HONG KONG POLYTECHNIC UNIVERSITY
DEPARTMENT OF COMPUTING

COMP 2322

COMPUTER NETWORKING

SOLUTIONS TO
MIDTERM TEST

1. [20 marks, 2 marks each]

1) d	2) b	3) c	4) b	5) c
6) a	7) c	8) d	9) a	10) b

2. [12 marks]

1) [4 marks]

Reasons:

1. Distributed DNS can prevent single point of failure on the centralized database
2. Distributed DNS can balance the traffic volume among different databases
3. Distributed DNS can deploy databases at different geographic locations so as to make the databases close to the users.
4. It is easy to maintain several small databases instead of one huge centralized database.

2) [4 marks, 2 marks each]

(1) when the file to be retrieved is small

When the file to be retrieved has not been modified, the caching mechanism works and the response will have the header fields and no data body. When the file to be retrieved has been modified, the caching mechanism does not work and the response will carry a small data body, which will not increase the response delay much. So the caching mechanism does not reduce the web application's response delay.

(2) when the file to be retrieved is large

When the file to be retrieved has not been modified, the caching mechanism works and the response will have the header fields and no data body. When the file to be retrieved has been modified, the caching mechanism does not work and the response will also have a large data body, which will greatly increase the response delay. So the caching mechanism can greatly reduce the web application's response delay.

3) [4 marks]

TCP/IP five layers: application layer, transport layer, network layer, datalink layer, physical layer [3 marks]

Two additional OSI layers: presentation layer, session layer [1 mark]

3. [10 marks, 2 marks each]

1) Sequence number: The receiver can use it to identify if the received packet is a new packet or a duplicated packet.
2) NACK packet: The receiver sends a NACK message to inform the sender that it has not received the packet correctly.
3) Retransmission: The sender retransmits a packet if the packet is considered lost.

4) Timeout: The timer is associated with each packet transmission. If the sender does not receive the ACK when the timer expires; it considers the packet is lost and retransmits the packet again.

5) Checksum: The checksum mechanism allows the receiver to detect if the received packet has 1-bit transmission error or not.

4. [15 marks]

1) [4 marks]

$AE35_h = 1010111000110101_b$, $E1C2_h = 1110000111000010_b$,

$D553_h = 1101010101010011_b$ [1 mark]

The sum of 1010111000110101_b, 1110000111000010_b, and 1101010101010011_b is 0110010101001100_b. [2 marks]

The 1's complement of the sum is $10011010\ 10110011_b$ [1 mark]

2) [5 marks]

The sequence number space must be large enough to cover the entire receiver window and entire sender window without causing the dilemma problem.

Suppose the window size is w. In case that the lowest-sequence number that the receiver is waiting for is packet m., receiver's window is [m, m+w-1] and it has received (and ACKed) packet m-1 and the w-1 packets before that. In case that none of those w ACKs has been yet received by the sender, then the sender's window would be [m-w, m-1]. Thus, the possible sequence number space is [m-w, m+w-1]. This means that the sequence number k must be large enough to accommodate 2w sequence numbers. Thus, k+1 $\geqslant$ 2w, that is, $w \leq \lfloor (k+1)/2 \rfloor$. [3 marks]

For k=10, w = 5. [2 marks]

3) [6 marks]

For the non-persistent HTTP with no parallel TCP connections:
Tr = 2*RTT+(2*RTT+5000*8/R)*10, where R stands for link rate (bps). [1 mark]
As the transmission time is not considered, the response times for both link rates are the same, Tr = 2.2 s [1 mark]

For the persistent HTTP:
1) If 10 objects can be requested in 1 RTT, then
Tr = 2*RTT+ RTT+(5000*8/R)*10. [1 mark]
When neglecting the transmission time, the response time is Tr = 0.3 s [1 mark]
2) If 10 objects are requested one by one in a sequence, then
Tr = 2*RTT+ (RTT+5000*8/R)*10. [1 mark]
When neglecting the transmission time, the response time is Tr = 1.2 s [1 mark]

5. [10 marks]

1) [4 marks]

Time to send message from source host to first packet switch

$T_1 = \frac{8\times10^6}{2\times10^6} = 4$ sec [2 marks]

With store-and-forward switching, the total time to move message from source host to destination host

$T = T_1 \times 3 = 12$ sec [2 marks]

2) [6 marks]

Time to send 1st packet from source host to first packet switch

$T_2 = \frac{8\times10^6/1000}{2\times10^6} = 4$ msec [2 marks]

Time at which 1st packet is received at the destination host

$T_2 \times 3 = 12$ msec [2 marks]

After this, every 4msec one packet is received at the destination host; thus time at which last (1000th) packet is received $= 12 + T_2 \times 999 = 4.01$ sec [2 marks]

6. [16 marks]

1) [1 mark]

TCP Reno

2) [2 marks]

TCP slow start is operating in the intervals [1,5] and [14,18].

3) [3 marks]

TCP congestion avoidance is operating in the intervals [5,13], [18,24], and [25,32].

4) [1 mark]

At the time instant 24, the segment loss is detected by a triple duplicate ACK.

5) [1 mark]

At the time instant 13, the segment loss is detected by a timeout.

6) [1 mark]

The threshold is initially 16.

7) [1 mark]

The threshold is 12.

8) [1 mark]

The threshold is 9.

9) [3 marks]

The 90th segment is sent at 9th transmission round. [1 mark]

The packets transmitted in each round is listed as follows: [2 marks]

Transmission round	Number of segments	Transmission segment ID
1	1	1
2	2	2-3
3	4	4-7
4	8	8-15
5	16	16-31
6	17	32-48
7	18	49-66
8	19	67-85
9	20	86-105

10) [2 marks]

The value of the cwnd size at the 32th round is 16; when the loss occurred by the timeout, the threshold will be set to half the value of the cwnd size, which is 8. [1 mark]

The cwnd will be set to 1. [1 mark]

7. [17 marks]

1) [3 marks]

source IP address: 212.85.50.115; destination IP address: 191.18.10.214;

sequence number: 150

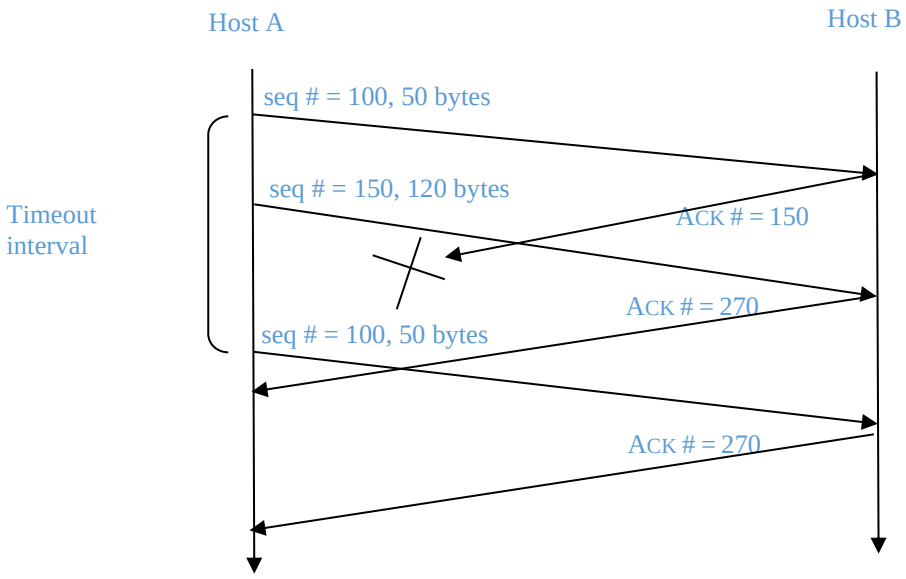
2) [1 mark]

acknowledgement number: 150

3) [1 mark]

The acknowledgment number: 100

4) [12 marks]



2 marks for each segment or acknowledgement with correct information