CPSC 441 L01
COMPUTER NETWORKS

MIDTERM EXAM

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October 27, 2021

This is a CLOSED BOOK exam. Textbooks, notes, laptops, personal digital assistants, tablets, and cell phones are NOT allowed. However, **calculators are permitted**.

It is a 45 minute exam, with a total of 50 marks. There are 16 questions, and 8 pages (including this cover page). Please read each question carefully, and write your answers legibly in the space provided. You may do the questions in any order you wish, but please USE YOUR TIME WISELY.

When you are finished, please hand in your exam paper and sign out. Good luck!

Student Name: _____

Score: _____ / 50 = _____ %

Optional Privacy Fold Here

Student ID: _____

True or False

Circle either **True** or **False** for each of the following 4 questions, for a total of 4 marks.

1 1. The Internet is built using a layered stack of communication protocols.

True False

1 2. The application-layer protocol for the World Wide Web is HTML.

True False

1 3. The User Datagram Protocol (UDP) offers an unreliable transport-layer service.

True False

1 4. On DSL (Digital Subscriber Line), the upstream and downstream rates differ.

True False

Multiple Choice

Choose the best answer for each of the following 6 questions, for a total of 6 marks.

1 5. The format of the messages exchanged between entities on a network are defined by:

(a) the transport layer

(b) end systems

(c) a protocol

(d) sockets

(e) an Internet Service Provider (ISP)

1 6. Receiving a transport-layer segment from the network layer, extracting the payload data, and delivering the data to the correct socket is known as:

(a) multiplexing

(b) demultiplexing

(c) flow control

(d) reliable data transfer

(e) unreliable data transfer

1 7. For Web sites that use cookies, state information about users is provided in:

(a) the optional cookie header line of HTTP request messages

(b) the optional cookie header line of HTTP response messages

(c) a cookie file stored in the user's browser

(d) a back-end database at the Web site

(e) all of the above

1 8. Which of the following is NOT used in the current email system on the Internet?

(a) user agent

(b) mail server

(c) SMTP

(d) TLS/SSL

(e) plain-text HTTP

1 9. Pipelined protocols are designed to:

(a) improve link utilization compared to a stop-and-wait protocol

(b) decrease RTT for large file transmissions

(c) increase RTT between sending packets and receiving ACKs

(d) decrease RTT between sending packets and receiving ACKs

(e) reduce bit errors and packet losses during transmissions

1 10. Which of the following are used in TCP's congestion control algorithm?

(a) slow start

(b) congestion avoidance

(c) fast recovery

(d) congestion window

(e) all of the above

Internet Protocol Stack

7 11. Use your knowledge of the Internet protocol stack to answer the following questions.

(a) (1 mark) What is the *layering principle*?

(b) (6 marks) Describe the Internet protocol stack, including the name of each layer, the key function of each layer, and the data unit handled by each layer. Include a diagram if you wish.

Application Layer Protocols

4 12. Give **two** different examples of application-layer protocols that rely on **caching** to improve the user-perceived performance of the network application. Make sure to indicate why caching is used, where the caches are located, and how they work.

Networking Delays

5 13. During his recent commercial space flight on the Blue Origin shuttle, William Shatner (also known as Captain Kirk from the Star Trek series) used his smartphone to take a photo of the planet Earth while 100 km above it. The photo was 8 MB in size. Suppose that he wants to upload this photo to his Facebook page, and is trying to decide whether to do it immediately during his shuttle flight, or after he lands back on Earth 10 minutes later. (Note: 1 Kbps = 10^3 bits per second, 1 Mbps = 10^6 bps, 1 MB = 2^{20} Bytes, and 1 Byte = 8 bits).

(a) (2 marks) Assuming that his cellular provider offers signal coverage that reaches the shuttle, with a data rate of 100 Kbps (and reasonable roaming charges), approximately how long will it take to upload the photo while still on the shuttle? Show your work.

(b) (2 marks) Assuming that his cellular provider offers signal coverage at the shuttle landing area, with a data rate of 1 Mbps, approximately how long will it take to upload the photo immediately after landing? Show your work.

(c) (1 mark) Considering that it will take 10 minutes before the shuttle lands, which of the foregoing two approaches is faster, and by how much?

Networking Concepts and Definitions

9 14. For each of the following pairs of technical terms, **define** each term, and **clarify** the key difference(s) between the two terms. Be clear and concise. If in doubt about your definition, feel free to supplement with a relevant example.

(a) (3 marks) "LAN" and "WAN"

(b) (3 marks) "transaction-oriented" and "session-oriented"

(c) (3 marks) "telnet" and "ssh"

Reliable Data Transfer (RDT)

8 15. Briefly explain the role of each of the following mechanisms in an RDT protocol at the transport layer. Make sure to indicate how each one works, and why it is needed.

(a) (2 marks) checksum

(b) (2 marks) negative acknowledgment (NAK)

(c) (2 marks) sequence number on DATA segments

(d) (2 marks) go-back-N

Transport-Layer Protocols

7 16. Use your knowledge of TCP and UDP to answer the following questions.

(a) (3 marks) List 3 examples of features provided by TCP that are not provided by UDP.

(b) (4 marks) For each of the following network applications (1 mark each), indicate whether **TCP or UDP** would best fit the service requirements of the application, and briefly explain **why**. State any assumptions that you make for each application.

- Streaming video client/server:

- Multiplayer online first-person shooting game:

- Text-based instant messaging app:

- Clock synchronization between computers on the Internet:

*** THE END ***