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Calculators may be used in this examination provided they are not capable of being used to store alphabetical information other than hexadecimal numbers

UNIVERSITY OF BIRMINGHAM

School of Computer Science

Third Year Undergraduate

06-30209

LH Advanced Networking

Main Summer Examinations 2025

Time allowed: 2 hours

[Answer all questions]

Turn Over

Question 1

Ethernet, as originally implemented, suffered from the problem of traffic between any two machines affecting all other machines on the same network.

(a) Describe the mechanism used to resolve conflict, known as "collisions", between multiple machines wishing to transmit at the same time. Why does this mechanism require there to be a minimum packet size? **[10 marks]**

(b) The problem of collisions has largely been solved in more recent versions of Ethernet. Describe the mechanisms used to ensure that in most circumstances machines are able to transmit without concern for other machines' traffic. **[10 marks]**

(c) You are managing a modern Ethernet network in your company building. You have been asked by a developer to investigate why his application is unable to stream data at a high speed between more than two systems. What investigations would you carry out? What are the possible causes? What would you recommend to improve the situation? **[15 marks]**

Question 2

In today's networks, it is important for machines to be able to obtain an IP address without requiring manual configuration.

(a) Two common techniques for address assignment are DHCP (for both IP version 4 and IP version 6) and SLAAC (for IPv6). Compare and contrast the operation of DHCP and SLAAC. A small diagram might be helpful. **[10 marks]**

(b) DHCP imposes substantial reliability requirements: the failure of the DHCP service has major impact. Explain what the consequences of the failure of the DHCP service can be. Is SLAAC subject to the same problems? Justify your answer. **[10 marks]**

(c) You have been tasked with designing a network infrastructure that minimises single points of failure. Describe how you would implement a robust DHCP infrastructure that will tolerate the failure of individual devices. **[15 marks]**

Question 3

Today, the dominant transport protocol on the Internet is TCP.

(a) TCP is often said to be "reliable". In the context of TCP, explain what is meant by this. How is this property achieved? Explain one situation in which TCP may not detect the corruption of data, and how this risk can be managed. **[10 marks]**

(b) TCP was developed on computers much less powerful we use today. One consequence of this is the "receive window" field only having sixteen (16) bits. What problems does this cause? What techniques are used to mitigate these problems? How do these techiques mitigate the problems you identified? **[10 marks]**

(c) IPv6 has a 20 bit "flow identifier" in the header. This can be used to identify individual TCP connections. Why is this useful, and how can it be used to optimise the performance of TCP in large networks? **[10 marks]**

Do not complete the attendance slip, fill in the front of the answer book or turn over the question paper until you are told to do so

Important Reminders

- Coats/outwear should be placed in the designated area.
- Unauthorised materials (e.g. notes or Tippex) must be placed in the designated area.
- Check that you do not have any unauthorised materials with you (e.g. in your pockets, pencil case).
- Mobile phones and smart watches **must** be switched off and placed in the designated area or under your desk. They must not be left on your person or in your pockets.
- You are not permitted to use a mobile phone as a clock. If you have difficulty seeing a clock, please alert an Invigilator.
- You are not permitted to have writing on your hand, arm or other body part.
- Check that you do not have writing on your hand, arm or other body part – if you do, you must inform an Invigilator immediately
- Alert an Invigilator immediately if you find any unauthorised item upon you during the examination.

Any students found with non-permitted items upon their person during the examination, or who fail to comply with Examination rules may be subject to Student Conduct procedures.