



Autumn Examinations 2016

Exam Code(s)	3BCT
Exam(s)	BSc Computer Science & Information Technology
Module Code(s)	CT3531
Module(s)	Networks and Data Communications 2
Paper No.	1
External Examiner(s)	Dr. J. Power
Internal Examiner(s)	Prof. G. Lyons Dr. J. Duggan *Dr. D. Chambers

Instructions: Answer any 4 questions.
All questions carry equal marks.

Duration	2 hrs
No. of Pages	3
Department(s)	Information Technology
Requirements	None

Question 1

- a) Explain the difference between *Asynchronous* and *Synchronous* transmission of data. Illustrate, using a suitable example, how *Manchester Encoding* can be used to allow a data receiver to recover the clocking information from transitions in the arriving data. 12 MARKS
- b) Digital signals transmitted via copper wire can sometimes be exposed to radiated electrical noise that can cause interference and potentially data loss in the received signal, especially if the distance involved is over 10m. Suggest a suitable physical transmission scheme that provides some level of immunity against this type of interference on copper wires. 13 MARKS

Question 2

- a) Compute the wavelength of a radio signal having a frequency of 2.4GHz. In what part of the electromagnetic spectrum does this signal belong i.e. would it correctly be described as UHF, Microwave or Infrared? 5 MARKS
- b) What is the main advantage of using a Digital Signal instead of an Analog Signal? Suppose we have a communications channel with 25MHz of bandwidth. How many bits/sec can be sent over one of these channels if 128-level digital signals are used? Assume a noiseless channel. 10 MARKS
- c) Television channels are generally 6MHz wide (in terms of bandwidth). What is the minimum signal-to-noise ratio required to transmit a 72Mbps data stream through one of these channels? 10 MARKS

Question 3

- a) Explain round trip time in the context of Ethernet (IEEE 802.3). The standard minimum frame size allowed on Ethernet (IEEE 802.3) is 64 bytes (from destination address to checksum, including both). Explain the reason behind this limitation. 13 MARKS
- b) Most existing wired Local Area Networks are now based on Cat-5 UTP type cabling. Suggest a suitable modulation and encoding scheme that facilitates fully duplex 100Mbps data transmission using one cable pair in each direction. The physical signal that is transmitted over the cable should have a maximum frequency component of about 31.25Mhz. Explain the solution proposed in your answer and why it would work. 12 MARKS

Question 4

- a) Explain briefly the role and function of the RIPE organisation. What kind of information may be found in the RIPE database? 5 MARKS
- a) In the context of email handling what does the term “DNS Blacklist” mean and how are these used by mail servers? Describe how email transfer agents cope with the transmission of messages containing multiple parts and in some cases arbitrary binary data e.g. image files. 8 MARKS
- b) What are the main enhancements provided in IPv6 over IPv4 and what impact is this protocol likely to have in the way we use the internet? Why has the new protocol not included protocol header support for IP fragments? How many IPv6 addresses are typically being allocated to each customer by ISPs? Give an example of what an IPv6 address will look like. 12 MARKS

Question 5

- a) Why does UDP exist? Would it not have been enough to just let user processes send raw IP packets? 5 MARKS
- b) NUI Galway uses the public IP address range 140.203.0.0/16 for its internal computer network. The University wants to be able to accommodate at least 30 departments with a maximum number of 2000 hosts per department. You are requested to design the optimum network layout using an individual subnet for each department. What is the maximum number of departments that the University can accommodate? Explain the logic of your answer. What subnet mask should be used? 10 MARKS
- c) There are well known problems with the performance of TCP that can occur when a sending application delivers data to TCP one byte at a time or a receiving application reads data from TCP one byte at a time e.g. the individual keystrokes transmitted and received during a remote login session. Suggest a complementary solution to each of these potential problems. 10 MARKS