



University
of Glasgow

Thursday, 11 May 2017
09:30 am - 11:00 am
(1 hour 30 minutes)

DEGREES of MSc, MSci, MEng, BEng, BSc, MA and MA (Social Sciences)

NETWORKED SYSTEMS (H)

Answer all 3 questions

This examination paper is worth a total of 60 marks.

The use of calculators is not permitted in this examination.

INSTRUCTIONS TO INVIGILATORS: Please collect all exam question papers and exam answer scripts and retain for school to collect. Candidates must not remove exam question papers.

1.
 - (a) Describe what is the role of the physical layer in the Open Systems Interconnection (OSI) reference model. [2]
 - (b) A common form of wired connection is an unshielded twisted pair. Briefly state 1) why the two wires that form the twisted pair are twisted together, and 2) why a typical cable includes more than one twisted pair. [3]
 - (c) Manchester encoding is a commonly used baseband encoding scheme for wired links. Describe how the binary digits 1 and 0 are encoded when using Manchester encoding. With the aid of a diagram, show how the sequence 0010 is encoded in Manchester encoding. [5]
 - (d) When using wireless links, the signal to be transmitted is modulated onto a carrier wave, rather than using a baseband encoding. With the aid of a diagram, demonstrate the operation of amplitude, frequency, and phase modulation. [6]
 - (e) Briefly state what is the Baud rate of a link. Explain what it means to say a link can send more than one bit per Baud. Give an example of how a wireless signal can be modulated so that two bits can be sent per Baud. [4]
2.
 - (a) Networked applications written in C often use the Berkeley Sockets API. This API provides two different sets of functions that can be used to send/receive data. TCP-based applications call the `send()` and `recv()` functions, while UDP-based applications typically use the `sendto()` and `recvfrom()` calls. Discuss why these two protocols use different calls to send and receive data. State what extra information is passed across the API when using UDP, in both sending and receiving cases. [6]
 - (b) Applications that use UDP often include some form of sequence number as part of the application data they send. With reference to the behaviour of UDP, and the underlying IP layer, explain why this is needed. [6]
 - (c) A commonly used application that runs over UDP is the Domain Name System (DNS). Explain why DNS was written to use UDP, and how it ensures reliability. Discuss whether you think UDP was an appropriate choice of transport. [8]
3.
 - (a) A routing algorithm is used to find the best path from a sender host to a receiver host, when those hosts are not directly connected. We considered both intra-domain routing and inter-domain routing. State what is the difference between these two classes of routing, and in what environment each would be used. [4]
 - (b) A distance vector algorithm is sometimes used for intra-domain routing. Describe what information is stored in the routing tables at each host when using distance vector routing. [4]
 - (c) The link-state routing algorithm is a popular alternative to the distance vector algorithm. Considering the information stored in the routing tables, the complexity of the routing algorithm, and the convergence time, outline the advantages and disadvantages of link-state routing when compared to distance vector routing. [6]
 - (d) Network Address Translator (NAT) devices are widely used in the Internet. Describe the purpose of a NAT, and give four reasons why NAT devices are used in the Internet. [6]