# DUBLIN INSTITUTE OF TECHNOLOGY

## DT228 BSc. (Honours) Degree in Computer Science

Year 2

## DT282 BSc. (Honours) Degree in Computer Science (International)

Year 2

### SUMMER EXAMINATIONS 2016/2017

### DATA COMMUNICATIONS [CMPU2005]

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MONDAY 15<sup>TH</sup> MAY                    4.00 P.M. – 6.00 P.M.

TWO HOURS

ATTEMPT <u>ALL</u> QUESTIONS. <u>NOT</u> ALL QUESTIONS CARRY THE SAME MARK.

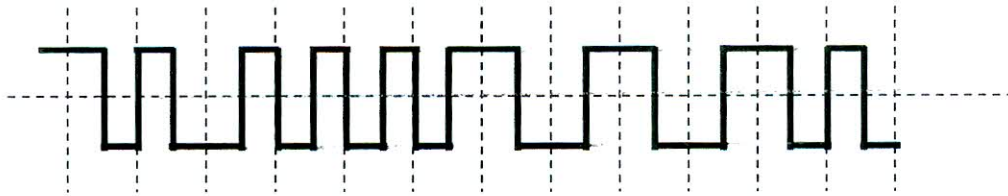1. Given the following waveform in Figure 1 (A *Transmission Signal*):



Figure 1 – A *Transmission Signal*.

(i) Identify the encoding technique used. Justify your answer. (3 marks)

(ii) *Synchronisation* and *D.C. Component* are two problems addressed by this technique. Outline the effects of these problems and how this encoding technique addresses them. (8 marks)

(iii) Based on the encoding technique identified in (i) above identify the bit stream associated with this waveform. (4 marks)

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

(i) Host A sends frame I(1,3) followed by I(2,3) to Host B and both frames arrive intact, Host B has no data to return to Host A. Identify the next frame from Host B to Host A. (3 marks)

(ii) If Host B's last transmission as per (i) above does not arrive at Host A what options does Host A have available? In your answer separately consider the situation where no timers expire on Host A and also, where a timer does expire on Host A. (6 marks)

(iii) Host B sends I(3,1), I(4,1), I(5,1), I(6,1) to Host A but the second frame (I(4,1)) does not arrive at Host A. How would Host A and Host B interact to resolve this scenario? (6 marks)

3. In relation to *internetworking*:

   (i) Describe what is meant by *universal service* and explain why it cannot be achieved across LANs that employ different technologies e.g. Bus and Ring LANs <u>without</u> the use of a Router. (6 marks)

   (ii) Describe the role played by a *Router* in providing *Universal Service*. (3 marks)

   (iii) Explain the process by which the Router receives data off a connected LAN and describe the high-level steps undertaken by the Router in moving data onto the next interconnected LAN towards the Destination Host. In your answer identify all PDUs involved in this process. (6 marks)

4. In relation to a *Bus Local Area Network* (LAN):

   (i) Describe the operation of the *CSMA* technique employed on this type of LAN explaining how collisions can occur. (6 marks)

   (ii) Identify and explain the additional technique employed by a Transmitting station to minimise the effects of collisions. (5 marks)

   (iii) Explain why *frame length* is an important consideration when the technique identified in (ii) above is employed and explain how it is considered. (4 marks)

5. Refer to Figure 2 (*A Sub-netted Network*). Given the Class C network address 204.15.5.0/24. Answer the following questions in relation to the <u>efficient</u> subnetting of this network address i.e. with minimal wastage of addresses, to create a sub-netted network as shown in Figure 3 with the following host requirements: Net A = 14 Hosts, Net B = 28 Hosts, Net C = 2 Hosts, Net D = 7 Hosts and Net E = 28 Hosts.

   For <u>each</u> sub-network identify:
   (i) The Network Address and Network Mask in CIDR (/slash) notation. (5 marks)
   (ii) The *Start* and *End Host* addresses. (10 marks)
   (iii) The *Broadcast* address. (5 marks)

   All addresses to be presented in Dotted Decimal Notation. Also, show the main steps involved in your calculations.
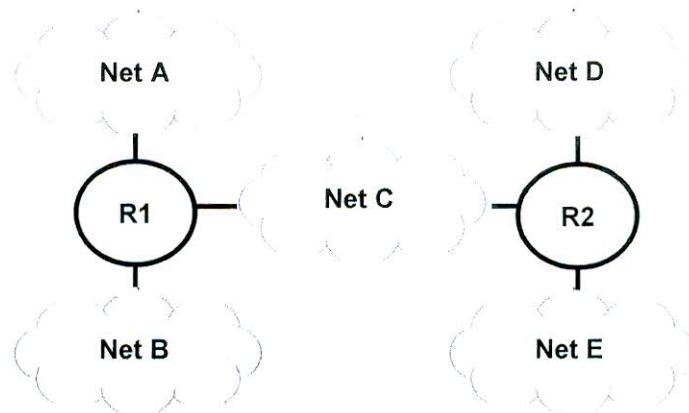
Figure 2 – *A Sub-netted Network.*

6. Given the internetwork in Figure 3 (*An Internetwork*). Consider the following scenarios; Host A has both Host B and Host Ds' IP addresses and wants to send a datagram separately to each of these hosts.
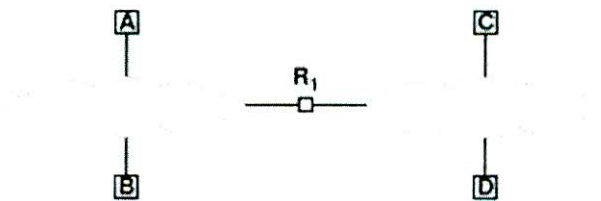


Figure 3 – *An Internetwork.*

(i) For each datagram transmission, identify which device's MAC address is contained in the Destination field of the *frame* leaving Host A.  (5 marks)

(ii) Identify which device's MAC address is contained in the Destination field of any response frames from Hosts B and D.  (5 marks)

(iii) Assuming Host A has no prior knowledge of any Host MAC addresses, explain the operation of the *Address Resolution Protocol* using the example of Host A obtaining the MAC address of Host B. In your answer identify the *Source* and *Destination* MAC addresses and *Source* and *Destination* IP addresses contained in any frames/datagrams exchanged.  (10 marks)