14/5/2019

14.00 - 16.00pm

CMPU 2005 Data Communications

Basement 1, Kevin Street

Programme Code: DT228, DT282
Module Code: CMPU 2005
CRN: 22396, 26459

TECHNOLOGICAL UNIVERSITY DUBLIN

KEVIN STREET CAMPUS

BSc. (Honours) Degree in Computer Science

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

Year 2

SEMESTER 2 EXAMINATIONS 2018/19

Data Communications

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Answer <u>All</u> Questions

Special Instructions/Handouts:

Not all questions carry equal marks.

1. Consider a Transmission System comprising a single electrical cable with a bandwidth of 30MHz.:

   (i) Explain the concept of transmission system bandwidth. In your answer refer to the use of a *simple sinusoidal* waveform as the transmission signal identifying the maximum frequency of the waveform. (5 marks)

   (ii) Having identified the maximum frequency of the *simple sinusoidal* waveform in (i) above, explain how this transmission system bandwidth limitation affects data rate. In your answer identify the maximum data rate achieveable with this signal assuming no other signal parameters are changed. (5 marks)

   (iii) If *digital* transmission signals are used instead, state whether this transmission system bandwidth limitation can be shared to facilitate simultaneous communications between multiple stations. Justify your answer with reference to transmission *signal* bandwidth. (5 marks)

2. Consider two computers (Hosts A and B) communicating using the HDLC protocol and employing the *Selective Reject Error Control* technique with modulo eight numbering. The following scenarios are to be explored using appropriate sequence numbers:

   (i) Host A sends frame I(5,2), I(6,2) and I(7,2) to Host B and all frames arrive intact. Identify the next **data** frame from Host B to Host A. (3 marks)

   (ii) Host B sends I(1,4), I(2,4), I(3,4), I(4,4) and I(5,4) to Host A. **One** of these frames fails to arrive causing Host A to respond immediately with SREJ(3) which in turn results in a response from Host B. This last transmission from Host B arrives successfully at Host A and no further transmissions are made at this point.

   The following table (Table 1 – *Incoming and outgoing buffers*) identifies three distinct events on the top row. Below each event there are a number of cells representing the contents of incoming and outgoing buffers on each host. Replicate the table in your answer book. For each event, enter the appropriate frame numbers identified above into each cell. If you believe there is nothing stored in a buffer simply enter the word 'Blank' in the appropriate cell. (12 marks)

	Prior to SREJ(3) leaving Host A.	**After** SREJ(3) has left Host A but **prior** to it arriving at Host B.	**After** Host B's response to SREJ(3) arrives at Host A.
Host A's incoming buffer			
Host B's outgoing buffer			

Table 1 – *Incoming and outgoing buffers.*

   (iii) Identify the next **data-carrying** frame from Host A to Host B after the missing frame has been dealt with as per (ii) above. Justify your answer. (5 marks)

3. In relation to LANs:

(i) Discuss the role of a Repeater device in extending the reach of a Bus LAN. In your answer separately explain how the device works in normal operation and when a collision occurs. (5 marks)

(ii) Discuss the role of a Bridge device in extending the reach of a Bus LAN. In your answer separately explain how the device works when there are no entries in the routing table and when the routing table is complete. (5 marks)

(iii) Explain how the routing table on a Bridge device is automatically populated. (5 marks)

4. In relation to collisions on a *Wired* and *Wireless* LANs:

(i) Frame size has a critical role to play in minimizing the effects of collisions on a Wired LAN. Explain why this is the case. (5 marks)

(ii) Assuming the propagation time (T_p) on a 10Mbps Bus LAN is 25.6μs. (25.6×10^{-6} seconds), calculate the minimum frame length, in bytes, required for this LAN. In your answer show your calculations. (5 marks)

(iii) Referring to the "Hidden Station Problem", explain why the technique used to detect collisions on a Wired LAN cannot be used on a Wireless LAN. In your answer identify the technique used on a Wireless LAN. (5 marks)

5. Refer to Figure 1 (*A Sub-netted Network*) and Table 2 (*Empty Address Table*). Given the following network address, 192.168.100.0/24:

(i) You are required to sub-net this address space to provide for at least 25 usable host addresses for each of the LANs shown. Transcribe the following table (Table 2 – *Empty Address Table.*) into your answer book and complete the entries for each of the sub-networks, A-E inclusive, using dotted-decimal notation. (10 marks)

Subnet	Network Address	First Host Address	Last Host Address	Broadcast Address	Mask
A					
B					
C					
D					
E					

Table 2 – *Empty Address Table.*

(ii) If Net-C is simply a connection between Routers 1 and 2 and will never have any other hosts connected to it, identify a more suitable address mask (in dotted-decimal notation) for this network such that there would be minimal wastage of addresses. (5 marks)

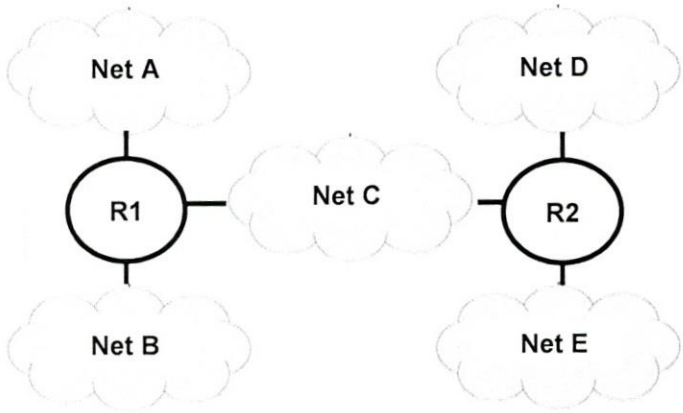

Figure 1 (*A Sub-netted Network*)

6. Given the internetwork in Figure 2 (*An Internetwork*). Router 1 has been allocated addresses 30.0.0.7 and 128.1.0.8 and Router 2 has been allocated addresses 128.1.0.9 and 192.4.10.9.

(i) Develop the high-level routing table for <u>each</u> of the routers identifying the *Next Hop* for each of the destination networks. (6 marks)

(ii) Consider a packet arriving at Router 1 with destination address 192.4.10.25. Outline the process by which the router would use the routing table developed in (i) above to route this packet. In your answer identify the outcome of the routing decision for a packet containing this destination address. (5 marks)

(iii) Having made a routing decision as per (ii) above, identify any additional addressing information required to deliver the packet and how this information would be obtained using ARP. Assume that the additional addressing information is <u>not</u> already known to the router. In your answer identify the source and destination addresses contained in all ARP messages and associated frames.

(9 marks)

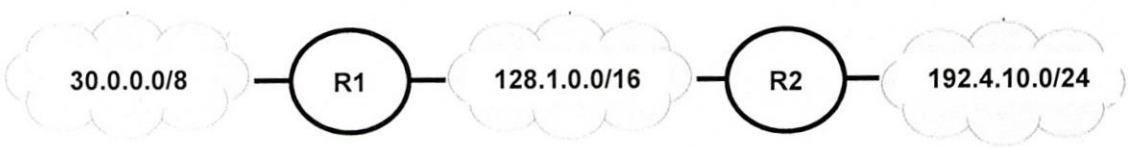

Figure 2 - *An Internetwork.*