COMP 61242

Two hours

UNIVERSITY OF MANCHESTER
SCHOOL OF COMPUTER SCIENCE

Efficient Computing

Date: Thursday 30th May 2019

Time: 14:00 - 16:00

Please answer all THREE Questions
Each Question is worth 20 marks

Use a SEPARATE answerbook for each QUESTION

This is a CLOSED book examination

The use of electronic calculators is permitted provided they are not programmable and do not store text

[PTO]

Question 1. [20 marks]

a) What is meant by forward error correction (FEC) and automatic re-transmission request (ARQ)? [4 marks]

b) Mention one advantage of FEC over ARQ and one advantage of ARQ over FEC. Does it make sense to combine FEC and ARQ? Explain your answers. [3 marks]

c) You are asked to apply FEC coding to 4-bit messages for transmission over a communication channel. What must be the minimum Hamming distance between any two coded messages if single bit-errors are to be correctable? How many parity bits are needed in this case? [2 marks]

d) How are the parity bits computed? Provide a table showing the values of the parity bits for each possible combination of message bits. [5 marks]

e) Describe the steps the FEC decoder has to perform in order to correct a coded message when it is assumed that, at most, a single bit-error may have occurred. When does the receiver decide that no correction is necessary? [4 marks]

f) What happens when more than one bit-error occurs? [1 mark]

g) How many parity bits would be required to enable single bit-errors to be corrected in 8-bit messages? [1 mark]

Question 2. [20 marks]

a) How does ‘wired equivalent privacy’ (WEP) aim to provide confidentiality, integrity and authentication in IEEE802.11 wireless LANs? What are the functions of the ‘integrity check vector’ (ICV), the ‘RC4’ cipher stream generator, the ‘WEP key’ and the ‘initialization vector’ (IV). Explain why WEP is not considered a good security solution for wireless LANs . [10 marks]

b) Explain what is

(i) a MAC address, and
(ii) an IP address.

Why does a smartphone need to have both these two types of addresses and what are the addresses used for? [8 marks]

c) What might happen if two mobile communication devices were manufactured and released with the same MAC address? [2 marks]

[PTO]

Question 3. [20 marks]

a) What are the main features of the following adaptations of 'transmission control protocol' (TCP) for wireless communications:

(i) Indirect TCP.
(ii) Snooping TCP.
(iii) Mobile TCP. [6 marks]

b) What is meant by 'quality of service' (QoS) and how does the required QoS differ between email (or text messaging), voice telephony and streaming media (speech, music and video) applications? [4 marks]

c) Explain why TCP is rarely used for streaming or telephony and explain why the 'real time transmission protocol ‘RTP’ is more commonly used. What are the features of RTP that make it different from TCP and user-datagram protocol (UDP)? [4 marks]

d) In principle, why are pulses of finite duration not used for data transmission over radio channels with single-carrier modulation? With the aid of a sketch or sketches, indicate what pulses-shapes are generally used and state their main properties. What limitation does the use of such pulses impose on the maximum achievable bandwidth efficiency with binary signalling? [6 marks]

END OF EXAMINATION