Student Number

THE UNIVERSITY OF MELBOURNE

SCHOOL OF COMPUTING AND INFORMATION SYSTEMS

PRACTICE EXAM – Semester 2, 2018

COMP90007 Internet Technologies

Exam Duration: 3 hours
Reading Time: 15 minutes

Total marks for this Exam: --

Length: This paper has 38 pages including this cover page.

Authorized materials: Writing materials (e.g. pens, pencils). Calculators and all other books are not allowed.

The exam paper must remain in the exam room and be returned to the subject coordinator.

Instructions to Students:

- This paper contains 35 questions.

- Answer questions in this exam booklet using pen only in the **space** provided after the questions. All even pages are intentionally left blank, which you can use for rough work. Note that only your answers within the given space on odd numbered pages will be marked.

- For multiple choice questions, choose the best answer.

- For short answer questions, two or three sentences should be sufficient to answer each question.

- Bullet points are acceptable in answering descriptive questions.

- *Any unreadable answers will be considered wrong*.

Multiple choice questions [choose only one answer for each question]: [1 mark each]

Q1. The Internet Protocol (IP) address of the sending and receiving hosts is identified at which layer of the OSI model?
   A) Layer 7
   B) Layer 2
   C) Layer 4
   D) Layer 3
   E) All of the above
   F) None of the above

Q2. Which of the following statements is correct regarding Services and Protocols?
   A) Service is a set of primitives that a layer provides to a layer above it
   B) Service defines what operations the layer is prepared to perform on behalf of it's users
   C) Protocol is a set of rules governing the format and meaning of packets exchanged by peers within a layer
   D) All of the above
   E) None of the above

Q3. Message latency, which is the time delay associated with sending a message over a link is made up of ___
   A) Jitter
   B) Transmission delay (message in bits / transmission rate)
   C) Propagation delay (length of channel / signal speed)
   D) Both transmission delay and propagation delay
   E) All of the above
   F) None of the above

Q4. Which of the following statements is correct?
A) Attenuation is the loss of reduction in amplitude of a signal as it passes through a medium
B) Time division multiplexing is used to give access to users with a fixed schedule
C) Frequency multiplexing allocates specific frequency range for each user to send their data
D) All of the above
E) None of the above

Q5. In Data Link layer, which framing methods can be used?
A) Character (Byte) count
B) Flag bytes with byte stuffing
C) Start and end flags with bit stuffing
D) All of the above
E) None of the above

Q6. Hamming distance, d, is the minimum bit flips to turn a valid codeword into any other valid one. Therefore, a Hamming distance of 4 can correct how many errors?
A) 1
B) 2
C) 3
D) 4
E) All of the above
F) None of the above

Q7. In MAC Sublayer, which of the following protocols could provide greater throughput under high network traffic load?
   A) Pure ALOHA
   B) Slotted ALOHA
   C) 1-persistent CSMA
   D) 0.1-persistent CSMA
   E) All of the above
   F) None of the above

Q8. Which of the following protocols is a limited contention protocol?
   A) Binary Countdown protocol
   B) Bit Map protocol
   C) Carrier Sense Multiple Access (CSMA)
   D) Adaptive Tree Walk Protocol
   E) All of the above
   F) None of the above

Q9. In Network layer, which of the following statements is correct?
   A) Services provided by a Network layer protocol depend on the router technology
   B) 20-bit label in MPLS network is used to determine where in the datagram the current fragment belongs to
   C) Subnetting is used to assign local private IP addresses to hosts
   D) NAT is a process used to join multiple IP prefixes into a single layer prefix to reduce the routing table size
   E) All of the above
   F) None of the above

Q10. What are the approaches used in establishing a reliable connection?
   A) Don't reuse Maximum Segment Lifetime (MSL) sequence numbers within twice the MSL?
   B) 3-way handshake for establishing connection
   C) Use a sequence number space large enough that it will not wrap even when packets are sent at a high transmission rate
   D) All of the above
   E) None of the above

Q11. Which of the following statements is correct?
   A) UDP is a connection-oriented protocol
   B) TCP is a connectionless protocol
   C) UDP supports flow control and error control through retransmission of bad segments
   D) All of the above
   E) None of the above

Q12. Which of the following techniques is/are used for supporting good quality-of-service (QoS)?
   A) Over-provisioning
   B) Traffic shaping
   C) Resource reservation
   D) Packet scheduling
   E) All of the above
   F) None of the above

Q13. In the lectures, we learnt that the Domain Name System is a distributed database implemented in a hierarchy of many name servers. Which of the following reasons is correct regarding why DNS is not centralised?
- **A)** Single point of failure
- **B)** Huge traffic volume will be going to a centralised location
- **C)** Distant centralized database for many users
- **D)** Difficult or hard to maintain a centralised system
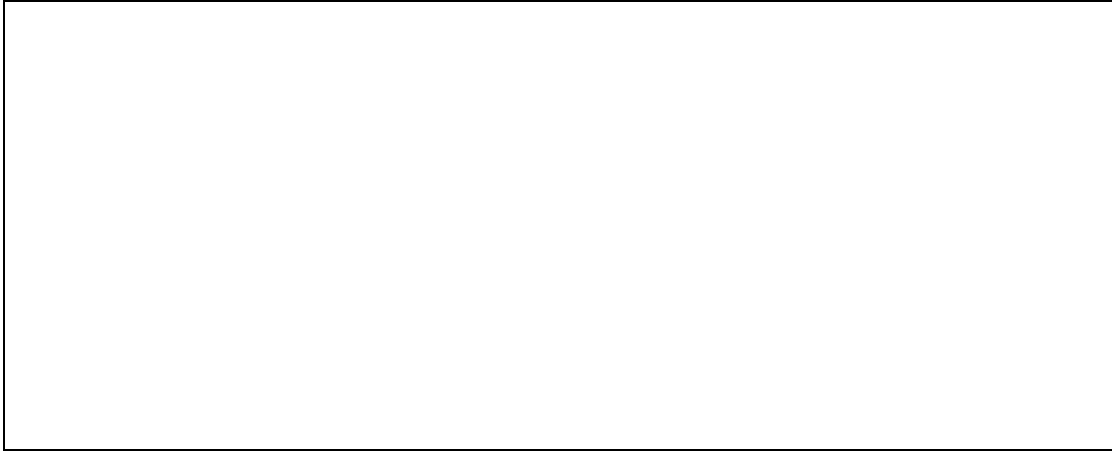- **E)** All of the above
- **F)** None of the above

Q14. In security, which of the following statements is correct?
- **A)** Symmetric Key Algorithms uses the same key for both encryption and decryption
- **B)** Asymmetric Key Algorithms allow different keys to be used for encryption and decryption
- **C)** Public Key Infrastructure is important to ensure safe distribution of public keys
- **D)** All of the above
- **E)** None of the above

Q15. Which of the following statements is correct about MD?
- **A)** MD uses a one-way hash function to take an arbitrary length of plaintext and compute a fixed-length bit string
- **B)** A MD from plaintext is much faster than encrypting plaintext
- **C)** MD could be used to speed up the derivation of a digital signature
- **D)** All of the above
- **E)** None of the above

Q16. a. Describe the OSI layer division principles (name 3). [1.5 marks]

b. Briefly explain the relative advantages and disadvantages of the OSI Reference Model versus the TCP/IP Reference Model. [1.5 marks]

Q17. The following data is the output of traceroute on a computer in the laboratory.

traceroute to cis.unimelb.edu.au (128.250.37.164), 64 hops max, 52 byte packets
1 10.9.152.1 3.304 ms 3.304 ms 3.304 ms
2 172.18.68.81 1.146 ms 1.099 ms 1.076 ms
3 172.18.68.83 1.133 ms 1.144 ms 1.115 ms
4 172.18.68.33 2.175 ms 1.931 ms 2.149 ms
5 172.18.66.133 9.724 ms 1.688 ms 1.989 ms
6 128.250.37.130 1.246 ms 1.205 ms 1.381 ms
7 128.250.37.164 1.988 ms 2.035 ms 1.848 ms

a. What is the IP address of the router connected to the destination? [1 mark]

b. Explain how Traceroute uses ICMP (Internet Control Message Protocol) in its operation. [2 marks]

Q18. a. Give three main characteristics that affect the performance of applications on networks. [1.5 marks]

b. Give an example of application that has stringent requirements on each of the three main characteristics you have given in Q18. a. [1.5 marks]

Q19. Briefly explain the relative advantages and disadvantages of using Fibre Optics versus Copper Wire. [3 marks]

Q20. a. How can you increase the bit rate of a 1200 baud line from 1200 bit/s to 3600 bit/s? [1.5 marks]

b. Consider a telephone signal that is bandwidth limited to 4 kHz. (i) At what rate should you sample the signal so that you can completely reconstruct the signal? (ii) If each sample of the signal is to be encoded at 256 levels, how many bits/symbol are required for each sample? (iii) What is the minimum bit rate required to transmit this signal? [1.5 marks]

Q21. a. The following binary data fragment occurs in the middle of a data stream for which the bit-stuffing algorithm described in the lectures is to be applied:

 00011111011111111111001

Show the output binary data stream after the bit-stuffing algorithm has been applied. (Note that you do not need to add any flag bytes)   [1 mark]

b. The following data fragment occurs in the middle of a data stream for which the byte-stuffing algorithm described in the lectures is to be applied: [1 mark]

A B ESC D FLAG FLAG ESC C

Show the output data stream after the byte-stuffing algorithm has been applied.

c. What is the maximum overhead in the byte-stuffing algorithm in general? [1 mark]

Q22. a. Briefly explain the difference in operation and philosophy of two approaches to error handling on the data link layer; error-correcting and error-detecting. [1.5 marks]
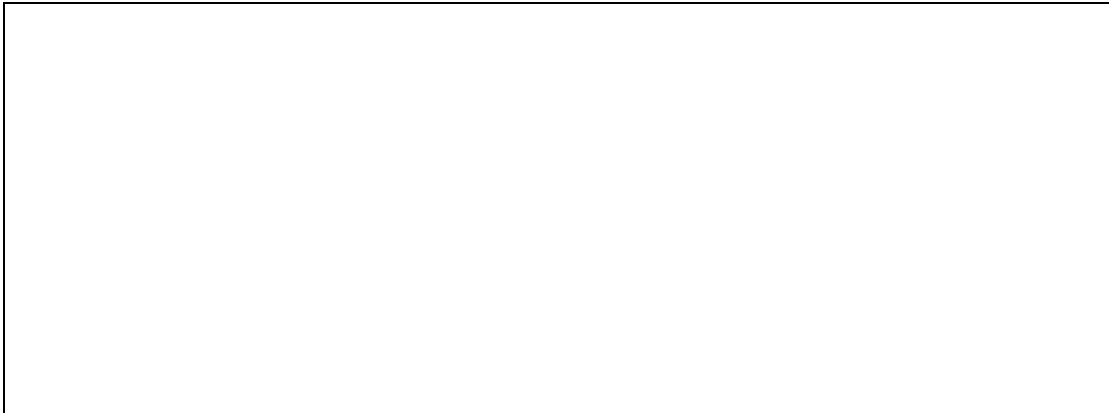
b. Data link protocols almost always put the CRC in a trailer rather than in a header. Why? [1.5 marks]

Q23. If a LAN is under high load, would it be more efficient to use a contention protocol or a collision free protocol in the MAC Sub-layer? Briefly explain your answer. [3 marks]

Q24. Consider a client program that needs to run the following operations on a remote file server:
a. List the contents of a directory
b. Open a file
c. Read a text file
d. Display the attributes of a file.

For each of the above operations, indicate whether they are more likely to be delay sensitive or bandwidth sensitive. Justify your answer? [3 marks]

Q25. Give the names of two sliding window protocols and briefly explain how each protocol works. [3 marks]

Q26. A router has built the following routing table. The router can directly deliver packets over Interface 0 and Interface 1 or it can forward to routers R2, R3 and R4.

Subnet Number	Subnet Mask	Next Hop
148.96.39.0	255.255.255.0	Interface 0
148.96.39.128	255.255.255.128	interface 1
148.96.40.0	255.255.255.128	R2
196.4.153.0	255.255.255.192	R3
Default		R4

Describe what the router does if a packet addressed to each of the following destinations is received.
(a) 148.96.40.12
(b) 148.96.39.193
(e) 196.4.153.90
[3 marks]

Q27. With respect to routing packets in the Network Layer, explain the difference between a connectionless and connection-oriented service? [3 marks]

Q28. Explain the purpose of subnetting and Classless Inter-Domain Routing (CIDR) for logically partitioning the IP Address space. [3 marks]

Q29. a. Give three requirements that are needed to ensure reliable connection establishment in the transport layer. [1.5 marks]

b. Give three types of policy choices at the Transport layer that can affect network congestion. In each case, briefly explain why the policy choice affects network congestion. [1.5 marks]

Q30. a. A common approach to removing jitter in streaming audio is to buffer incoming packets at the receiver. Briefly explain the main problem with using this approach for video conferencing. [1 mark]

b. Briefly explain what is bandwidth delay product? [1 mark]

c. Briefly explain what do we need low water mark and high water mark in media player buffer management? [1 mark]

Q31. a. Give 3 reasons for the emergence of Voice-over-IP telephony as an alternative to the PSTN. [3 marks]

Q32. a. Name two services that DNS provides and give one reason why DNS is not implemented centrally? [2 marks]

b. Is a DNS server a client, a server, or both? Briefly justify your answer. [1 marks]

Q33. a. An encrypted file needs to be accessed in non-sequential order. Which cipher mode is best suited to encrypting this file, and briefly explain why [1.5 marks]

a. Give three important properties of a message digest [1.5 marks]

Q34. a. Briefly explain Dijkstra's algorithm in computing a set of optimal routes from all sources to a given destination. [1.5 mark]

b. Briefly explain Flooding and how it is used in any of the routing protocol. [1.5 mark]

Q35. Considering the transport layer, briefly explain the key challenge in reliable connection establishment and 3 approaches in dealing with this challenge. [3 marks]