THE UNIVERSITY OF MELBOURNE
DEPARTMENT OF COMPUTING AND INFORMATION SYSTEMS

Practice Examination – Semester 1, 2018

COMP90007: Internet Technologies

Exam Duration: 3 hours **Total marks for this Exam: 60**
Reading Time: 15 minutes
This exam has 6 pages.

Authorised materials:
The following items are authorized: writing materials (e.g. pens, pencils)
Calculators are *not* allowed.

Instructions to Invigilators:
Supply students with standard script book.

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

Instructions to Students:

- This paper contains 20 questions, each question is worth 3 marks.
- Answer all 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 on odd numbered pages will be marked.
- As a guide, a few sentences should be sufficient to answer each question.
- Marks may be deducted for overly long answers or irrelevant information.
- Any unreadable answers will be considered wrong.

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Q1. Briefly explain the relative advantages and disadvantages of the OSI Reference Model versus the TCP/IP Reference Model. [3 marks]

Q2. The following data is the output of traceroute on a computer in a Alice Hoy 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

Please use the above data to answer the following questions.

a. What is the IP address of the router connected to the destination?

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

c. What is the average round trip delay between the source and the router with IP address 172.18.68.81?

Q3. 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]

Q4. The bandwidth and latency are the main characteristics of the networks affecting the performance of applications on networks. Define bandwidth and latency as discussed in lectures. Give an example of a network that exhibits high bandwidth but also high latency. Then give an example of a network that has both low bandwidth and low latency. [3 marks]

Q5. How can you increase the bit rate of a 1200 baud line from 1200 bit/s to 3600 bit/s? [3 marks]

Q6. Consider a telephone signal that is bandwidth limited to 4 kHz. (a) At what rate should you sample the signal so that you can completely reconstruct the signal? (b) If each sample of the signal is to be encoded at 256 levels, how many bits/symbol are required for each sample? (c) What is the minimum bit rate required to transmit this signal? [3 marks]

Q7. 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:

00011111101111111111001

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)

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:

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? [3 marks]

Q8. Briefly explain the difference in operation and philosophy of two approaches to error handling on the data link layer; error-correcting and error-detecting. [3 marks]

Q9. Data link protocols almost always put the CRC in a trailer rather than in a header. Why? [3 marks]

Q10. 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]

Q11. Briefly explain how the Binary Countdown Protocol works and describe the relative advantages over the Bit Map Protocol. [3 marks]

Q12. 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]

Q13. A router has built the following CIDR entries in its routing table. The router can directly deliver packets over Interface 0 or it can forward to routers R2 and R3.

Address / mask	Next Hop
128.16.64.0 / 21	Interface 0
128.16.80.0 / 21	R2
128.16.72.0 / 21	R2
128.16.88.0 / 21	R2
Default	R3

Can you simplify the routing table by aggregating addresses having the same outgoing lines? Briefly explain your answer. If you can simplify, give the simplified routing table. [3 marks]

Q14. Explain the purpose of subnetting and Classless Inter-Domain Routing (CIDR) for logically partitioning the IP Address space. [3 marks]

Q15. With respect to routing packets in the Network Layer, explain the difference between a connectionless and connection-oriented service? [3 marks]

Q16. 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. [3 marks]

Q17. 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. [3 marks]

Q18. Briefly explain the architecture of the email system by describing key components and services. What are the basic steps of SMTP protocol? [3 marks]

Q19. Give three reasons for the emergence of Voice-over-IP telephony as an alternative to the PSTN. [3 marks]

Q20. a. Is a DNS server a client, a server, or both? Briefly justify your answer.
b. Give three important properties of a message digest. [3 marks]

End of exam