CNA 2016 Exam can be found at:
https://docs.google.com/document/d/1_rGdOVsOmBW8rIcw0_xxS0Kv8Mm2Bc40ZoEBFfcnw3o/edit?usp=sharing

BLACK: EXAM QUESTIONS
BLUE: CLINT'S CURRENT ANSWERS
RED: FEEDBACK/ANSWERS FROM ANYONE ELSE FOR CLINT TO MODERATE/MODIFY
MAGENTA: REQUESTS FOR CLARIFICATION

Application Layer

Question 1 [Total for Question 1: 24 marks]

(a) The equation for determining the download time for a peer-to-peer file sharing and client/server file sharing is given below.

Match the following terms to what they represent
i) F/u_s
ii) F/d_min
iii) NF/(u_s+SUM(u_i))
iv) NF/u_s
1) Time needed for server to upload one copy of the file
2) Time for cooperating peers + server to upload a copy of the file to all peers
3) Time for server to upload file to all clients
4) Time for slowest peer to download one copy of the file
[4 marks]
i) F/u_s = (1) Time needed for server to upload one copy of the file
ii) F/d_min = (4) Time for slowest peer to download one copy of the file
iii) NF/(u_s+SUM(u_i)) = (2) Time for cooperating peers + server to upload a copy of the file to all
iv) NF/u_s = (3) Time for server to upload file to all clients

(b) True or False: assuming that the server participates in the peer to peer exchange (as in the equation above), peer to peer download will always be faster than or the same speed as client/server download. Explain your answer [3 marks]
True. If the server has only one peer, then the server and peer are effectively acting as a client/server, even though it is peer-to-peer. As more peers are added, the load of sharing files becomes shared and the download is faster. (Need to check this one. Could be wrong. Will consult textbook)
I believe this is correct.

(c) You are building a communication network based on RFC 1149 "IP over avian carrier". You attach two 128GB flash drives to your pigeon. You can write data to the flash drive at the rate of 20 MB/s and you can read data from the flash drive at the rate of 50MB/s. The flying speed of a pigeon is 80km/h and pigeons do not need to stop for food or rest before reaching destination.

i. What is the total time needed for you to send and your friend who lives in Brazil (Rio is 13600 km from Adelaide) to receive a 4*10^9 bit file of your favourite home movies? Solve for the number of seconds delay. Show your work. [6 marks]
13600km / (80km/h) = 170h poor pigeon!
4*10^9bits / (8bits/byte) = 5*10^8bytes
5*10^8bytes / (20*10^6bytes/s)=25s
5*10^8bytes / (50*10^6bytes/s)=10s
Taping and removing the drives from the pigeon - dependent on your pigeon
Answer: 170h and a bit

ii. Under what conditions would IP over avian carrier have a lower propagation delay or transmission delay than using the Internet? Explain your answer. [4 marks]
Transmission delay = how long it takes to write your data
Propagation delay = how long it takes for the data to travel down the line
Conditions:
Pigeon has lower prop delay than internet = pigeon can travel near the speed of light
Pigeon has lower trans delay than internet = you can get the data written and taped onto the pigeon faster than you can send the data to your router and onto the internet

(d) Give two reasons why iterative DNS queries are preferred to recursive DNS queries. Explain your answer. [2 marks]

1) Recursive DNS queries put a lot of load on the top level DNS servers than iterative queries
2) ???Could use recursive DNS as part of a DDOS attack???
3) Must be a better reason that I am missing

(e) Explain three techniques used by the Web (HTTP) to reduce latency [3 marks]
Pipelining
Persistance
???I forgot??? Parallel non-persistent ???
(Need to explain in detail)
Proxy server?
(f) One key role of protocols is to define the syntax (ie structure) of requests and responses. To do this, protocols need to define where one exchange ends and the next one begins. Give two plausible ways in which a text based protocols can indicate the end of an exchange. [2 marks]
(I might be interpreting this question wrong. Is it asking how we know the end of a packet, or the end of a “connection”)

1) A header argument that says how large the data packet is
2) A defined “end of file” marker at the end of the data packet

Transport Layer
Question 2 [Total for Question 2: 25 marks]

(a) How does a web browser know the destination port to connect to reach a web server? [2 marks]

(b) Explain in detail how TCP provides congestion control. [6 marks]

(c) Explain why it is reasonable to assume that receiving 3 duplicate ACKs in TCP is an indication that the network is not currently congested. [2 marks]

(d) We looked at three protocols for providing reliable transport: Alternating Bit, Go-Back-N and Selective-Repeat.
i. Which of these is likely to perform best in the presence of high error rates? Explain. [3 marks]

ii. What is the optimal size for the sending and receiving window for each of these protocols? [3 marks]

iii. Given a window size, W , what is the minimum sequence space required for each of these protocols? [3 marks]

(e) A TCP sender finds out the available receive buffer space through the 'receive window' header field of packets/acknowledgments sent by the receiver to the sender. The flaw in this approach is that if the receiver has no space, it will send a receive window of 0. This indicates that the sender should not send any more data as there is no space in the receiver's buffer. However, if the sender does not send data, the receiver may never send a packet to tell the sender when there is space. Assuming we do not want the receiver to gratuitously send packets to the sender just to tell it about window space (ie the receiver should only send packets to the sender if it either has data to send or if it is sending an acknowledgement), what can the sender do resolve this problem? [3 marks]

(f) Give an example of a case where a two-way handshake to establish a connection could leave one side of the connection live while the other side does not believe there is a connection. [3 marks]
Party A SYNs Party B
Party B SYN-ACKs Party A

Network Layer
Question 3 [Total for Question 3: 11 marks]

(a) Given the network shown above, show the development of the routing table for node A using Dijkstra's algorithm. You must show your work and the final routing table (next hop and path cost for each destination) for full marks. [6 marks]

(b) Node A is using distance vector routing. The current distance table and routing table at Node A are shown below.
i. Node A receives the following vector from neighbour Node B [A, 2 C, 2 D, 2 E, 5]
Show the updated distance table at A after it processes this vector. [3 marks]

ii. What vector, if any, will be sent by A after its distance table has been updated? [2 marks]

Internet Protocol
Question 4

(a) Suppose there are three routers between a source host and a destination host. Ignoring fragmentation, an IP datagram sent from the source host to the destination host will travel over how many interfaces? How many forwarding tables will be indexed to move the datagram from the source to the destination?
[2 marks]
(b) What is the binary equivalent of the network address of the IP address 223.1.3.27/16?
[2 marks]
(c) You have a network 115.64.4.0/22 that you want to create subnets on. The subnets need to support up to 60 hosts each. How many bits would you allocate for the host part of the subnets? How many such subnets can you support?
[7 marks]
(d) Briefly describe three limitations (1 mark per limitation) of IPv4 that justify the development and deployment of IPv6.
[3 marks]
(e) Suppose Host A sends Host B a TCP segment encapsulated in an IP datagram. When Host B receives the datagram, how does the network layer in Host B know it should pass the segment (that is, the payload of the datagram) to TCP rather than to UDP or to something else?
[2 marks]
(f) IPv6 uses 128 bit addresses compare to IPv4, so it will take longer for routers to process IPv6 datagrams. Explain clearly by providing one argument why you agree or disagree with this statement?
[2 marks]
[Total for Question 4: 18 marks]

Switching and Link Layer Protocols
Question 5
0.4

0.3
Slotted ALOHA
0.2
0.1
Pure ALOHA
0.5
1.0
1.5
2.0
G = offered load = Np (N=users, p = probability of success by a given node)
Figure 2: Performance of ALOHA and Slotted ALOHA
(a) Pure Aloha (sender may start transmission during any time) has a maximum efficiency that is half that of Slotted Aloha (sender can only start transmission at synchronised time slots). Explain in detail why Pure Aloha is only able to achieve half the efficiency.
[4 marks]
(b) Suppose 3 hosts share a 2 Mbps data link. Each host transmits at 1 Mbps when it has access to the link. Also suppose each host transmits 20 percent of the time.
You are told to propose an access control mechanism for sharing the 2 Mbps broadcast channel. Clearly explain the data rates achievable with each of the following schemes in this scenario: TDMA, FDMA, slotted ALOHA, pure ALOHA),
[8 marks]
(c) CSMA/CD efficiency is governed by the equation shown. There are two ways to improve the efficiency of a CSMA/CD network 1) increase the transmission delay or 2) decrease the propagation delay. Explain how each of these could be achieved in an actual network without changing the medium of the link (ie you can't change from optical fibre to copper).
ef f iciency = 1/1 + 5t prop /t trans
[4 marks]
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Figure 3: MPLS Network
(d) Consider the Multi-Protocol Label Switching (MPLS) network shown in Figure 3, and suppose that routers R5 and R6 are now MPLS enabled. Suppose that we want to perform traffic engineering so that packets from R6 destined for A are switched to A via R6-R4-R3-R1, and packets from R5 destined for A are switched via R5-R4-R2-R1. Show the MPLS tables in R5 and R6, as well as the modified table in R4, that would make this possible. (Clearly indicate the name of the router

and clearly draw the routing table where required to show additions or changes to routing tables. You do not need to reproduce the network)
[4 marks]
(e) Why is an ARP query sent within a broadcast frame? Is an ARP response sent within a broadcast frame and why or why not?
[4 marks]
(f) Suppose the information content of a packet is the bit pattern
1110 0110 1001 1101
and an even parity scheme is being used. What would the value of the field containing the parity bits be for the case of a two-dimensional parity scheme? Your answer should be such that a minimum-length EDC (error dectection and correction) field is used.
[4 marks]
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(g) Given that in a CSMA/CD protocol using binary exponential back off, the adapter waits K × 512 bit times after a collision, where K is drawn randomly. What is the maximum length of time the adapter will wait until the next transmission attempt given 7 collision has occured so far. Assume that you have a 10 Mbps broadcast channel?
[3 marks]
[Total for Question 5: 31 marks]
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ICMP, SNMP and Security

Question 6

(a) Ping (ICMP) is a useful tool for debugging network problems. Give an example of how ping could be used in network testing.
[2 marks]

(b) Explain how Traceroute builds a list of the routers on the path from the host through the network to the destination.
[3 marks]

(c) In what way does a hash provide a better message integrity check than a checksum (such as the Internet checksum)?
[3 marks]

(d) Suppose certifier.com creates a certificate for foo.com. Typically, the entire certificate would be encrypted with certifier.com's public key.
True or False? Briefly explain your answer.
[3 marks]

[Total for Question 6: 11 marks]
End of exam