CMSC 417 Computer Networks — Fall 2020

First Third-Term Exam

Take home — 24 hours — *Thursday, Oct. 8th*

⊕ *Do not forget to write your name on the first page. Initial each subsequent page.*
⊕ *Be* **neat** *and* **precise. I will not grade answers I cannot read.**
⊕ *You should draw simple figures if you think it will make your answers clearer.*
⊕ *Good luck and remember, brevity is the soul of wit*

- All problems are mandatory
- I cannot stress this point enough: **Be precise**. If you have written something incorrect along with the correct answer, you should **not** expect to get all the points. I will grade based upon what you **wrote**, not what you **meant**.
- Maximum possible points: 50 + bonus.

Name: Dazhi Peng

Problem	Points
1	
2	
3	
4	
5	
Total	

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	2	4	8	16	32	64	128	256	512	1024	2048	4096	8192	16384	32768	65536

0.P

1. Nomenclature

(a) Describe the following terms: (2 points each)

- Autonomous System

An entity that runs its own network as part of the Internet. Some examples include the Stub AS, Transit AS, and Multihomed AS.

- CIDR

Classless Interdomain Routing with address format a.b.c.d/x.
Unlike "classic IP" / subnets which used exact match, CIDR only mapped the destination to the matching Prefix.
Reduces the routing table size and allow small companies to have a single large network by combining multiple small networks together.

- Multi-homed AS

AS that connects to multiple other ASs, but does not transits traffic for others. Usually used when you have multiple connections but does not want to transit data for others.

- Broadcast Address

An IP address that you can use to send messages to all machines on that network. For example, if the network number is 128.8.0.0, the broadcast address will be 128.8.255.255.
(all ones on host part)

- Class B IP address

IP addresses with first byte number ranging from 128-191 in decimal. In binary, Class B addresses look like 10 net host
14 bits 16 bits.

D-P

2. Routing

(a) List one advantage and one disadvantage of Link State routing over Distance Vector (2 points)

Advantage: Quick convergence

Disadvantage: Higher computation and storage cost.

(b) How sequence numbers used in Link State Routing? (2 points)

They are used to distinguish new linked state packets from old linked state packets. Higher sequence number implies newer linked state packet.

(c) How is Split Horizon different from Poisoned Reverse? Explain with an example. (3 points)

Split Horizon: When a node sends an update, it does not send route to the node where it learned the shortest path from.

Poissoned Reverse: A node will send a route of infinity to the node where it learned shortest path from.

ex. If B has (E, 2, A) in table

In split horizon, B won't include (E,2) in its update to A.

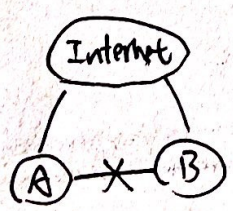
In poissoned reverse, B will send (E,∞) in its update to A.

(d) What is a "periodic update" in Distance Vector. Are they necessary? Why or why not? (3 points)

(1) Sending update after each given amount of time, like every 15 seconds.

(2) It's necessary for the next hop table.

(3)



Link AB may die, though A & B will complain, this won't affect any nodes in the Internet. Thus, even though there's a path in the Internet for A to reach B, A will never find out.

1).P

Internet Protocol

(a) Suppose you are allocated the prefix 111.222.3.4/26.

i. How many IP addresses do you control? (1 point)

$2^6 = 64$.

ii. Divide your allocation into three subnets, two of equal size and one double the size of the others. For each subnet, list the following: (3 points)

	Subnet-id	Mask	Broadcast	# hosts	Highest Address	Lowest Address
Subnet 0	111.222.3.0	255.255.255.240	111.222.3.15	16	111.222.3.15	111.222.3.0
Subnet 1	111.222.3.16	255.255.255.240	111.222.3.31	16	111.222.3.31	111.222.3.16
Subnet 2	111.222.3.32	255.255.255.224	111.222.3.63	32.	111.222.3.63	111.222.3.32.

(b) Suppose a IP fragment with ID 1023, offset 192, MF=0, DF=0, TTL=17 and payload size 532 bytes is transmitted on a link with MTU 276 bytes. List the header values for the resultant fragments. You may assume no IP options; IP Len includes header. You may assume that link MTU of x means an IP datagram of total length x can be sent over the link. (3 points)

	IP ID	Offset	MF	DF	TTL	IP Len.
Fragment 0	1023	0 192	1	0	16	276
Fragment 1	1023	224	1	0	16	276
Fragment 2	1023	256	0	0	16	40

(c) IP reassembly code receives a datagram with previously unseen Identification=32317, Total Len **1000** bytes, MF flag=1, and offset=**8190**. How should this datagram be processed. (3 points)

~~Payload = 1000 - 20 = 980 bytes.~~

Since the datagram has not been previously seen and the offset != 0, we should wait until receive all fragments to reassemble or until a timeout expires.

D.P

. CIDR, BGP

(a) What is the difference between a *transit* and *multi-homed AS*? (2 points)

Transit AS allows transit traffic to pass.

(b) Provider P has four customers with allocations 112.8.32/8, 112.8.33/8, 112.8.34/8, and 112.8.35/8. What CIDR prefix should P advertise. (2 points)

112/8

(c) UMD has two providers, Cogent and Comcast. What techniques can can UMD use to ensure that its outgoing traffic to the Internet (but not to Comcast customers) is carried by Cogent? (3 points)

Set the local pref to Cogent to be higher than the local pref to Comcast.

(d) How can UMD ensure that most of its incoming traffic is carried by Comcast instead of Cogent. (3 points)

When sending advertisement to Comcast, set its MED to be lower than the MED of Cogent.

1).P

5. Mobile IP, Implementation

(a) What is a 'Home Agent' in Mobile-IP? (2 points)

Entity that does proxy ARP on behalf of mobile host when the mobile host is remote.

(b) (How) is "tunneling" used in Mobile-IP? (2 points)

When home agent receives packet from the correspondent, it will use "tunneling" to create a new packet (src = HA, dst = mobile host) proto = IP in IP which original packet is treated as payload. And send to the mobile host.

(c) Function sendMessage is supposed to send a message over TCP socket s whose 1st four bytes is the message length (inclusive), followed by the two byte integer 17, and a NULL-terminated string str. sendMessage returns 0 on success or -1 on error. All integers are in network byte order. s and str are provided to sendMessage. Show an implementation of sendMessage.

```
int sendMessage(int s, char *str){
    int len = strlen(str);
    uint8_t buffer[len+7] = {0};

    uint32_t mesLen = htonl(len);
    uint16_t seventeen = htons(17);

    memcpy(buffer, mesLen, 4);
    memcpy(buffer+4, seventeen, 2);
    memcpy(buffer+6, str, len+1);

    size_t bytes_sent=0, temp=0;

    while(bytes_sent < len+7){
        temp = send(s, buffer+bytes_sent, len+7-bytes_sent, 0);
        if(temp == -1){
            return -1;
        }
        bytes_sent += temp;
    }
    close(s);
    return 0;
}
```