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 2015/2016

DATA COMMUNICATIONS [CMPU2005]

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MONDAY 16TH MAY 4.00 P.M. – 6.00 P.M.

TWO HOURS

Attempt all questions. NOT all questions carry the same mark.

1. Refer to Figure 1 – Router Architecture. Develop the routing tables for routers 1 and 2 identifying for each *destination network* the associated *mask* in dotted-decimal notation and the *next hop*. (10 marks)

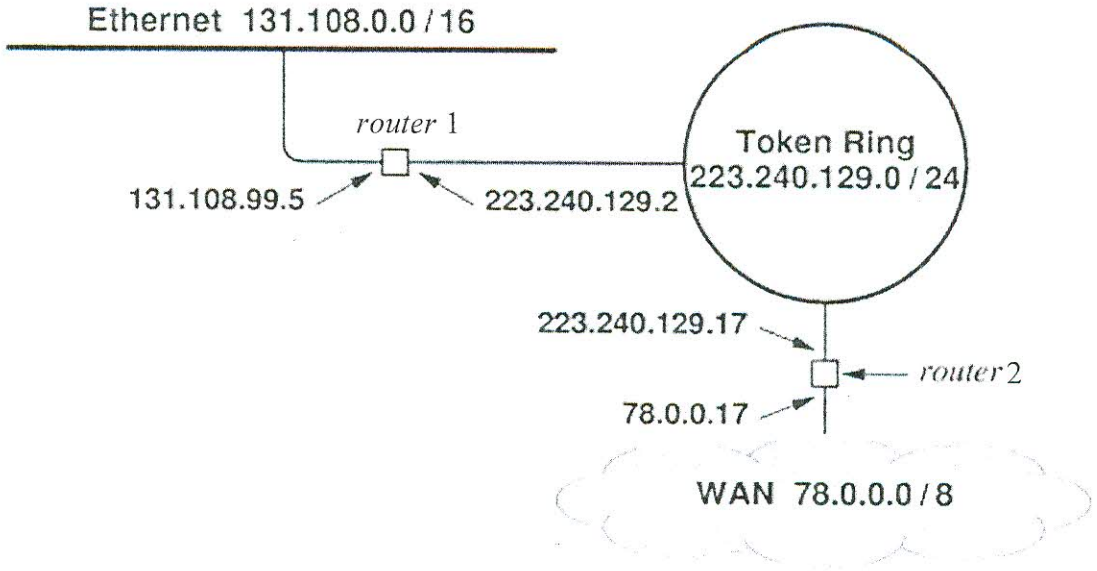
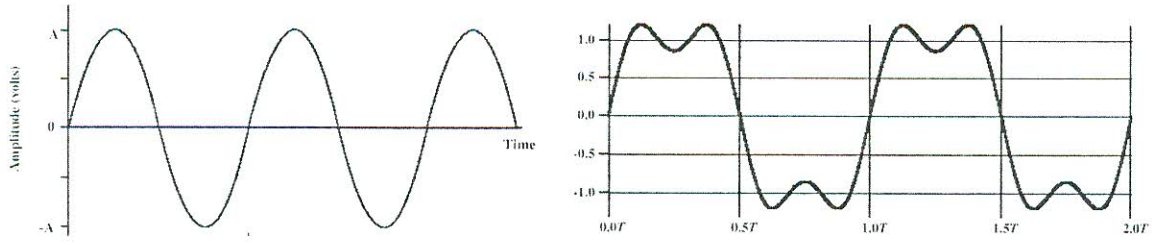


Figure 1 – Router Architecture

2. Consider a Transmission System with a bandwidth of 15MHz. and two Transmission Signals; (as illustrated in Figure 2 - Two Waveforms) one a simple sine wave of frequency (**f** Hz.) and the other a composite waveform comprising two components at **f** Hz. and **3f** Hz.



$s(t) = \sin(2\pi ft)$ $\quad\quad$ $s(t) = \sin(2\pi ft) + {}^{1}/_{3}\sin(2\pi(3f)t)$

Figure 2 – Two Waveforms.

(i) For each Transmission Signal: Calculate the maximum frequency the Transmission Signal can be transmitted across the Transmission System without distortion. In your answer outline the logic of your approach. (5 marks)

(ii) Given the particular shape of each Transmission Signal and assuming no other encoding techniques are used, what bit pattern could usefully be carried by each signal? (5 marks)

(iii) Assuming the bit pattern from (ii) above. For each Transmission Signal: What is the fastest data rate that can be achieved across this Transmission System? In your answer outline the logic of your approach. (5 marks)

3. Figure 3 identifies the typical components associated with the Virgin TV service offering:

(i) Identify the type of signals associated with letters A, B and C. Justify your answer. (6 marks)

(ii) Identify the function of the devices indicated with letters D, E and F. In your answer explain what each device is used for. (6 marks)

(iii) In relation to the co-axial cable indicated with the letter C: Illustrate and briefly explain how the signal on this cable would appear when looked at from the perspective of the *frequency domain*. Restrict your answer to the TV services identified in the diagram. (3 marks)

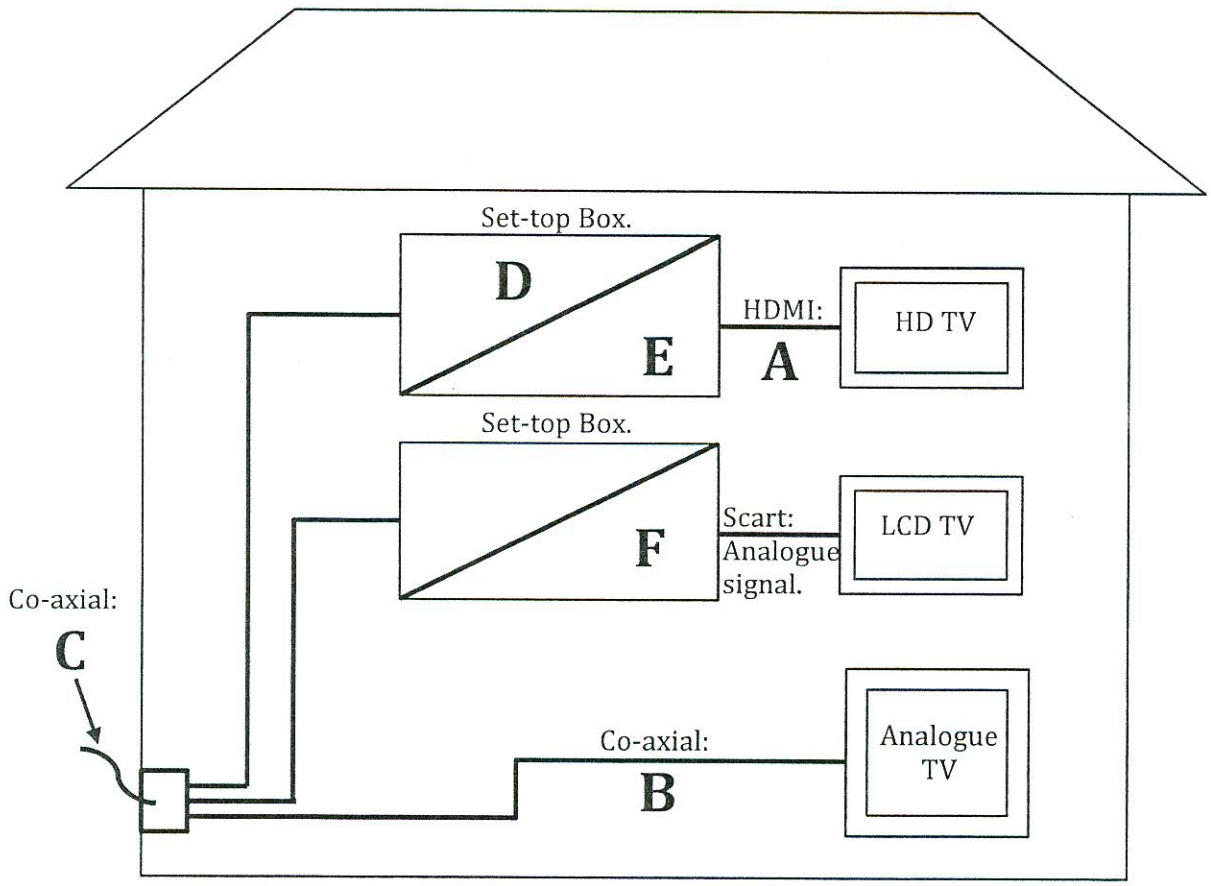


Figure 3. – The subscriber components associated with the Virgin TV service offering.

4. In relation to the use of *error control* techniques:

   (i) From the perspective of a Receiving station only: Explain how the use of the *Go-back-N* technique differs from the *Selective Reject* technique when an ***out-of-sequence*** frame arrives. (5 marks)

   (ii) From the perspective of the Transmitting station responding to the Receiver station as per (i) above: Explain how the use of the *Go-back-N* technique differs from the *Selective Reject* technique. (5 marks)

   (iii) From the perspective of a Transmitting station only: Explain how the use of the *Go-back-N* technique differs from the *Stop-and-Wait* technique when a timer expires for a frame previously transmitted. (5 marks)

5. In relation to *routing* strategies on a *Packet-switched* network:

   (i) Briefly explain the following five requirements for routing strategies: Simplicity, Optimality, Correctness, Efficiency and Fairness. (5 marks)

   (ii) Briefly describe the operation of the following routing strategies from the perspective of an individual Packet Switch node making a routing decision for a packet arriving at one of its input ports: *Flooding* and *Fixed.* (5 marks)

   (iii) Compare/contrast the Fixed and Flooding routing strategies in relation to the following routing requirements: *Simplicity* and *Efficiency.* (5 marks)

6. In relation to a *Star Local Area Networks* (LANs):

   (i) Identify and briefly describe the chracteristics of the two types of *hub* device (the *shared-medium hub* and the *switched LAN hub*) that can be used in a Star LAN. (5 marks)

   (ii) Identify the medium access technique employed on each LAN and explain if collisions are possible when either hub device is used. (5 marks)

(iii) Refer to figure 4 – Performance on a Star-LAN. The diagrams (Left and Right) in figure 4 illustrate the overall performance on each of the LANs discussed in (i) above. Explain the diagrams. In your answer identify which diagram relates to which type of hub device.

(5 marks)

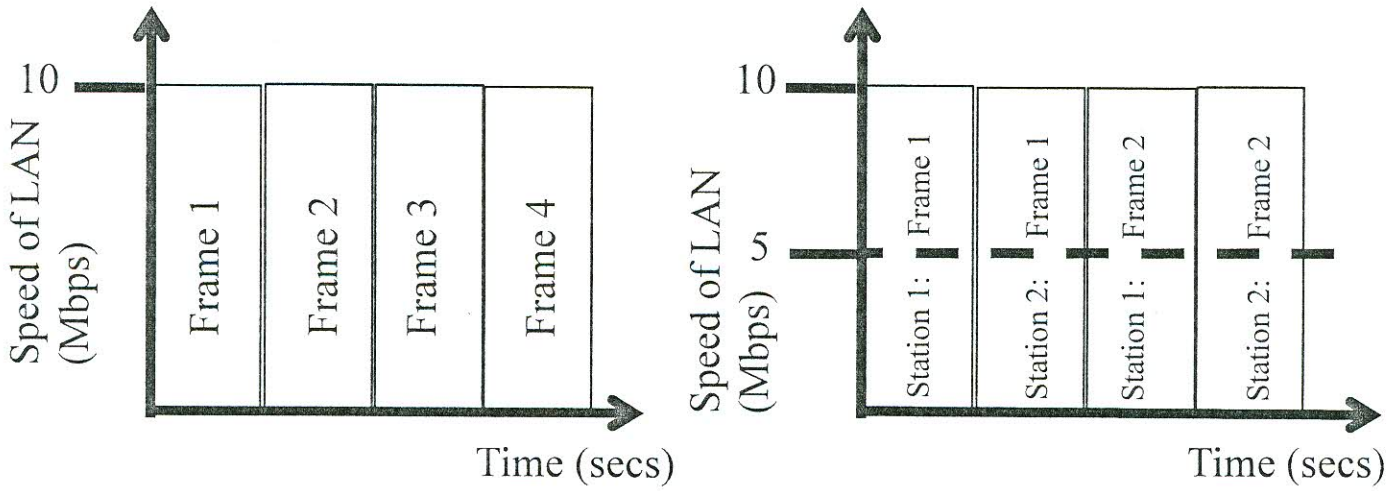


Figure 4 – Performance on a Star-LAN.

7. An ISP is granted a block of addresses starting with 190.100.0.0/16 (contains 65,536 addresses). The ISP needs to distribute these addresses to two groups of customers as follows:
   - Group 1 has 64 customers each requiring 256 addresses, and,
   - Group 2 has 128 customers each requiring 128 addresses.

   Assuming that Group 1 customers are allocated addresses first, followed by Group 2 customers.

   (i) Separately for each group identify: the first, second, third and last customer address blocks. For each customer specify the first and last host addresses, the address mask used, the *network* and the *broadcast* addresses. (10 marks)

   (ii) Identify how many addresses from the original block remain after these allocations. (5 marks)