CPSC 441
COMPUTER COMMUNICATIONS

FINAL EXAM

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

It is a 120 minute exam, with a total of 100 marks. There are 20 questions, and 10 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!

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Student Name: _____

Student ID: _____

Score: _____ / 100 = _____ %

Multiple Choice

Choose the best answer for each of the following 12 questions, for a total of 12 marks.

1 1. The datalink layer service model in an IEEE 802.3 Ethernet LAN is:

(a) connection-less, unacknowledged

(b) connection-less, acknowledged

(c) connection-oriented, unacknowledged

(d) connection-oriented, acknowledged

1 2. The datalink layer service model in an IEEE 802.11b Wireless LAN is:

(a) connection-less, unacknowledged

(b) connection-less, acknowledged

(c) connection-oriented, unacknowledged

(d) connection-oriented, acknowledged

1 3. The maximum end-to-end user-level throughput achievable for a large FTP download using TCP on an 11 Mbps IEEE 802.11b WLAN is approximately:

(a) 1 Mbps

(b) 2 Mbps

(c) 5.5 Mbps

(d) 11 Mbps

1 4. The RTS/CTS mechanism in IEEE 802.11 wireless networks is designed to cope with:

(a) the hidden node problem

(b) the exposed node problem

(c) the stupid node problem

(d) the super node problem

(e) Denial of Service attacks

1 5. The primary difference between Slotted ALOHA and Pure ALOHA is that:

(a) Slotted ALOHA requires global synchronization for its time slots

(b) the vulnerable period in Slotted ALOHA is half of that in Pure ALOHA

(c) the maximum achievable efficiency of Slotted ALOHA is double that of Pure ALOHA

(d) all of the above

(e) none of the above

1 6. The transport-layer functionality of the User Datagram Protocol (UDP) protocol includes:

(a) port addressing and checksums

(b) sequence numbers and acknowledgements

(c) timeouts and retransmission

(d) flow control and congestion control

(e) none of the above

1 7. The IETF version of Mobile IP allows a mobile user to maintain the same IP-level identity even when roaming to a foreign network. The operation of Mobile IP involves:

(a) a Home Agent

(b) a Foreign Agent

(c) indirect routing

(d) tunneling

(e) all of the above

1 8. The Reverse Address Resolution Protocol (ARP) is used for:

(a) mapping an IP address to a MAC address

(b) mapping a MAC address to an IP address

(c) mapping a human-readable host name to an IP address

(d) mapping an IP address to a human-readable host name

(e) all of the above

1 9. Multimedia networking applications are typically:

(a) delay-sensitive and loss-sensitive

(b) delay-sensitive and loss-tolerant

(c) delay-tolerant and loss-sensitive

(d) delay-tolerant and loss-tolerant

(e) all of the above

1 10. The Integrated Services (IntServ) approach to Quality of Service (QoS) on the Internet requires:

(a) a signalling protocol for traffic service requirements

(b) admission control

(c) QoS-aware routing algorithms

(d) packet priority and link scheduling mechanisms

(e) all of the above

1 11. Multicast routing on the Internet can be supported using:

(a) TDM and FDM

(b) CSMA and CSMA/CD

(c) MANET and ICMP

(d) DVMRP and MOSPF

(e) all of the above

1 12. The eventual deployment of IPv6 on the Internet will:

(a) expand the address capabilities to many more IP devices

(b) provide better support for mobile users

(c) provide better support for Quality of Service

(d) provide better support for Internet security

(e) all of the above

Protocol Stack

8 13. For each of the following items, identify the layer or layers of the protocol stack with which the item is associated. Be as specific as possible. (1 mark each)

(a) QuickTime video

(b) datagram

(c) CSMA

(d) Manchester encoding

(e) subnetting

(f) congestion window size

(g) collision domain

(h) slow start

Network Delay Calculation

5 14. A 1500-byte Ethernet frame is about to be transmitted on a 100 Mbps switched Ethernet link leading directly from Calgary to Edmonton, which is 250 kilometers away.

(a) (2 marks) Assuming that the first bit is transmitted at time 0, at what time does the very last bit of the frame get transmitted? Show your work.

(b) (2 marks) Assuming a signal propagation speed of 2.0 x 10^8 meters per second, what is the propagation delay until the first bit arrives in Edmonton? Show your work.

(c) (1 mark) At what time does the last bit of the frame arrive in Edmonton?

Networking Concepts and Definitions

15 15. For each of the following pairs of terms, explain each term, making sure to identify the similarities (if any) and the **key differences** between the two terms.

(a) (3 marks) "connection-oriented" and "connection-less"

(b) (3 marks) "error detection" and "error correction"

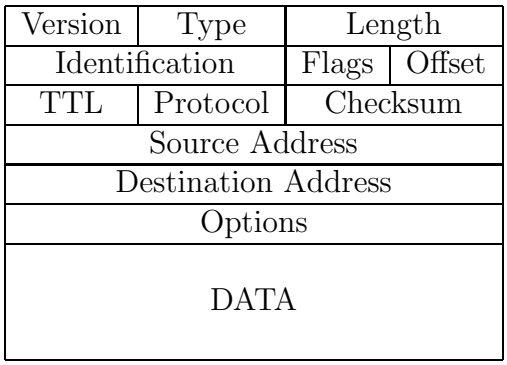
(c) (3 marks) "video frame" and "Ethernet frame"

(d) (3 marks) "Ethernet hub" and "Ethernet switch"

(e) (3 marks) "collision avoidance" and "congestion avoidance"

Network Layer

12 16. The diagram below shows the header format for an Internet Protocol (IP) datagram.



Use your knowledge of IP and the diagram to answer the following questions:

(a) (1 mark) What value does a typical IP packet carry in the Version field?

(b) (1 mark) How many bits are used for an IP address in IPv4?

(c) (2 marks) What is the maximum IP datagram size in IPv4? Why?

(d) (2 marks) How is the TTL field used on the Internet? What purpose does it serve?

(e) (2 marks) What is the purpose of the Protocol field in the IP header? How is it used?

(f) (4 marks) What is IP fragmentation? Why is it needed? Which fields are used to support this mechanism on the Internet? How does it work?

Internet Routing

16 17. The Internet uses several techniques to achieve host-to-host routing of IP datagrams.

(a) (4 marks) What is meant by a *distance-vector* routing algorithm? What is a *link-state* routing algorithm? What are the key differences between these two approaches?

(b) (4 marks) What is meant by *intra-domain* routing? What is *inter-domain* routing? What are the key differences between these two approaches?

(c) (2 marks) What is ARP? What role does it play in Internet routing?

(d) (2 marks) What is "tunneling"? What role does it play in Internet routing?

(e) (4 marks) List 2 examples of features in BGP (Border Gateway Protocol) that are not present in earlier Internet routing protocols such as RIP or OSPF. Briefly explain why these features are useful, and how these features work.

Medium Access Control Protocols

12 18. For each of the following MAC-layer protocols, write a clear, concise synopsis of how the protocol operates.

(a) (3 marks) polling

(b) (3 marks) Pure ALOHA

(c) (3 marks) 1-persistent CSMA

(d) (3 marks) adaptive tree walk

Local Area Networks

8 19. An 11 Mbps IEEE 802.11b WLAN is often referred to as "Wireless Ethernet". Use your knowledge of LANs to answer the following questions.

(a) (3 marks) List **3** similarities between an IEEE 802.11b WLAN and classic Ethernet.

(b) (5 marks) List **5** differences between an IEEE 802.11b WLAN and classic Ethernet.

The Future Internet

12 20. The following quotes are from a USA Today article by David Lieberman (Nov 18, 2007).

> "The Web will start to seem pokey as early as 2010, as use of interactive and video-intensive services overwhelms local cable, phone and wireless Internet providers... Users will experience a slow, subtle degradation, so it's back to the bad old days of dial-up... The cool stuff that you'll want to do will be such a pain in the rear that you won't do it..."

In essence, this article forecasts the imminent collapse of the Internet as we know it, due to excessive video traffic.

(a) (2 marks) Why is video traffic particularly difficult for the Internet to handle?

(b) (3 marks) What are some of the weaknesses in the current Internet design that make it susceptible to this particular problem?

(c) (3 marks) What possible solutions are there to prevent this demise of the Internet?

(d) (4 marks) What additional problems do you see as the greatest challenges facing the Internet in the next 10 years? Can any of these be overcome? If so, how?

*** THE END ***