S228/222C

DUBLIN INSTITUTE OF TECHNOLOGY

BSc. (Honours) Degree in Computer Science

Year 2

SUMMER EXAMINATIONS 2014/2015

DATA COMMUNICATIONS [CMPU2005]

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MONDAY 18TH MAY 4.00 P.M. – 6.00 P.M.

TWO HOURS

ATTEMPT ALL QUESTIONS. NOT ALL QUESTIONS CARRY THE SAME MARK.

1. Pairs of communicating devices such as computers, telephones, etc. connected to STDM MUX/DEMUX devices can be considered as having a dedicated pathway between each other. Explain this concept addressing the concepts of *timeslots* and *channels* in relation to the operation of STDM. Use appropriate illustrations where necessary. (10 marks)

2. Framing is an important part of serial Data Communications.

   i.) Explain why *framing* is necessary from the perspective of the Receiver. (4 marks)

   ii.) Illustrate and briefly explain the generic framing structure employed in *asynchronous* and *synchronous* communications. (6 marks)

3. What is the speed of a voice call within Europe? In your answer explain how this speed is calculated and state Nyquist's *Sampling Theorem*. (10 marks)

4. Consider two computers (A and B) communicating using the HDLC protocol. The following scenarios are to be explored using appropriate sequence numbers:

   i.) A sends I(2,2) to B: Identify the next *data-carrying* frame from B to A. (3 marks)

   ii.) B is expecting a response from A to its last transmission as per i) above. What interaction would occur between A and B if A's response does not arrive in a timely manner? (6 marks)

   iii.) A sends I(2,2), I(3,2), I(4,2), I(5,2) to B but the second frame (I(3,2)) does not arrive at B. How would A and B interact to resolve this scenario? (6 marks)

5. Consider the IP address 192.168.10.0.

   i.) What address mask would be required to identify this as Class C address? (1 mark)

   ii.) Assuming the above address is a Class C address how would it be further sub-divided into four equally sized *sub-networks* and what would be the required *sub-network mask*? (1 mark)

   iii.) Identify the start and end address in each address block. (8 marks)

6. In relation to a *Packet Switched* network:

   i.) Illustrate and explain how the size of the packet affects the time taken to deliver a message across the network. In your answer deal with the following scenarios and assume that the network used has four nodes:
   a) Message comprises a single packet containing forty octets of data,
   b) Message comprises two packets each containing 20 octets of data, and
   c) Message comprises four packets each containing 10 octets of data.
   Assume all packets contain three octets of header. (4 marks each)

   ii.) Explain the differences in relation to speed of delivery of the entire message between each of the scenarios and identify the limiting factor in relation to packet size. (3 marks)

7. In relation to communications across a *Bus LAN* that employs *CSMA*:

   i.) Explain the impact of frame collisions and explain, in general terms, how this would normally be addressed using the *Go-Back-N* error control technique. (10 marks)

   ii.) Explain how supplementing CSMA with *Collision Detection* affects the use of *Go-Back-N* error control, if at all. (5 marks)

8. The transmitted frame T = 111100110010101 includes an error detection code that was calculated using the *Cyclic Redundancy Check* (CRC) *error detection* technique. The P-value used in the calculation was $P = 11011$. Test this frame to determine if an error has occurred. In your answer show each of the steps involved in the test. (15 marks)