CMSCI 355   Exam 2 (Due Mon 11/9/20)

Directions: This is a take-home test. Take as much time as you need for test, as long as it is in by the due date. You may use any resources you like as long as they don't involve another human helping you. For instance, you can use books, class notes, websites, and calculators. But you must not get assistance in any form from anyone in class, any professor, any family member, anybody on the internet, etc. The only exception is you can ask me for clarifications on what a problem is asking.

You can either do your work on the test itself or on a separate sheet. Be sure to show all work.

1. Please write or type a statement in your own words saying that you did not receive assistance on this test, that you did not give anyone assistance, and that this is 100% your own work. **This problem is not optional.**

2. True or False.

    (a) _____ IPv4 has a checksum, but not IPv6.

    (b) _____ If you send a packet to the address 234.56.78.90, it's pretty likely that more than one host might receive it.

    (c) _____ If the router at address 10.0.0.1 has a routing table entry that tells it to forward a certain packet to 10.0.0.2, and 10.0.0.2's table tells it to forward the packet to 10.0.0.1, then that packet will bounce between those two routers until one of them is turned off or its table entry is changed.

    (d) _____ 192.168.0.255 is a potential address for a host on the network 192.168.0.0/24.

    (e) _____ It's not possible to assign yourself an address to communicate on a local network. You must rely on DHCP or a network administrator.

    (f) _____ The IPv4 checksum needs to be recomputed by each router because the TTL changes at each hop.

    (g) _____ It's possible to tell if a message is TCP or UDP just by looking at the Layer 3 header.

    (h) _____ When a device first joins a network, its DHCP Discover message is sent unicast directly to the DHCP server.
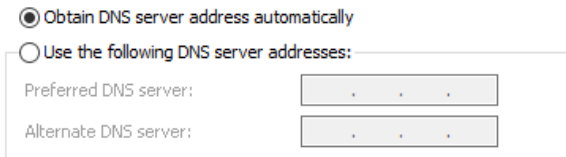
3. Mount St. Mary's and Frederick Community College both run networks in the 10.0.0.0/8 block. Which of the following is true?

    (a) These networks are in violation of IANA standards since no two networks should have the same addresses.

    (b) Each school has to run a separate NAT router to translate addresses so that their networks don't interfere with each other.

    (c) There's no issue except that people on the Mount network have to be careful not to accidentally send things to FCC's part of the network and vice-versa.

    (d) These networks are totally separate from each other, and there's no issue.

4. Suppose your computer is on a local network at address 192.168.1.44 with a NAT router on that network having IPs 192.168.1.1 and 72.103.99.96. If you contact a remote web server from your computer, which address will show up in its logs?

(a) 192.168.1.1   (b) 192.168.1.44   (c) 72.103.99.96   (d) all of these

5. If a packet with TTL 1 arrives at your computer, that means

(a) it came from a computer that is 1 hop away from you

(b) if it had passed through even one more router on its way to you, then it would not have made it to you

(c) both (a) and (b)

(d) none of these

6. If a device joins a network, gets an address from DHCP, and then leaves the network, what happens to its IP address?

(a) The device carries it to whatever new network it joins.

(b) The DHCP server has to send a DHCP NAK to the device before it leaves the network in order to reclaim the address.

(c) After the lease expires, the server can reassign it to someone else.

(d) It is permanently wasted, which is part of the reason why we have run out of IPv4 addreses.

7. If a packet is *not* part of an IP fragment, which of the following must be true?

(a) MF=0   (b) fragment offset=0   (c) both (a) and (b)   (d) DF=0

8. The class-based (classful) system of IP addressing is

(a) still the dominant system, with CIDR only starting to take hold

(b) useful for understanding why the IP space looks the way it does, but not really in use much anymore

(c) not in use anymore on IPv4, but it is in use on IPv6

(d) both (b) and (c)

9. In the old class-based system of IP addresses, the address 125.211.81.19 would have been part of which class of network?

(a) A   (b) B   (c) C   (d) D   (e) E

10. Below is the output from using ping on Windows. The server that sent back the reply sent what type of message?

```
> ping google.com -i 2

Pinging google.com [172.217.15.110] with 32 bytes of data:
Reply from 96.120.9.9: TTL expired in transit.
```

(a) DHCP NAK   (b) ICMP Echo Reply   (c) ICMP Time Exceeded   (d) IP NAK

11. Which of these is a solution to the lack of IPv4 addresses?

(a) IPv6   (b) NAT   (c) both   (d) none of these

12. Which of these is the name of the DHCP message in which a device accepts the IP address given to it by a DHCP server?

    (a) DCHP ACK   (b) DHCP Discover   (c) DHCP Offer   (d) DHCP Request

13. Which of the following is true of the typical size of IPv4 packets on the internet and the maximum size? All values are in bytes.

    (a) typical=1500, max=65535
    (b) typical=500, max=2048
    (c) typical=1500, max=1500
    (d) typical=65535, max=65535

14. If you want to be able to SSH into a computer on your home network from the outside world, and your home router is running NAT, which of the following is true?

    (a) You can access the computer by using the NAT router's IP address and port 22.
    (b) You might be able to access it if you set your router to do port forwarding to that computer.
    (c) You'll need to run STUN and configure your computer's SSH settings with the info you learn from STUN.
    (d) There's nothing special you need to do. Just write down the computer's local address and make a connection on port 22.

15. If I send a packet with TTL 96 and it passes through 4 intermediate routers before getting to its destination, what will its TTL be when it reaches its destination?

    (a) 92   (b) 96   (c) 100   (d) There's no way to tell

16. The TTL header field is critically important to which networking tool/process?

    (a) Path MTU Discovery   (b) Ping   (c) Traceroute   (d) All of these

17. Which of these are considerably harder or impossible to do if ICMP messages are blocked?

    (a) Path MTU Discovery   (b) Ping   (c) Traceroute   (d) All of these

18. A /37 network in IPv6 has how many addresses?

    (a) 37   (b) 91   (c) 95   (d) 137438953472   (e) about 2.5×10^{27}

19. In which of these protocols does a router send its entire routing table to its neighbors?

    (a) RIP   (b) OSPF   (c) both   (d) neither

20. An internet server has IP address 94.12.102.9 and MAC address 23-98-F8-C2-0D-33. You can reach it from most places in the world by

    (a) sending a packet to that IP address
    (b) sending a packet to that MAC address
    (c) either (a) or (b)
    (d) you need to specify both the IP and the MAC

21. Which of the following is true about IPv4 versus IPv6?

   (a) Almost all internet traffic is IPv4.

   (b) A decent percentage of internet traffic is IPv6, but IPv4 is still dominant.

   (c) Almost all internet traffic is IPv6

22. When a packet reaches a NAT router, which information *from the packet* is especially important for knowing which computer on the internal network to send it to?

   (a) port number   (b) MAC address   (c) destination IP   (d) both (a) and (b)

23. Wireshark will display a MAC address like c0:c1:c0:aa:bb:cc as Cisco-Li_aa:bb:cc. How does it know the Cisco_Li part?

   (a) It has a table/does a lookup that tells it that MAC addresses starting with c0:c1:c0 are Cisco_Li devices

   (b) It looks for the device name in the layer 2 header

   (c) It looks for the device name in the layer 3 header

   (d) It sends an ARP query asking the device to identify itself

24. For each of the addresses below, put an X if it is an address that you could theoretically reach from almost anywhere on the internet if there is a server listening there. Leave it blank if it would not be possible to reach it from most places.

___ 0.103.79.104	___ 1.224.18.249	___ 10.88.172.64	___ 74.8.103.226
___ 100.101.22.48	___ 127.47.85.212	___ 128.64.32.16	___ 169.254.221.100
___ 172.21.44.97	___ 192.168.155.111	___ 220.11.74.106	___ 249.47.109.87

25. From my office I sent pings to 127.201.37.92, 172.217.8.14, 192.168.1.2. One of them took 6 ms, one took 1 ms, and one took less than 1 ms. Fill in the blanks with which is which (you're entering 6, 1, and <1).

   _____ 127.201.37.92   _____172.217.8.14   _____192.168.1.2

26. The image below is taken from an OS system setting. The "Obtain DNS server address automatically" setting is set. What protocol is used by this computer to obtain that DNS server address?

27. When a device needs to know the MAC address of a computer on a network that has a particular IP address, what does it do?

28. There are certain servers you can contact that will tell you what port number and IP address they see on the packets you're sending them. This is part of getting around what networking "obstacle"?

29. Telling a system not to fragment a packet is a key component of which networking tool/process?

30. Write the IPv6 address 4209::1998 in non-zero-compressed form.

31. Write the address range 10.0.0.0 – 10.0.3.255 in CIDR notation.

32. In IPv4 CIDR notation, what is the smallest possible network that could fit 1400 hosts? [Your answer should be of the form "/xx".]

33. Suppose you have a /14 network. You decide to use 5 bits of the host portion of the address to create subnetworks. How many subnetworks are possible this way?

34. Consider the address 10.40.132.18 on a /19 network.

    (a) Write the subnet mask in dotted binary notation.

    (b) Write the subnet mask in dotted decimal notation.

    (c) Find the lowest possible address on this network in dotted decimal notation.

    (d) Find the highest possible address on this network in dotted decimal notation.

35. A network uses a range of addresses starting with 10.0.0.0 with a subnet mask of 255.255.240.0 What is the highest possible address in this range in dotted decimal notation?

36. Suppose we want to break the network 10.0.0.0/8 into subnets of 16382 hosts. List the ranges of addresses in each of the first 2 subnets.

37. Suppose RIP is being used to manage routing on the network. The routing tables of A and B are shown. Suppose B sends out a periodic update to its neighbors. What will A's table look like after the update?

A's table

B	C	D	E	F
1	3	5	∞	1

B's table

A	C	D	E	F
1	7	3	9	1

38. Below is a graph in which the shortest paths from a are being sought by Dijkstra's Algorithm. The first few steps have already been done and the results are indicated on the graph. The gray shaded vertices have already been chosen and examined. Perform the next step and **only that step**. Indicate which vertex is chosen next, which labels change, and what they change to.
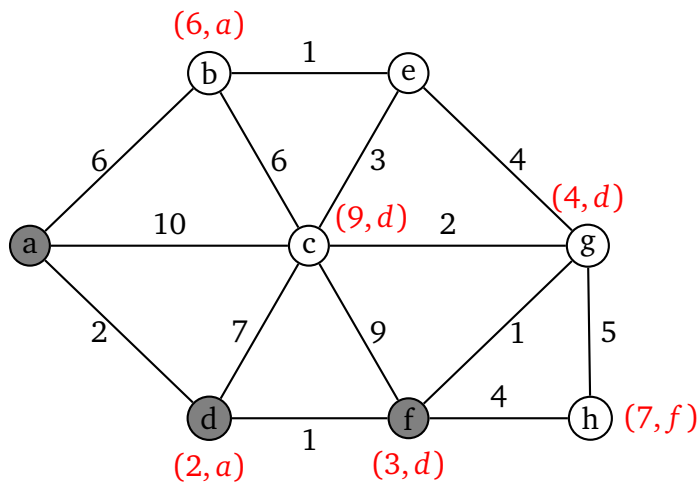
39. At the end of a Dijkstra's algorithm search from vertex a in a graph (not the graph above), we have the following list of labels. Use that to fill in the routing table for a (on the right) showing both the costs and the first hop.

vertex	label
b	$(2, a)$
c	$(4, g)$
d	$(3, b)$
e	$(2, g)$
f	$(5, d)$
g	$(1, a)$

a's table	a	b	c	d	e	f	g
cost	–						
first hop	–						