Chapter 5: Sample Questions, Problems and Solutions
Bölüm 5: Örnek Sorular, Problemler ve Çözümleri

Örnek Sorular (Sample Questions):

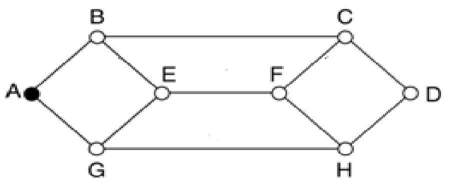
• What is Store-and-Forward packet switching?
• What is a connectionless service?
• Which is a connection-oriented service?
• What are the nonadaptive routing algorithms?
• What are the adaptive routing algorithms?
• What is the optimality principle?
• What is a sink tree?
• What is the shortest path routing algorithm?
• What is a distance vector routing algorithm?
• What is a link state routing algorithm?
• What is a hierarchical routing algorithm?
• What is a broadcast routing algorithm?
• What is a reverse path forwarding routing algorithm?
• What is a multicast routing algorithm?
• What is a routing algorithm for mobile hosts?
• What is a routing algorithm in Ad Hoc networks?
• What is congestion?
• List the policies that affect congestion in Transport, Network and Data Link layers.
• Describe the congestion control in Virtual-Circuit Subnet.
• Describe the congestion control in Datagram Subnet.
• What are hop-by-hop choke packets?
• What is Jitter control?
• What is flow?
• What is quality of service?
• What is buffering technique for achieving good quality of service?
• What is the leaky bucket algorithm for achieving good quality of service?
• What is the token bucket algorithm for achieving good quality of service?
What is an admission control for achieving good quality of service?
• What is packet scheduling for achieving good quality of service?
• What is RSVP-the Resource reSerVation Protocol for achieving good quality of service?
• What is an expedited forwarding for achieving good quality of service?
• What is an assured forwarding for achieving good quality of service?
• How networks differ?
• How networks can be connected?
• What is a multiprotocol router?
• What are concatenated Virtual Circuits?
• What is connectionless internetworking?
• What is tunneling?
• What is internetwork routing?
• What is fragmentation?
• What is the IP protocol?
• Draw the header for the IPv4.
• What are IP addresses?
• What is subnet?
• What is CIDR – Classless InterDomain Routing?

- What is subnet mask?
- What is network address translation?
- What is FTP-file transfer protocol?
- What is the internet control message protocol?
- What is the ART-address resolution protocol?
- What is RARP – reverse address resolution protocol?
- What is DHCP-dynamic host configuration protocol?
- What is OSPF-the interior gateway routing protocol?
- What is BGP-the exterior gateway routing protocol?
- What is internet multicasting?
- What is mobile IP?
- What is IPv6?

Örnek Problemler ve Çözümleri (Sample Problems and Solutions):

(Chapter 5, Problem 7-1)

Consider the following network.

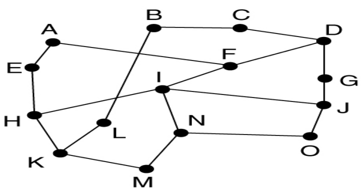


Suppose that it uses flooding as the routing algorithm. If a packet sent by A to D has a maximum hop count of 3, list all the routes it will take. Also tell how many hops worth of bandwidth it consumes.

ANS:
It will follow all of the following routes:
ABCD, ABCF, ABEF, ABEG, AGHD, AGHF, and AGEB
The number of hops used is 24.

(Chapter 5, Problem 7-2)

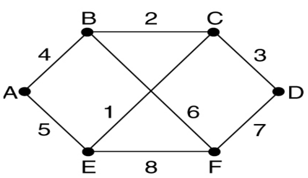
Consider the following network. Suppose that it uses flooding as the routing algorithm. If a packet sent by A to G has a maximum hop count of 3, list all the routes it will take. Also tell how many hops worth of bandwidth it consumes.



ANS:
It will follow all of the following routes:
AEHK, AEHI, AFIH, AFIN, AFIJ, AFDC, AFDG
The number of hops used is 21

(Chapter 5, Problem 9-1)

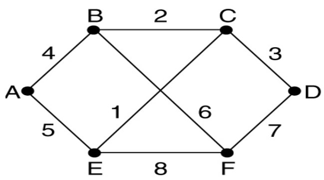
Consider the following subnet. Distance vector routing is used, and the following vectors have just come in to router *C*: from *B*: (5, 0, 8, 12, 6, 2); from *D*: (16, 12, 6, 0, 9, 10); and from *E*: (7, 6, 3, 9, 0, 4). The measured delays to *B*, *D*, and *E*, are 6, 3, and 5, respectively. What is *C*'s new routing table? Give both the outgoing line to use and the expected delay.



ANS:
Going via *B* gives (11, 6, 14, 18, 12, 8).
Going via *D* gives (19, 15, 9, 3, 9, 10).
Going via *E* gives (12, 11, 8, 14, 5, 9).
Taking the minimum for each destination except *C* gives (11, 6, 0, 3, 5, 8). The outgoing lines are (*B*, *B*, -, *D*, *E*, *B*).

(Chapter 5, Problem 9-2)

Consider the following subnet. Distance vector routing is used, and the following vectors have just come in to router F: from B: (5, 0, 8, 12, 6, 2); from D: (16, 12, 6, 0, 9, 10); and from E: (7, 6, 3, 9, 0, 4). The measured delays to B, D, and E, are 9, 6, and 3, respectively. What is F's new routing table? Give both the outgoing line to use and the expected delay.



ANS:

New vectors to F

	from B	from D	from E
A	**5**	**16**	**7**
B	**0**	**12**	**6**
C	**8**	**6**	**3**
D	**12**	**0**	**9**
E	**6**	**9**	**0**
F	**2**	**10**	**4**

New delays from F to neighbors	
B	**9**
D	**6**
E	**3**

F's new routing table

	Via B	Via D	Via E
A	**14**	**22**	**10**
B	**9**	**18**	**9**
C	**17**	**12**	**6**
D	**21**	**6**	**12**
E	**15**	**15**	**3**
F	**11**	**16**	**7**

Going via B gives (14, 9, 17, 21, 15, 11)
Going via D gives (22, 18, 12, 6, 15, 16)
Going via E gives (10, 9, 6, 12, 3, 7)
Taking the minimum for each destination except F gives
(10, 9, 6, 6, 3, -)
The outgoing lines are (E, B, E, D, E, -)

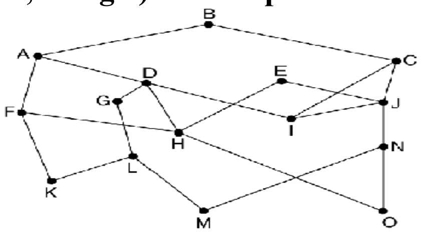
(Chapter 5, Problem 10)

If delays are recorded as 8-bit numbers in a 50-router network, and delay vectors are exchanged twice a second, how much bandwidth per (full-duplex) line is chewed up by the distributed routing algorithm? Assume that each router has three lines to other routers.

ANS:
The routing table is 400 bits. Twice a second this table is written onto each line, so 800 bps are needed on each line in each direction.

(Chapter 5, Problem 14)

Looking at the following subnet, how many packets are generated by a broadcast from B, using a) reverse path forwarding and b) the sink tree? Sketch diagrams.



ANS:

a) The reverse path forwarding algorithm takes five rounds to finish. The packet recipients on these rounds are AC, DFIJ, DEGHHIIJKN, EFHLLMOO, GMLH, respectively. A total of 28 packets are generated.

b) The sink tree needs four rounds and 14 packets.

(Chapter 5, Problem 38)

Convert the IP address whose hexadecimal representation is A44FF1BC to dotted decimal notation.

ANS:

$(A)_{16}=(1010)_2$

$(4)_{16}=(0100)_2$

$(F)_{16}=(1111)_2$

$(1)_{16}=(0001)_2$

$(B)_{16}=(1011)_2$

$(C)_{16}=(1100)_2$

$(A44FF1BC)_{16}=(10100100.01001111.11110001.10111100)_2$

$(10100100)=2^7+2^5+2^2=128+32+4=(164)_{10}$

$(01001111)=2^6+2^3+2^2+2^1+2^0=64+8+4+2+1=(79)_{10}$

$(11110001)=2^7+2^6+2^5+2^4+2^0=128+64+32+16+1=(241)_{10}$

$(10111100)= 2^7+2^5+2^4+2^3+2^2=128+32+16+8+4=(188)_{10}$

$(A44FF1BC)_{16}=164.79.241.188$

(Chapter 5, Problem 39-1)

A network on the Internet has a subnet mask of 255.255.240.0. What is the maximum number of hosts it can handle?

ANS:

The mask is 20 bits long, so the network part is 20 bits. The remaining 12 bits are for the host, so 4096 host addresses exist.

(Chapter 5, Problem 39-2)

A network on the Internet has a subnet mask of 255.255.224.0. What is the maximum number of hosts it can handle?

ANS:
The mask is 19 bits long, so the network part is 19 bits. The remaining 13 bits are for the host, so 8192 host addresses exist.

(Chapter 5, Problem 40-1)

A large number of consecutive IP address are available starting at 198.16.0.0. Suppose that four organizations, A, B, C, and D, request 4000, 2000, 4000, and 8000 addresses, respectively, and in that order. For each of these, give the first IP address assigned, the last IP address assigned, and the mask in the w.x.y.z/s notation.

ANS:
To start with, all the requests are rounded up to a power of two. The starting address, ending address, and mask are as follows:
A: 198.16.0.0 – 198.16.15.255 written as 198.16.0.0/20
B: A: 198.16.16.0 – 198.23.15.255 written as 198.16.16.0/21
C: A: 198.16.32.0 – 198.47.15.255 written as 198.16.32.0/20
D: A: 198.16.64.0 – 198.95.15.255 written as 198.16.64.0/19

(Chapter 5, Problem 40-2)

A large number of consecutive IP address are available starting at 198.16.0.0. Suppose that four organizations, A, B, C, and D, request 2000, 4000, 6000, and 8000 addresses, respectively, and in that order. For each of these, give the first IP address assigned, the last IP address assigned, and the mask in the w.x.y.z/s notation.

ANS:

	Starting address	Ending address	Mask
A:	198.16.0.0	198.16.7.255	198.16.0.0/21
B:	198.16.16.0	198.16.31.255	198.16.16.0/20
C:	198.16.32.0	198.16.63.255	198.16.32.0/19
D:	198.16.64.0	198.16.95.255	198.16.064.0/19

(Chapter 5)

An ATM network uses a token bucket scheme for traffic shaping. Anew token is put into the bucket every 5 msec. Each token is good for one cell which contains 48 bytes of data. What is the maximum sustainable data rate?

ANS:
With a token every 5 msec, 200,000 cells/sec can be sent. Each cell holds 48 data bytes or 384 bits. The net data rate is then 76.8 Mbps.

(Chapter 5)
Is fragmentation needed in concatenated virtual-circuit internets or only in datagram systems?

ANS:
Fragmentation is needed in both. Even in a concatenated virtual-circuit network, some networks along the path might accept 1024 – byte packets, and others might only accept 48-byte packets. Fragmentation is still needed.

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Suppose that instead of using 16 bits for the network part of a class B address originally, 20 bits had been used. How many class B networks would there have been?

ANS:
With a 2 – bit prefix, there would have been 18 bits left over to indicate the network. Consequently, the number of networks would have been 2 power of 18 or 262,144. However, all 0s and all 1s are special, so only 262,142 are available.

(Chapter 5)

Give the comparison table of datagram and virtual-circuit subnets

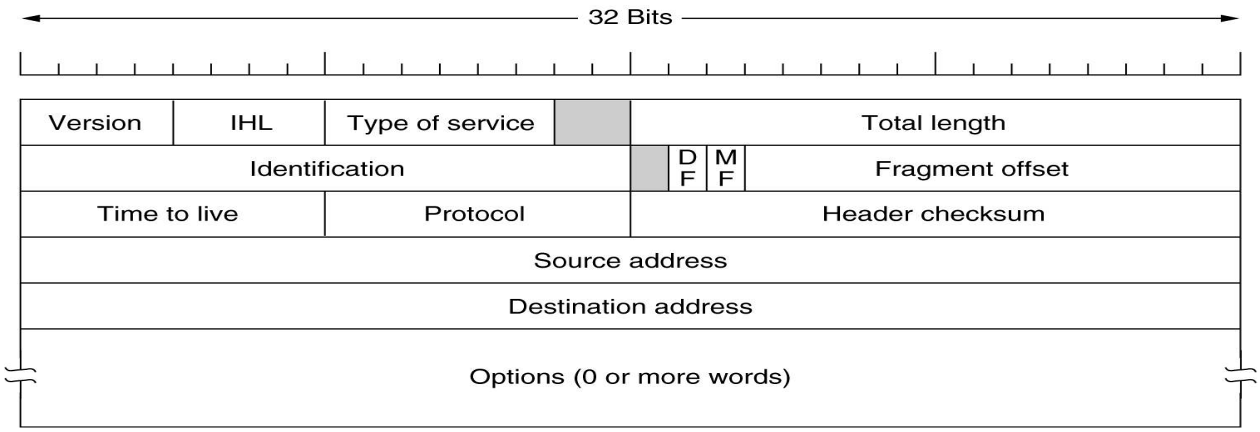
ANS:(p.349)

Issue	Datagram subnet	Virtual-circuit subnet
Circuit setup	Not needed	Required
Addressing	Each packet contains the full source and destination address	Each packet contains a short VC (Virtual-Circuit) number.
State information	Routers do not hold state information about connections	Each VC requires router table space per connection
Routing	Each packet is routed independently	Route chosen when VC is set up; all packets follow it
Effect of router failures	None, except for packets lost during the crash.	All VCs that passed through the failed router are terminated
Congestion control	Difficult	Easy if enough resources can be allocated in advance for each VC
Quality of service	Difficult	Easy if enough resources can be allocated in advance for each VC

(Chapter 5)

Draw the header for the IPv4. Define each of fields.

ANS:



(Chapter 5)

Fill in the comparison table of the quality-of-service requirements

ANS:

Application	Reliability	Delay	Jitter	Bandwidth
E-mail	High	Low	Low	Low
File transfer	High	Low	Low	Medium
Web access	High	Medium	Low	Medium
Remote login	High	Medium	Medium	Low
Audio on demand	Low	Low	High	Medium
Video on demand	Low	Low	High	High
Telephony	Low	High	High	Low
Videoconferencing	Low	High	High	High