DUBLIN INSTITUTE OF TECHNOLOGY

KEVIN STREET, DUBLIN 8.

DT228BSc (Honours) Degree in Computer Science

YEAR 2

DT761 Higher Certificate in Science & Technology

SEMESTER 2 EXAMINATIONS 2014

CMPU 2005

DATA COMMUNICATIONS

Mr. D. Bourke

Dr. D. Lillis

Mr. K. Foley

Monday 19th May 2014, 17:00 – 19:00

Attempt all questions in Section A

and four questions from Section B.

Section A carries 40 marks and

Section B carries 60 marks.

Section A

1. Explain why sending a message across a *Packet Switched* network using <u>two</u> smaller packets is faster than sending it in a single packet. Include an illustration in your answer. (8 marks)

2. Using the hex form of the following message (shown on the second line) calculate the 16-bit error detection code using the *checksums* error detection technique. Using the same message describe/demonstrate how this technique can fail. (8 marks)

H	e	l	l	o		w	o	R	l	D	.
48	65	6C	6C	6F	20	77	6F	72	6C	64	2E

3. In relation to *internetworking* describe what is meant by *universal service*. In your answer, briefly describe any <u>two</u> issues that must be addressed in the provision of *universal service*. (8 marks)

4. Two stations A and B employ the HDLC protocol. Station A sends frames (I,3,2) and (I,4,2); what is the next logical <u>data</u> frame returned by station B? Also, what frames/messages are exchanged between stations A and B if station B's frame is not acknowledged? Identify all sequence numbers in your answer. (8 marks)

5. How many 14-host subnets can be derived from 194.10.25.0/27. In your answer identify: the <u>size</u> of the address mask used and the range of addresses associated with each subnet. (8 marks)

Section B

6. In relation to *Transmission System Bandwidth* (TSB):

   i.) Explain, in simple terms, TSB in relation to a continuously oscillating waveform. (5 marks)

   ii.) Explain the impact of TSB on a sharp-edged signal and explain how this impact can be minimized. (5 marks)

   iii.) TSB can also be viewed as "the ability of the Transmission to deal with changes in state". Explain this in relation to the use of *Manchester* encoding versus *NRZ* encoding. (5 marks)

7. In relation to the use of the *Cyclic Redundancy Check* (CRC) *error detection* technique:

   i.) Specify for which type of communication; *Synchronous* and/or *Asynchronous*, is this technique most suited. Justify your answer. (5 marks)

   ii.) Identify the formula used to determine the *Frame Check Sequence* (R) for a given message M and an (n+1)-bit pre-determined divisor P. (2 marks)

   iii.) Calculate, using *modulo 2 arithmetic*, R for the message $M = 11110010001$ and identify the final frame (T) to be transmitted. In your answer show each of the steps involved in the calculation. Assume that the pre-determined divisor is $P = 11011$. (8 marks)

8. In relation to *Synchronous Time Division Multiplexing* (STDM):

   i.) Explain whether this is an *analogue* or a *digital* transmission technique. Justify your answer. (2 marks)

   ii.) Illustrate and explain the operation of an STDM MUX device with n input signals. (8 marks)

   iii.) Assuming the devices connected to each of the inputs/outputs of the MUX/DEMUX devices are exchanging HDLC frames. Do the MUX/DEMUX devices interrogate any of the fields associated with the HDLC frames in transit and if not, why not? (5 marks)

9. In relation to a Packet Switched (PS) network:

   i.) Each node operates in "store and forward" mode. Explain what this means. (4 marks)

   ii.) How does "store and forward" mode address the problem of slow hosts communicating with fast hosts i.e. "speed matching/conversion"? (5 marks)

iii.) Identify four key differences between *Circuit Switched* and *Datagram* Packet Switched networks in terms of: how routing decisions are made, how packets move through the network, the phases of communication and the order in which packets arrive. (6 marks)

10. In relation to IP addressing:

i.) Explain the motivation behind *Network Address Translation* (NAT) and identify the addresses that are reserved for its use. (5 marks)

ii.) Explain the basic operation of the use of this technique for any host on private network 172.18.3.0/27 attached to a router with public address 200.24.5.8 wanting to communicate with an external host on the internet. (5 marks)

iii.) Discuss the limitation of this technique if the router is only assigned a single public address and how this limitation might be addressed if the router was assigned multiple public addresses. (5 marks)