

UNIVERSITY OF SASKATCHEWAN  
Department of Computer Science

CMPT 434.3 MIDTERM EXAMINATION

March 1<sup>st</sup>, 2006

Total Marks: 50

CLOSED BOOK and CLOSED NOTES  
NO CALCULATOR

Time: 50 minutes

Instructions

Read each question carefully and write your answer legibly on the examination paper. **No other paper will be accepted.** You may use the backs of pages for rough work but all final answers must be in the spaces provided. The marks for each question are as indicated. Allocate your time accordingly.

Ensure that your name AND student number are clearly written on the examination paper and that your name is on every page.

Question	Marks
1 (6 marks)	3
2 (6 marks)	4
3 (12 marks)	10
4 (14 marks)	11
5 (12 marks)	8
Total	36/50

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SAP

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1. **General** (6 marks in total – 1 mark for each part) Give the technical term that best fits each of the following descriptions or definitions.

(a) A technique used in distance-vector routing, wherein a node  $z$  that routes through a neighbour node  $y$  to get to a node  $x$  will advertise to  $y$  that its distance to  $x$  is infinity.

nearest-neighbors

X

(b) A theorem that gives the maximum achievable data rate on a channel as a function of the channel bandwidth and the signal to noise ratio.

Nyquist Theorem?

X

(c) A phase of TCP operation in which the sending rate is increased exponentially fast.

Slow start

✓

(d) A server for an application using TCP has one of these for each established TCP connection with a client, as well as one with which it receives new connection requests.

A port

X

(e) The time from when the first bit of a packet is transmitted on a link, until that first bit arrives at the receiver.

Propagation delay

✓

(f) These are sent by Web servers to clients, and then returned with subsequent requests by the clients, so as to allow web sites to keep track of users.

cookies

✓

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2. Data Communication Basics (6 marks in total)

3  
64000  
512

(a) (2 marks) If the baud is 8000, and each channel "state" has 64 possible values, what is the transmission rate in bps?

$8000 \text{ bps (64 states)} = 512\,000 \text{ bps}$

(b) (2 marks) What property of Manchester encoding makes it suitable for synchronous communication?

It has timing built into the way it sends data so it is self clocking.  $\int \dots \int$  } Transitions always present for a 0 or a 1.

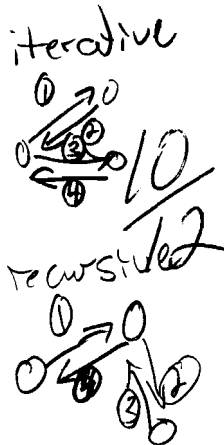
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(c) (2 marks) There are many communication satellites that orbit the Earth at an altitude of about 35,900 km. Why this particular altitude?

At this altitude they can stay "stationary" with respect to the earth's rotation. They will always be over the same spot on the earth.

3. Application Layer (12 marks in total)

(a) (4 marks) Typically, hosts make recursive DNS queries to their local DNS server, while the local DNS server makes iterative queries to other DNS servers. State the difference between iterative and recursive DNS queries, and describe the possible advantages of mixing the two query types in this way.



- iterative queries don't expect the DNS server they are sent to, to make a query itself to get information while recursive queries do.

- By mixing iterative & recursive queries you can better utilize DNS server bandwidth by sharing the work involved with sending & receiving queries between more servers.

(b) (4 marks) State the difference between *persistent* and *non-persistent* HTTP, and give one advantage of each.

- persistent HTTP will retain a connection for longer than it takes to send 1 item.
- non-persistent HTTP will only retain a connection for the time it takes one object to be transferred.
- with websites that have lots of objects a persistent connection will be more beneficial as you have less overhead with setting up connections.
- Advantage of non-persistent is the freeing up of server resources between requests to the web server.

(c) (4 marks) What method is used in the SMTP protocol to ensure that receivers can unambiguously determine the end of each email message?

There is a period placed on a line by itself followed by a line containing one line feed and one carriage return character.

what if appears in body of email?

3

4. Transport Layer (14 marks in total)

(a) (4 marks) List two services that both UDP and TCP provide, and two services that only TCP provides.

UDP & TCP both provide

- Provide data transfer services
- 

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3

only TCP provides

- reliable data transfer ✓
- congestion control ✓

(b) (6 marks in total) Consider a communication session using a selective repeat reliable data transfer protocol, with receiver and sender window sizes of 5, and a 4-bit sequence number (i.e., sequence numbers range from 0 through 15). Suppose that the receiver has received (and transmitted acks) for packets with sequence numbers 0, 1, ..., 13 (in that order). Assume FIFO delivery (i.e., that packet transmissions that make it through to the receiver are never re-ordered by the network).

(i) (2 marks) List the sequence numbers of the packets that the receiver could receive next, in order from the "oldest" packet, to the "newest" packet.

*If sent 13 then oldest packet not ack'd at the sender side is 9. depending on which ack was lost depend on all acks being received by sender and some of the sent packets being lost*

*(oldest) 9, 10, 11, 12, 13, 14, 15, 0, 1, 2 (newest)*

(ii) (2 marks) Assuming 4-bit sequence numbers, FIFO delivery, and identical receiver and sender window sizes, what is the largest receiver/sender window size that could be safely used?

*1/2 of the amount of sequence #'s*

*$\frac{16}{2} = 8$  is the max window size that can be safely used*

(iii) (2 marks) State two of the mechanisms by which reliable delivery protocols attempt to deal with the problems caused by non-FIFO delivery.

- Buffer packets received out of order until the other expected packets are received.
- Drop out of order packets received and request from sender the desired packet again.

(d) (4 marks) Give the size (in segments) of the congestion window of a TCP Reno flow for each of the first 10 "transmission rounds" under the following assumptions: 1) in each round a full window of segments is sent; 2) the first segment transmitted in each of the 5<sup>th</sup> and 8<sup>th</sup> transmission rounds is lost, and the losses are detected via triple-duplicate ACK; and 3) all other segments (and all acknowledgments) are received without error.

Round	1	2	3	4	5	6	7	8	9	10
Congestion window size	1	2	4	8	4	5	6	3	4	5
	1	2	4	8	16	8	9	10	5	6

5. Network Layer (12 marks in total)

(a) (2 marks) List two uses of ICMP in the Internet.

? X

(b) (4 marks) State the key difference between datagram and virtual circuit networks, and give one advantage of each approach.

- VC networks have all IP datagrams travel in a set path through predetermined routers.
- Datagram networks send each IP datagram through a possible different path that is chosen at ~~the~~ time.
- VC networks it is easier to detect packet loss due to the in order delivery nature of the network with all packets taking the same path.
- Datagram networks can sometimes better utilize network resources through dynamic path assignment.

(c) (6 marks) Suppose that a router's security is compromised, and an attempt is made to use it to disrupt operation of the Internet. Do think the misbehaving router could cause greater disruption with the link-state, or with the distance-vector, approach to routing, and why? As part of your answer, be sure to briefly state what these approaches are.

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- link-state you send shortest hop info to all routers in a network causing a lot of traffic in the network?
- distance-vector you send shortest hop info to only your neighbors and they in turn send only to neighbors
- with link-state you could cause all routers to quickly think this router was unreachable which could be very problematic if it was a very central router.
- with distance-vector approach bad news travels slowly so if you are trying to be malicious the "bad news" that isn't really bad news would propagate slowly through the network and slow things down while being detected more slowly as well by a network administrator.

The End