

- (1) a coaxial cable has only one conductor
- (2) radio signal can travel in both guided and unguided media
- (3) a radio link is considered a physical link
- (4) twisted pair is an example of an unguided media
- (5) none of the above is a correct answer

Answer (just give numbers): _____

(Q3) (1 point) When streaming a video from a media company (call it X) who distributes their videos through a **Content Distribution Network (CDN)** video server (call it Y), one often starts with a video URL with hostname of in company X's domain. Which of the following is **not** a typical step in converting this initial domain X URL into a domain Y URL for the video client to finally **streaming the video** directly from a video server in domain Y?

- (1) client's local DNS server asks company Y's authoratative DNS server to resolve the hostname in domain X
- (2) company X's authoratative DNS server redirects DNS request to the authoratative DNS server for company Y
- (3) company Y's authoratative DNS server returns the IP address of the video server in company Y
- (4) client asks its local DNS server to resolve the hostname in the initial domain X video URL
- (5) none of the above is a correct answer

Answer (just give numbers): _____

(Q4) (1 point) If you have a router with the sum of the packet arrival rates from the input links is greater than the output link capacity for a significant period of time, what can be expected due to the difference in these rates?

- (1) packet reordering
- (2) loss bits in packet
- (3) bit flips in packet
- (4) packet drop
- (5) none of the above is a correct answer

Answer (just give numbers): _____

(Q5) (1 point) Which of the following is **not** an **advantages** of **web caching**?

- (1) web caching can increase the bandwidth of an institution's access link
- (2) web caching is an inexpensive solution to reduce traffic on access link
- (3) web caching can reduce traffic on an institution's access link
- (4) web caching can reduce response time for client requests
- (5) none of the above is a correct answer

Answer (just give numbers): _____

(Q6) (1 point) Which of the following is **not** a characteristic of a **communication link**?

- (1) propagation delay
- (2) transmission delay
- (3) link bandwidth
- (4) round-trip-time
- (5) transmission rate

Answer (just give numbers): _____

(Q7) (2 points) For a population of $n = 3$ independent users with identical statistical behavior, each with probability $p = 0.8$ of being present, what is the probability that **exactly** $k = 2$ **users are present** at any given time? (a) (0.5 pt) Please write down an expression for your answer using the symbols mentioned above (i.e., n , p , and k). You can use **pow(a,b)** to denote a^b and **choose(a,b)** to denote $\binom{a}{b}$. (b) (1.5 pt) Evaluate your expression in (a) by plugging in the values of $n = 3$, $p = 0.2$, and $k = 2$ then give a single numerical value in the end.

(Q8) (1 point) Which of the following is true about **packet switching**?

- (1) entire packet must arrive at router before it can be transmitted on next link
- (2) application-layer message is always sent as one packet
- (3) a packet is transmitted at less than full link capacity when the network is congested
- (4) packets are rarely queued at a router
- (5) on a link, propagation delay is always less than transmission delay

Answer (just give numbers): _____

(Q9) (1 point) Which of the following is true about **packet switching vs. circuit switching**?

- (1) circuit switching has no setup cost
- (2) packet switching is great for bursty data
- (3) packet switching is a “slam dunk winner” over circuit switching
- (4) there can be excessive queueing for circuit switching
- (5) none of the above is a correct answer

Answer (just give numbers): _____

(Q10) (1 point) Which of the following is true about **circuit switching**?

- (1) compare to packet switching, circuit switching allows more users to use the network
- (2) in circuit switching, each link can only support one “circuit”
- (3) one advantage with circuit switching is that it has no idle resource
- (4) one advantage with circuit switching is guaranteed performance
- (5) none of the above is a correct answer

Answer (just give numbers): _____

(Q11) (1 point) Which of the following is true about the **client-server architecture**?

- (1) servers often runs on network-core devices
- (2) clients often run in data centers
- (3) servers often initiates connections with clients
- (4) clients often communicate directly with other clients
- (5) clients may have dynamic IP addresses

Answer (just give numbers): _____

(Q12) (1 point) Assuming that the Internet protocol stack is used everywhere, which of the following is typically true about encapsulation (i.e., adding an appropriate header) and decapsulation (i.e., removing an appropriate header) as an application-layer message travels from sending host to the receiving host? (Below, the word “packet” is used in a generic way to mean networking data in any protocol layer.)

- (1) as packet travels to a router, it usually gets decapsulated twice and then encapsulated twice
- (2) as a packet goes from the network layer to the link layer, no header is usually added
- (3) two types of headers will be added as the application-layer message travels down the protocol stack on the sending host
- (4) as packet travels to a switch, it usually gets decapsulated twice and then get encapsulated twice
- (5) none of the above is a correct answer

Answer (just give numbers): _____

(Q13) (1 point) Which of the following are typically considered **end systems**?

- (1) cable modems
- (2) cellphones
- (3) base station
- (4) cell towers
- (5) routers

Answer (just give numbers): _____

(Q14) (1 point) Consider of a popular content that’s available only on one server to start with. If all clients start downloading at the same time, the **distribution time** is the amount of time it takes for all clients to finish downloading. Which of the following is true about the **distribution time** for a **wide range of number of clients** under some best-case analysis discussed in lectures?

- (1) using a client-server-only approach, the distribution time is approximately proportionally to the number of clients
- (2) the difference in distribution time between a peer-to-peer approach and a client-server-only approach stays the same as the number of clients increases
- (3) using a peer-to-peer approach, the distribution time is approximately proportionally to the number of clients
- (4) using a client-server-only approach, distribution time cannot be improved even if the content can be replicated on other servers
- (5) none of the above is a correct answer

Answer (just give numbers): _____

(Q15) (1 point) Below, the word “packet” is used in a generic way to mean networking data in any protocol layer. Which of the following is true about **sockets programming**?

- (1) when a TCP server receives a request packet from a client, the code in the application layer cannot know the client IP address and port number
- (2) when an UDP server sends a response packet to the client, the code in the application layer does not need to specify the client’s IP address and port number
- (3) when a TCP server sends a response packet to the client, the code in the application layer does not need to specify the client’s IP address and port number
- (4) when an UDP server receives a request packet from a client, the code in the application layer cannot know the client IP address and port number
- (5) none of the above is a correct answer

Answer (just give numbers): _____

(Q16) (1 point) What would a **network protocol** typically **not** specify?

- (1) message format
- (2) steps a human operator must follow
- (3) action taken on message transmission
- (4) action taken on message reception
- (5) none of the above is a correct answer

Answer (just give numbers): _____

(Q17) (1 point) Which of the follow statement is correct about **propagation delays**?

- (1) propagation delay is a function of packet size
- (2) propagation delay is small on a local area network
- (3) congestion contributes to propagation delay
- (4) propagation delay is a function of transmission speed
- (5) none of the above is a correct answer

Answer (just give numbers): _____

(Q18) (1 point) Which of the following is **not** an example of a **application layer protocol**?

- (1) DNS
- (2) FTP
- (3) SMTP
- (4) Skype Protocol
- (5) UDP

Answer (just give numbers): _____

(Q19) (2 points) (a) (1 pt) In two words or less, what are the **names** of the two popular **content server placement philosophies** for **Content Distribution Networks (CDNs)**? (b) (1 pt) For **each** of these philosophies, in 10 words or less, **where** would it **place content servers** (please be specific)? Please note that you are asked to give **four** answers altogether in this question.

(Q20) (1 point) Which of the following is true about **traceroute**?

- (1) traceroute is an application-level program
- (2) the printout of traceroute shows only queueing delays
- (3) the delay numbers shown from one line to the next can never decrease
- (4) traceroute will keep retrying when it does not get a response from a router
- (5) the delay numbers on any line of the traceroute printout usually have identical values

Answer (just give numbers): _____