One hour - on line

The exam will be taken on line.
This is the paper format, which will be available as a backup.

QUESTION PAPER MUST NOT BE REMOVED FROM THE EXAM ROOM

Please do NOT use the exam paper to write your answers

UNIVERSITY OF MANCHESTER
SCHOOL OF COMPUTER SCIENCE

Digital Wireless Communication and Networks

Date: Wednesday 30th May 2012
Time: 14:00 - 15:00

Please answer any TWO Questions from the THREE questions provided

For full marks your answers should be concise as well as accurate.
Marks will be awarded for reasoning and method as well as being correct.

This is a CLOSED book examination

The use of electronic calculators is permitted provided they are not programmable and do not store text.
1. a) Why is it often useful to talk about ‘symbol rate’ or ‘chip rate’ rather than 'bit rate’ as the data transfer speed for communications channels? (2 marks)

b) Why must some time be left between transmitted symbols? (1 mark)

c) Using simple diagrams where appropriate, explain why it is often possible to support higher wireless data rates indoors than is possible outdoors? How is the maximum usable ‘symbol rate’ approximately determined? (4 marks)

d) How does your answer to 1.c) above affect the bit rate that high speed wireless networks can provide? (2 marks)

e) IEEE 802.11 b, g and a have SIFS values of 10µs, 10µs and 16µs respectively. What are these times needed for? (3 marks)

f) Using IEEE 802.11 as an example, briefly explain how wireless devices should decide what transmit power and bit rates to use in order to maximise efficient spectrum usage. Your answer should consider both:

   i. centrally controlled and ad-hoc/mesh topologies,
   ii. both sparse and dense networks of wireless users. (8 marks)
2.  
   a) What is the main difference between an IEEE 802.11 wireless ad-hoc network and a wireless mesh network? (2 marks)

   b) If a wireless mesh network has a connection via an Access Point (AP) to the infrastructure Internet, suggest how the mesh might efficiently route traffic:
      
      i. between one mesh host and another
      ii. between any mesh host and the connected infrastructure?

   (4 marks)

   c) UDP is described as “fire-and-forget”:
      
      i. How does this apply to UDP packets at the wireless data-link layer and below? (2 marks)
      ii. How can UDP be used by the application layer, to transport data requiring reliable transfer? (2 marks)

   d) What differences might be observed between UDP performance over an IEEE 802.11 link and UDP performance over a wired Ethernet link for unicast, multicast and broadcast traffic? (4 marks)

   e) Why are Not-Acknowledgements (NACKs) seldom used in wireless networks for end-to-end and hop-by-hop failure to deliver confirmation (2 marks)

   f) How would you decide when and how to use acknowledgements for:
      
      i. Sensor data transfer from source to sink in a battery powered sensor network?
      ii. The download of new instructions from the sink to the nodes in a battery powered sensor network?

   (4 marks)
3. a) What is a Decibel (dB)?

b) A mobile phone has a maximum wireless output power of 33dBm whereas another phone has a maximum output power of 30dBm. Express these powers in Watts?

c) What is meant by the term ‘Signal to Noise and Interference Ratio’ (SNIR)? Explain what is included in this ratio.

d) How does the SNIR relate to the number of bit errors experienced on a wireless channel?

e) In a mobile phone network, how is the decision to handover to another base station (using the same technology) made? What different factors should be taken into account when deciding whether or not to carry out a handover?

f) What extra factors might need to be considered if handovers to and from other base station technologies such as between the mobile phone network and IEEE 802.11 are supported?