

TECHNOLOGICAL UNIVERSITY DUBLIN

Grangegorman

TU856 – BSc. (Honours) in Computer Science

TU858 – BSc. (Honours) in Computer Science (International)

Year 2

SEMESTER 2 EXAMINATIONS 2022/23

Data Communications

Internal Examiners

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External Examiner

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Instructions

Answer 4 out of 5 questions.

All questions carry 25 marks.

Duration: 2 hours.

Special Instructions: Strike out excess questions answered.

1. In relation to *Transmission Impairments* on an electrical cable
- (i) What is *signal attenuation*? In your answer explain the type of signal it affects (analogue or digital).
(5 marks)
 - (ii) Explain the operation of each of the following devices used to address attenuation and compare each in terms of how it deals with noise: amplifier and repeater.
(5 marks)
 - (iii) Describe *thermal noise* and *impulse noise* and identify possible sources of such impairments.
(5 marks)
 - (iv) With reference to Shannon's Noisy Channel Capacity formula, explain the effect on channel capacity as noise increases towards infinity i.e. an extremely noisy channel. In your answer, state the formula and explain the associated parameters.
(10 marks)
2. Consider the operation of the *Go-Back-N* and *Stop-and-Wait Error Control* techniques. In each of the following questions structure your answer to highlight each technique separately, explaining the operation of the transmitter and receiver stations and, identifying the purpose of any numeric values included in messages leaving each station.
- (i) For each technique, separately explain the operation of the transmitter and receiver stations in *normal operation* i.e. when no error conditions are present.
(5 marks)
 - (ii) For each technique, separately explain the operation of the transmitter and receiver stations when a frame is *lost*. In your answer identify how the lost frame is detected.
(10 marks)
 - (iii) For each technique, separately explain the operation of the transmitter and receiver stations when the receiver station is implementing flow control. In your answer identify any command messages that may be issued and how transmission is resumed.
(10 marks)

3. In relation to *contention* on a Local Area Network (LAN):

- (i) Explain how the use of CSMA gives rise to *contention*. In your answer explain the operation of CSMA and explain the role of backoff timers. (5 marks)

- (ii) Illustrate and explain the effects of *contention* on the performance/throughput of the LAN.

Diagram: (3 marks)
Explanation: (5 marks)

- (iii) Refer to Figure 1 – *A bridged and non-bridged network*. Explain how the use of a bridge device reduces the impact of contention on the perceived performance of the LAN (assumed to operate at 10Mbps). In your answer explain the concept of *parallelism* and give a rough estimate of the performance/throughput of the LAN from the perspective of any individual station. (12 marks)

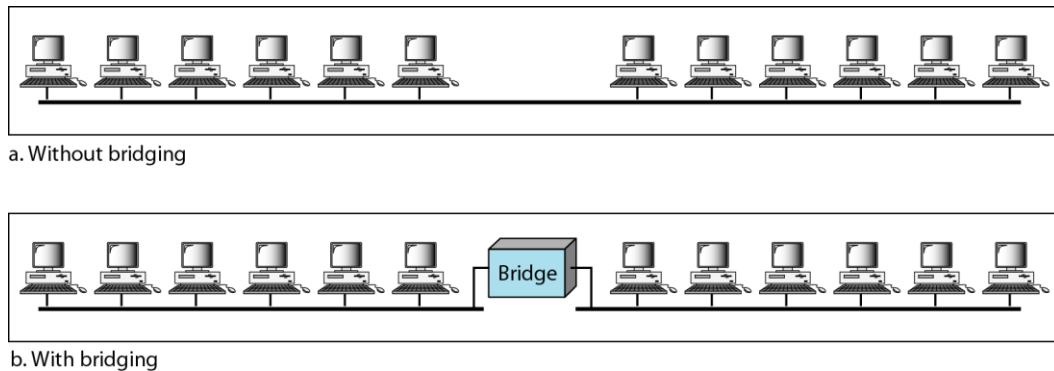


Figure 1 – *A bridged and non-bridged network*.

4. Given the internetwork in Figure 2 (*An Internetwork*). Router 1 has been allocated addresses 192.168.10.1 and 209.165.200.225 and Router 2 has been allocated addresses 10.1.1.1 and 209.165.200.226.

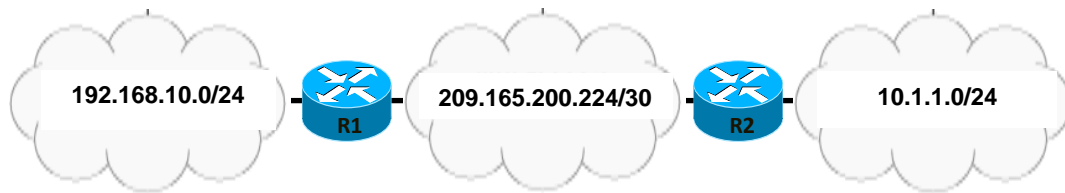


Figure 2 - *An Internetwork*.

- (i) Explain the concept of *next hop* routing. In your answer describe, at a high level, the operation of routing from the point where a datagram packet arrives at a router and identify the outcome from the routing process. Restrict your discussions to IP addresses only.

(5 marks)

- (ii) Develop the high-level routing table for both routers, R1 and R2, identifying the *Next Hop* address for each of the destination networks.

(8 marks)

- (iii) Having completed the routing process identified in (i) above, the router uses *address resolution*. Identify the outcome of address resolution and explain the role *ARP request/response messages* play in the process. In your answer identify which of the following addresses are placed in the source/destination MAC address fields and source/destination IP address fields of the ARP request/response packets (ignore the address fields of the frames carrying the packets):

Router MAC address, Router IP address, 00:00:00:00:00:00, Network Broadcast IP address, Next Hop MAC address, Next Hop IP address, FF:FF:FF:FF:FF:FF. Note: Not all addresses are used

(12 marks)

5. Given the IP address block: 192.168.1.0/24. Using VLSM, identify appropriate sub-net addresses to meet the following network requirements: Net A = 28 Hosts, Net B = 52 Hosts, Net C = 15 Hosts, Net D = 5 Hosts. Copy the following table into your answer book and insert the IP addresses in Dotted Decimal Notation and Masks in CIDR notation. Also, show the main steps involved in your calculations.

N/W.	Mask	N/W Address	Starting Host	End Host	Broadcast Address
A:					
B:					
C:					
D:					

Table: (12 marks)

Calculations: (13 marks)