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Network Architecture I: Exam 2

- Put your name and student id.
- The exam is closed book and closed note.
- You have 75 minutes to complete the exam.
- Answer all the questions directly on the exam papers (back page included). If you need additional sheets, let the instructor know.
- *Be brief, but do not omit necessary details.*
- If the problem appears to be ambiguous to you, write your assumptions along with your answer.
- Enjoy and Good luck!

67/93

1. (6 pt) Answer 'true' or 'false' to the following questions.

T or F

a) TTL field in IP header is incremented by one on each hop.

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F b) TCP uses Selective Repeat ARQ. It uses both SD & GBN

T c) Virtual circuit forwarding requires resource reservation prior to data forwarding.

-2

F d) An object can always be found in a Gnutella-like P2P system if existing.

F e) TCP provides reliability on a hop-by-hop basis.

T f) For TCP, AIMD relates to how a source responds to network congestion.

2. (3 pt) Which type of application would *not* be difficult to use behind a NAT? (Ans: b)

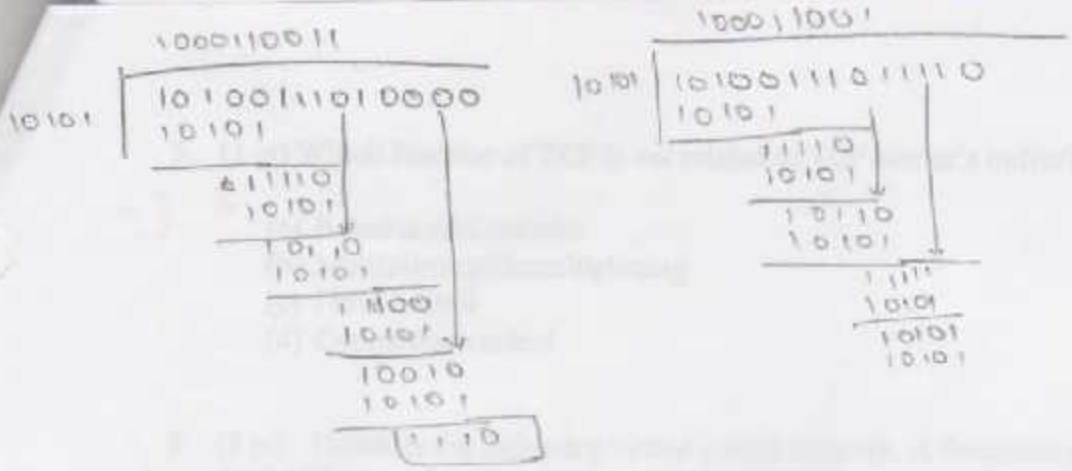
(a) File sharing
(b) Web browsing
(c) IP Telephony
(d) Peer-to-peer gaming

3. (3 pt) Which function of TCP is *not* related to providing reliable packet transmission? d

(a) Timeouts
(b) Sequence number
(c) Acknowledgements
(d) Sender's buffer size change

4. (3 pt) Which of the following is *not* about saving IP address usage? (Ans: a)

(a) IPv6
(b) DHCP
(c) CIDR
(d) NAT



R

$d = 10^7$ $\quad T_T = d/s = 10^7/2\times10^8 = 0.05$

$R = 10^6$ $\quad tT = L/R = \frac{4\times10^5}{10^6} = 0.4$

$S = 2\times10^8$

$L = 4\times10^5$ $\quad 0.45$

$\frac{2\times10^4}{10^6} = 0.02$

$2(2(0.05) + 0.02)$

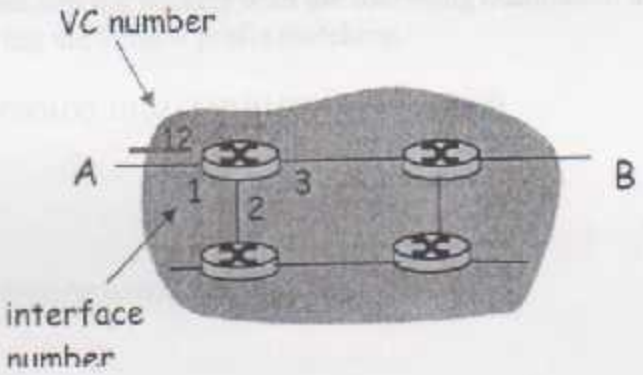
$\frac{}{0.05\times10^6} = 50K$

5. (3 pt) Which function of TCP is *not* related to TCP sender's buffer? C

-3 b

(a) Reliable data transfer
(b) Multiplexing/Demultiplexing
(c) Flow control
(d) Congestion control

V 6. (5 pt) Consider the following virtual circuit network. A forwarding table of the northeast router is shown below. On the northwest router, what interface and outgoing VC# will be used for a packet from A?



Incoming interface	Incoming VC #	Outgoing interface	Outgoing VC #
1	12	2	22
1	22	3	18
2	12	3	17
2	2	1	30
3	67	3	87

The packet from A uses incoming interface 1 and incoming VC # 12
Comes out from outgoing interface 2 and outgoing VC # 22

7. (10 pt) The table below is a routing table using CIDR. Address bytes are denoted in binary. The notation '/12' in 11000000.01100000.00000000.00000000/12 denotes a netmask with 12 leading 1-bits, that is 11111111.11110000. 00000000. 00000000.

NetMask/Length	NextHop
11000100.01011110.00000010.00000000/23	A
11000100.01011110.00000100.00000000 /22	B
11000100.01011110.10100000.00000000/19	C
11000100.01011110.01000000.00000000/18	D
11000100.01001100.00000000.00000000/14	E
11000000.00000000.00000000.00000000/2	F
10000000.00000000.00000000.00000000/1	G

Select to what next hop the packets with the following destination address will be delivered, following the longest prefix matching.

a. (5 pt) 11000100. 01011110.01000011.11111100

D

b. (5 pt) 11000100.01011110.11101100.10001111

F

8. (9 pt) Write the answers to the following questions on reliable data transfer mechanisms.

(a) Selective repeat :
   i. Receiver window size: N
   ii. Number of timers: N
   iii. Minimum number of sequences: N+N

(b) Go-Back-N
   i. Receiver window size: 1
   ii. Number of timers: 1
   iii. Minimum number of sequences: N+1

(c) Stop-n-Wait
   i. Receiver window size: 1 ✓
   ii. Number of timers: 1 ✓
   iii. Minimum number of sequences: 1 2 −1

9. (6 pt) On IP fragmentation and reassembly: MTU : Maximum transmit unit
   (a) Why is it necessary?
   Each Communication link may have different MTU
   (b) Where does it occur?
   fragmentation: Network
   reassembly: EndSystem
   (c) What fields of IP header are used for fragmentation and reassembly?
   flag field and offset field

data	IP hdr	flag	offset

10. (5 pt) What are the problems of a P2P system with a centralized directory (eg. Napster)?
   System Crash
   bottleneck problem
   Copyright infringement

11. (5 pt) What is 'controlled flooding' (or 'limited scope flooding') in Gnutella like P2P system?
   Gnutella is a P2P System where each peer is connected to neighboring peers and these peers connecting to their neighboring peers so when we want to search for a file Query message goes to all these peers the Searching is good but in order to limit the number of peers to which the Query message must be sent we make use of limited Scope flooding.

12. (15 pt) The following requests for network address allocations are received in this chronological order. Each network receives an address allocation before the next network requests its addresses.

Requests: Network A – 2030 Hosts
Network B – 510 Hosts
Network C – 4096 Hosts

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(a) (10 pt) Use CIDR address allocation for the requests above starting from address 193.134.17.0. Allocate addresses in the order they were requested with each allocation using the lowest range of addresses possible. Give the answer in standard CIDR notation. Once these have been allocated, gaps exist of unallocated addresses in between those of the networks above. Give the range of addresses for those gaps. The table below has space to list 5 gaps, but there may not actually be that many.

	CIDR Address Specification	Range of Addresses Allocated
Network A	193.134.17.0/21	193.134.21.0 – 193.134.31.255
Network B	193.134.17.0/23	193.134.17.0 – 193.134.17.255
Network C	193.134.17.0/20	193.134.25.0 – 193.134.31.255

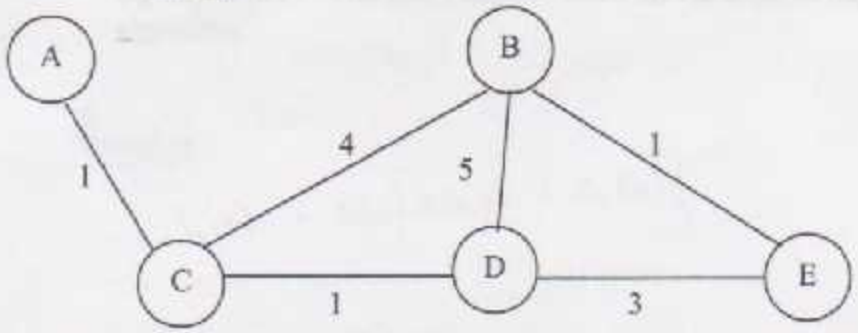
	Range of Addresses Not Allocated
Gap 1	193.134.18.0 – 193.134.20.255
Gap 2	
Gap 3	
Gap 4	
Gap 5	

(b) (5 pt) What is the lowest starting address larger than 193.134.17.0 where the allocation could have started and no gaps would have existed after the address allocations?

193.134.32.0

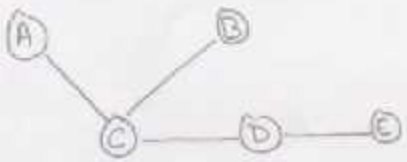
22.0

13. (20 pt) Consider the network shown below (the labels are the delay on the links).



(a) (10pt) Show the operation of Dijkstra's (Link State) algorithm for computing the shortest path from C to all destinations.

S.No	N'	d(A), p(A)	d(B), p(B)	d(D), p(D)	d(E), p(E)
1	C	1, C	4, C	1, C	∞
2	CA		4, C	1, C	∞
3	CAD		4, C		4, D
4	CADB				4, D
5	CADBE				



	Link
A	(C, A)
B	(C, B)
D	(C, D)
E	(C, D)

(b) (10pt) Show the distance table that would be computed by the distance vector algorithm in C. You don't have to show all the steps of the distance vector algorithm.

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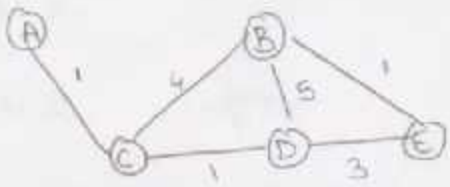


formulae

$$d_x(y) = \min\left[c(x,v) + d_v(y)\right]$$

$c(C,A) = 1$ $\quad d_A(E) = 5$

$c(C,D) = 1$ $\quad d_D(E) = 3$

$c(C,B) = 4$ $\quad d_B(E) = 1$

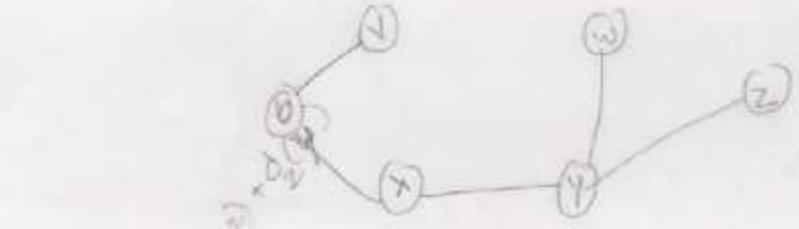
$$\min\begin{bmatrix} 1+5 \\ 1+3 \\ 4+1 \end{bmatrix} = 1+3 = 4$$

$$d_C(E) = c(C,D) + d_D(E)$$

N'	D(v), p(v)	D(x), p(x)	D(w), p(w)	D(y), p(y)	D(z), p(z)
	v	x	w	y	z
u	2, u	1, u	5, u	∞	∞
ux	2, u		4, x	2, x	∞
uxy	2, u		3, y		4, y
uxyv			3, y		4, y

uxyvw

uxyvwz



v	(u, v)
x	(u, x)
w	(y, w)
y	
z