Internet Protocols Midterm (2018. 4. 25)

<1 Hour>

*** You can answer in English or in Korean. 영어 또는 한국어로 답하시오. ***

Student ID **Name**

1. What is the only "interface" that is running on your smartphone when you switch it to the "airplane mode"? loopback **[3pts]**

2. Choose as many relevant properties from (a-f) below, for the interfaces on your smartphone.

```
(a)  POINTTOPOINT  (b) ARP  (c) NOARP  (d) BROADCAST  (e) MTU  (f) LOOPBACK
```

   A. LTE interface a,c,e **[2pts]**

   B. Wi-Fi interface b,d,e **[2pts]**

3. What is the reason that the mapping between the sender's protocol address and the sender's hardware address is provided in the ARP request? **[3pts]** To save ARP transaction for the IP datagram coming in the opposite direction from the target

4. Answer the following questions on ARP messages to be used for duplicate address detection.

   A. State the minimum conditions that the gratuitous ARP message should meet.

      i. ARP request **[2pts]**

      ii. sender IP address = target IP address **[2pts]**

   B. Write down the Wireshark filter to use to see only the gratuitous ARP messages. arp.isgratuitous **[1pt]**

   C. You want to force the gratuitous ARP by using two consecutive commands on Windows. Write down the command sequence. ifconfig /release → ifconfig /renew **[4pts]**

   D. Why do we need to transition to ACD from the old gratuitous ARP? To prevent ARP cache poisoning **[3pts]**

5. A packet is traveling through the Internet towards 163.152.2.127.

   A. Which part of the address is stored in the default-less core routers? Use the CIDR notation to answer. 163.152.0.0/16 **[2pts]**

   B. Given 255.255.255.128 is the subnet mask in the destination network, what is the subnet number in decimal? 4 **[2pts]**

   C. Given the subnet mask of (B), what is the destination MAC address to carry this packet in the last hop? 0x ff ff ff ff ff ff **[1pts]**

6. What are the two commands on Windows that show the routing table?

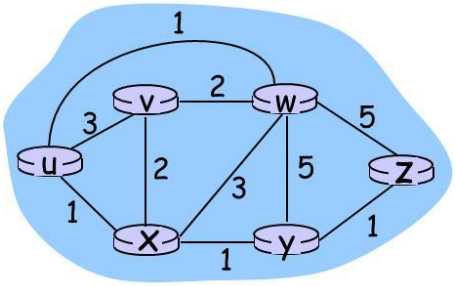
   A. route print **[2pts]**

   B. netstat -r **[2pts]**

7. What is the attribute that lets BGP find any routing loop? AS-PATH **[2pts]**

8. Write down the command to insert an entry in the routing table, so that the destination 157.0.0.0/8 is reachable through 157.55.80.1 at the metric value of 3? route ADD 157.0.0.0 MASK 255.0.0.0 157.55.80.1 METRIC 3 **[3pts]**

9. Suppose OSPF computes the routing table for the following network topology. What will go into the 'Next Hop' column in the routing table at router "X"? Fill in the empty boxes in the table. **[2.5pts]**



Destination	*Next Hop*
u	U
v	V
w	U
y	Y
z	Y

10. Fill in the table for the classification of Internet routing protocols. **[2.5pts]**

Coverage	Method	Algorithm	Routing protocol
Intra-domain	Distance-Vector	Bellman-Ford	RIP
	Link-State	Dijkstra	OSPF | IS-IS
Inter-domain	Path-Vector	Policy-based	BGP

11. The following is the OSPF Hello message trace captured in a network. Just after this message, the link to the router is broken.

A. How long should this condition last to trigger the re-computation of shortest paths? 40 seconds **[2pts]**

B. What is the evidence that the OSPF messages are simultaneously delivered to multiple neighboring routers? Dest IP 224.0.0.5 is a class-D (multicast) address **[1pt]**

```
> Internet Protocol Version 4, Src: 192.168.170.8, Dst: 224.0.0.5
v Open Shortest Path First
  v OSPF Header
      Version: 2
      Message Type: Hello Packet (1)
      Packet Length: 44
      Source OSPF Router: 192.168.170.8
      Area ID: 0.0.0.1
      Checksum: 0x273b [correct]
      Auth Type: Null (0)
      Auth Data (none): 0000000000000000
  v OSPF Hello Packet
      Network Mask: 255.255.255.0
      Hello Interval [sec]: 10
    > Options: 0x02 ((E) External Routing)
      Router Priority: 1
      Router Dead Interval [sec]: 40
      Designated Router: 192.168.170.8
      Backup Designated Router: 0.0.0.0
```

12. Suppose an IP datagram arrives at a computer that has two interfaces whose IP addresses are 163.152.161.2 and 10.16.10.3, respectively. Now, the datagram has destination address 121.129.49.80, and the computer is configured to function as a router. If the routing table at the computer is as shown below,

Destination	Netmask	Gateway	Interface	Metric
0.0.0.0	0.0.0.0	163.152.161.1	163.152.161.2	25
0.0.0.0	0.0.0.0	10.16.10.1	10.16.10.3	20
10.16.10.0	255.255.255.0	Connected	10.16.10.3	281
10.16.10.167	255.255.255.255	Connected	10.16.10.3	281
10.16.10.255	255.255.255.255	Connected	10.16.10.3	281
127.0.0.0	255.0.0.0	Connected	127.0.0.1	306
127.0.0.1	255.255.255.255	Connected	127.0.0.1	306
127.255.255.255	255.255.255.255	Connected	127.0.0.1	306
163.152.161.0	255.255.255.0	Connected	163.152.161.2	266
163.152.161.54	255.255.255.255	Connected	163.152.161.2	266
163.152.161.255	255.255.255.255	Connected	163.152.161.2	266
255.255.255.255	255.255.255.255	Connected	127.0.0.1	306
255.255.255.255	255.255.255.255	Connected	163.152.161.2	266
255.255.255.255	255.255.255.255	Connected	169.254.195.4	286
255.255.255.255	255.255.255.255	Connected	10.16.10.167	281

A. What will be the destination address in the datalink layer header if the ARP cache is as given below? f8-66-f2-7d-99-ff **[1pt]**

121.129.49.81	**64-ae-0c-41-32-c0**	**dynamic**
163.152.161.1	**64-ae-0c-41-32-c0**	**dynamic**
10.16.10.1	**f8-66-f2-7d-99-ff**	**dynamic**
255.255.255.255	**ff-ff-ff-ff-ff-ff**	**static**

B. If you release 10.16.10.3 through DHCP, how does the answer change in (A)? 64-ae-0c-41-32-c0 **[1pt]**

C. If you perform a limited broadcast, what interface will the packet go out on? (Identify the IP address of the interface) 163.152.161.2 **[1pts]**

13. The following IP datagram that carries a UDP datagram in the payload. Note that the number are all in decimal except the UDP checksum.

Version	**6**	**DS field**	**ECN**	**1200**	
Identification				**Flags**	**Fragment offset**
240		**17**		**Header checksum**	
163.152.1.1					
172.217.31.228					
Options (length = 4 bytes)					
67				**68**	
1176				**0x0000**	
UDP Data					

A. Fill in the two blank (not shaded) fields with an appropriate value. **[6pts]**

B. List up the values of the IP header fields that are used to compute the UDP checksum? 163.152.1.1, 172.217.31.228, 17 **[3pts]**

C. What is the most probable number of routers traversed so far? 15 **[1pt]**

D. For what application protocol is this UDP datagram being used? DHCP **[1pt]**

14. A UDP sender is sending a datagram. The 16-bit sum of the UDP datagram happens to be 0xFF.

A. What will be the checksum value? 0xFF **[1pt]**

B. When the receiver adds the sum and the checksum, what will it get in hexadecimal in case there was no error in transit? 0xFF **[2pts]**

15. In the following trace,

A. Select the packet numbers (from the leftmost column) that correspond to a complete DHCP-based configuration including the duplicate address detection. Write the packet numbers in the order they happen. 2,16,17,18,20 **[5pts]**

B. Select the packet numbers that testify to the fact that the DHCP client for this transaction has reset the B flag. 16,18 **[2pts]**

C. What is the IP address of the presumed DHCP server for this configuration? 10.16.6.10 **[1pt]**

D. Select the packet numbers used for ACD. 3,10,12,20 **[2pts]**

E. Write down any four parameters that this DHCP client can configure other than the IP address. subnet mask, router address, DHCP server address, DNS server address, lease time **[2pts]**

F. What is the router address presumably configured at the DHCP client through DHCP? **10.16.25.1** **[1pt]** And which packet reveals the fact? 22 **[1pt]**

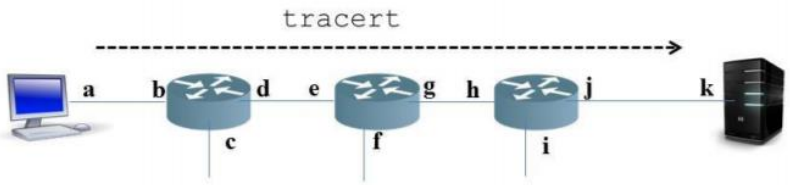
1	0.000000	0.0.0.0	255.255.255.255	DHCP	363	DHCP Request - Transaction ID 0xb9632681
2	0.034125	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0xacb6f52e
3	0.108382	Apple_2e:d5:22	Broadcast	ARP	60	Who has 10.16.25.83? Tell 0.0.0.0
4	0.244713	0.0.0.0	255.255.255.255	DHCP	350	DHCP Discover - Transaction ID 0x9cfafdec
5	0.350112	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0x72c7fbaa
6	0.350740	10.16.0.17	255.255.255.255	DHCP	342	DHCP NAK - Transaction ID 0x72c7fbaa
7	0.356471	0.0.0.0	255.255.255.255	DHCP	349	DHCP Request - Transaction ID 0x7889dcf6
8	0.356979	10.16.0.17	255.255.255.255	DHCP	342	DHCP NAK - Transaction ID 0x7889dcf6
9	0.365345	Apple_17:cf:90	Broadcast	ARP	60	Gratuitous ARP for 10.16.26.33 (Request)
10	0.376855	LiteonTe_0a:01:c5	Broadcast	ARP	60	Who has 10.16.20.46? Tell 0.0.0.0
11	0.394960	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x3136576c
12	0.424731	Apple_2e:d5:22	Broadcast	ARP	60	Who has 10.16.25.83? Tell 0.0.0.0
13	0.464058	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x72c7fbab
14	0.503174	IntelCor_fd:5c:0f	Broadcast	ARP	60	Who has 10.16.32.101? Tell 10.16.10.243
15	0.524175	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0xffcdd564
16	0.676999	10.16.6.10	10.16.25.12	DHCP	342	DHCP Offer - Transaction ID 0xacb6f52e
17	0.678331	0.0.0.0	255.255.255.255	DHCP	362	DHCP Request - Transaction ID 0xacb6f52e
18	0.684372	10.16.6.10	10.16.25.12	DHCP	342	DHCP ACK - Transaction ID 0xacb6f52e
19	0.755069	Apple_2e:d5:22	Broadcast	ARP	60	Gratuitous ARP for 10.16.25.83 (Request)
20	0.758735	IntelCor_99:cc:60	Broadcast	ARP	42	Who has 10.16.25.12? Tell 0.0.0.0
21	0.794168	8e:e8:e5:ea:51:b6	Broadcast	ARP	60	Who has 10.16.6.116? Tell 10.16.6.10
22	0.833010	IntelCor_99:cc:60	Broadcast	ARP	42	Who has 10.16.25.1? Tell 10.16.25.12

16. You see that an IP address has been assigned to your interface through DHCP, and the lease expires in 2 hours. After 1 hour elapses, what two DHCP messages will you see that are exchanged between your computer and the DHCP server? DHCP request, DHCP ACK **[2pts]**

17. What command do you execute to see the following captured packet? ipconfig /release **[2pts]**

1	0.000000	192.168.0.32	192.168.0.1	DHCP	342	DHCP Release - Transaction ID 0xf3273f61

18. **Tracert** will return the IP addresses of the interfaces b, e, h, and k, even though there are also other interfaces on some of the traversed machines. Explain the reason that only b, e, h, k are reported, considering the order of the three things that a router performs on an arriving IP datagram? TTL decrement is first executed on reception through the interfaces, before routing table lookup or checksum recomputation. **[3pts]**



19. Mark "T" if the given statement is always true, or mark it "F". **[4pts]**

Sending an IP datagram to 163.152.255.1 delivers the datagram to the interface with address 163.152.*.1 at every subnet in Korea University.	F
ARP cache lookup returns the hardware address of only the interfaces one hop away.	T
By setting the Broadcast flag in a DHCP request, the DHCP client asks the router (DHCP relay) to relay it to the DHCP server through broadcast.	F
The IP protocol number of ARP is 0x0806.	F
If the routing table outputs "on-link" as the next hop (gateway), it means that the destination address of the IP datagram should be used as the input to the ARP cache lookup.	T
The UDP pseudo-header is not attached in the UDP datagram in transit.	T
BGP uses the number of Autonomous Systems to traverse as the most important metric when determining the path to a destination network.	F
The default routers keep pushing an IP datagram towards the core of the Internet if the packet matches the default entry.	F

20. What are the two uses of ICMP? **[2pts]**
    A. IP datagram delivery error report
    B. network status probing

21. Differentiate the two codes of ICMP Time Exceed error by explaining on what condition the errors occur. **[2pts]**
    C. IP TTL becomes 0 during transit
    D. One or more fragments do not arrive during reassembly

22. ICMP Redirect error can only happen in an "unusual" environment. What is this unusual environment? Explain. **[2pts]** There are multiple routers on the same subnet

23. You see the following IP option in the packet trace for the **tracert**. What command-line option did you use with the **tracert** on Windows? j **[2pts]**

```
Options: (12 bytes), Loose Source Route
  IP Option - Loose Source Route (11 bytes)
    Type: 131
    Length: 11
    Pointer: 4
    Source Route: 163.162.161.54 <- (next)
    Destination: 163.162.161.54
  IP Option - End of Options List (EOL)
```

24. Suppose the fragmentation happened for an IP datagram. Specify the Wireshark filter at the destination host to match only the fragment that contains the transport layer port numbers. ip.flags.mf==1 && ip.frag offset==0 **[2pts]**

25. Write any two pieces of information that you can find about 163.152.1.1 using the **whois** service. network name, address block range, name server address, location, registry, AS number **[4pts]**