Name _____

Final Exam – CSE 30264 – Spring 2022

1. [2.5 pts] What are the key fields in a 5-tuple that describes a network flow?

   [1.25 pts] Give a fully-populated example.

2. [3 pts] Describe how a tagged presentation of data differs from an untagged presentation of data.

3. [4 pts] How do micro-services, HTTP, TLS, and REST relate to one another?

4. [3 pts] If an application is said to be elastic, what does that mean?

5. [3 pts] If we have something like a scanned image of an exam, what might be a better way to save / transmit the image: GIF or JPEG? Why?

6. [3 pts] If we are very early in the lifetime of a TCP connection, what is the mechanism most likely to detect a loss: RTO or Fast Re-Transmit? Why?

7. [4 pts] In class, we described several technologies that while useful have not seen widespread adoption across the Internet. Pick **two** of the following and describe at a high-level why adoption has not occurred more broadly: QoS, AQM, ECN, multicast, IPv6.

8. [10 pts] Describe at a high-level the major differences and similarities in **C programming** using UDP versus TCP from both the client as well as the server perspective (e.g. typical sequence of calls). For the purposes of comparison, you need only compare / contrast server vs. server and client vs. client. You do not need to describe arguments to any of the function calls.

9. [5 pts] A colleague makes the comment: "I don't think you can use SIP over UDP across your IPsec tunnel for your VPN under IPv4. It conflicts with RED which needs the flow identifier from IPv6." Is this statement plausible? Is it correct? Why or why not?

10. [10 pts] Describe what happens when transferring 42 KB of content using TCP using illustrations that explain how the data is transferred after the connection has been established. For your illustration, you can make appropriate network assumptions to keep things simple (ex. convenient value for MSS, ignore transmission time, queuing time, etc.). Your example should include a transition in terms of the TCP modes of operation. You may assume that loss does not occur. You should state / label all appropriate TCP settings and any notable transitions.

11. [2 pts] How long in terms of RTTs would this data transfer take in the scenario that you described?

12. [3 pts] Why does a NAT in front of a network make things difficult / impossible for a device behind the NAT to act as a server?

13. [3 pts] If all of the flows in the network are TCP friendly, does that mean that the network is likely to be fair? Why or why not?

14. [3 pts] Is it possible to create a token bucket configuration such that the token bucket effectively only provides CBR rather than VBR policing? Why or why not?

15. [8 pts] Illustrate the 3-way handshake for TCP providing valid values / flags / numbers / addresses / ports for all packets up until data would be sent.

16. [3 pts] Speedtest.net has an option to derive speed using either a single connection or parallel connections. Are there any networking environments where parallel connections might be especially advantageous? Why?

17. [3 pts] What does it mean for the network to be FIFO / best effort? Why does that operate reasonably well in today's Internet?

18. [3 pts] Why is it better generally to have a smaller buffer than a larger buffer on routers?

19. [5 pts] For the following network configuration, briefly explain what the following fields mean: Physical Address, IPv4 Address, Subnet Mask, Default Gateway, DNS Servers.

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Ethernet adapter Ethernet:

   Connection-specific DNS Suffix  . : lan
   Description . . . . . . . . . . . : Intel(R) Ethernet Connection (2) I219-LM
   Physical Address. . . . . . . . . : 3C-52-82-57-F2-03
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::fc4d:828e:d969:1268%11(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.86.63(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : Wednesday, April 20, 2022 10:10:57 PM
   Lease Expires . . . . . . . . . . : Tuesday, May 3, 2022 7:28:08 AM
   Default Gateway . . . . . . . . . : 192.168.86.1
   DHCP Server . . . . . . . . . . . : 192.168.86.1
   DHCPv6 IAID . . . . . . . . . . . : 54284930
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-21-CB-81-E7-3C-52-82-57-F2-03
   DNS Servers . . . . . . . . . . . : 192.168.86.1
   NetBIOS over Tcpip. . . . . . . . : Enabled
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Note that there is extra space under this question to allow ample space for the last exam question.

20. [15 pts] Explain the Internet at a level appropriate to a college student starting out in Computer Science (think of yourself in the EG classes).

    Draw a picture and outline several of the critical protocols that make the Internet operate. Label appropriately where the protocol applies and describe at least **five major protocols** underneath with a sentence or two about the role of the protocol in the Internet.