

**OLLSCOIL NA hEIREANN, CORCAIGH  
THE NATIONAL UNIVERSITY OF IRELAND, CORK**

**COLAISTE NA hOLLSCOILE, CORCAIGH  
UNIVERSITY COLLEGE, CORK**

**Summer Examination 2006  
Second Science**

**Computer Science  
CS2204 – Network Computing**

Professor S. Craw  
Professor G. P. Provan  
Professor C. J. Sreenan  
Dr. D. Grigoras

You may use a calculator.  
Use separate answer books for Parts A and B.

Time allowed: 3 hours

**PART A  
Dr. D. Grigoras**

**ANSWER BOTH QUESTIONS.**

**Question A-1 [20 marks]**

Authentication is of paramount importance to secure network communication; it means proving someone's identity without any doubt. Explain what is a Key Distribution Center (KDC) and how KDC can assist in the authentication process. Show graphically how can two users registered with the same KDC share a symmetric key for their communication. Comment on all steps of this protocol.

**Question A-2 [40 marks]**

TCP is considered a reliable transport protocol. One key element of this protocol is the sequence number.

- a) Explain the role of the sequence number and how it is used by TCP. Where does the sequence number appear in the TCP segment format? *[12 marks]*
- b) Let's consider two hosts, A and B, that have an open TCP session. A sends a segment with sequence number 120 and after some time receives a segment from B with sequence number 300 and acknowledgment number 140. How many bytes were received and confirmed by host B? What is the meaning of 300? *[12 marks]*
- c) If B receives two segments from A with no errors, the first with sequence number 120, and the second with sequence number 220, and each carries 50 bytes, what will be the acknowledgment number sent by B to A? *[8 marks]*
- d) Out-of-order segments can be ignored or buffered by the receiver. What are the benefits of each of the two methods? *[8 marks]*

**PART B**  
**Professor C.J. Sreenan**

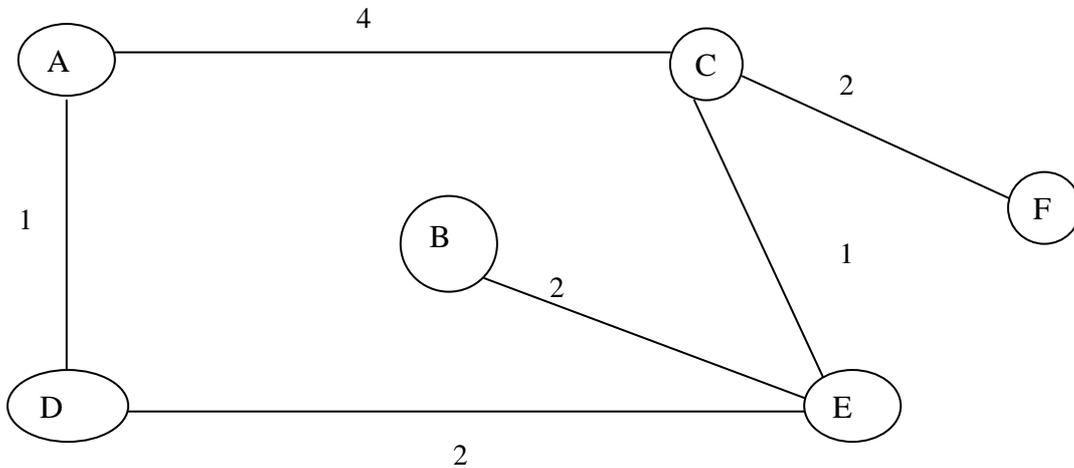
**ANSWER ANY TWO QUESTIONS.**

**Question B-1: Packet Switching [40 marks]**

a) [20 marks] Define the datagram and virtual circuit switching approaches. Compare them using the following three headings. Please keep your comments brief and concise.

- a) Delay
- b) Failures
- c) Overhead

b) [10 marks] For the network given in the figure below, you are asked to show the sequence of tables as they appear in the process of generating the final global *Distance-Vector* routing table. Confirm that the initial table as provided is correct and use it as a starting point by copying it into your answer book.



From Node	(Distance) To Node					
	A	B	C	D	E	F
A	0	$\infty$	4	1	$\infty$	$\infty$
B	$\infty$	0	$\infty$	$\infty$	2	$\infty$
C	4	$\infty$	0	$\infty$	1	2
D	1	$\infty$	$\infty$	0	2	$\infty$
E	$\infty$	2	1	2	0	$\infty$
F	$\infty$	$\infty$	2	$\infty$	$\infty$	0

c) [10 marks] Routing protocols typically assign a cost to each network link. A simple approach is to assign a static cost of 1 to each link, but more sophisticated approaches use dynamic metrics. Identify some dynamic metrics that can be used. Give an example to illustrate the benefit of using a dynamic metric instead of a static metric. Explain what bad effects can result if dynamic metrics are not used properly in making routing decisions.

**Question B-2: Internetworking [40 marks]**

a) [20 marks] Expand the acronym DHCP and state briefly the purpose of using DHCP. Explain the difference between static and dynamic allocation of addresses by a DHCP server. When allocating dynamic addresses, what mechanism is used by DHCP to deal with reclaiming addresses from hosts that become disconnected, crash, etc?

b) [10 marks] Using an example, explain the motivation for using *classless* IP addressing. A new Internet Service Provider (ISP) is allocated the following address: 200.23.16.0/23. Explain what is meant by this address syntax. The ISP decides to use 3 bits to divide its address range equally amongst its clients – how many clients can it support and, how many hosts can each client have on the network?

c) [10 marks] As the Internet has evolved, new protocols and techniques have been devised to cope with new challenges and opportunities. Three such developments are:

1. IP version 6 (IPv6)
2. Virtual Private Networks (VPNs)
3. Network Address Translation (NAT)

Select *one* of these topics, explain the nature of the issue(s) it addresses, the salient features of its design and operation, and provide some comments on its effectiveness.

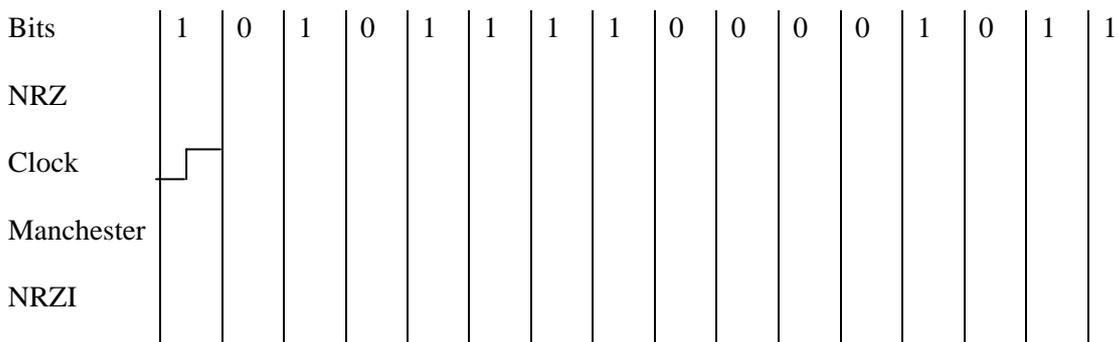
**Question B-3: Link Layer [40 marks]**

a) [20 marks] Explain how each of the following error detection techniques work. Please keep your comments brief and concise.

1. Two-Dimensional Parity
2. Checksum
3. Cyclic Redundancy Check (CRC)

State which technique is considered to be the most effective in terms of its ability to detect a wide range of errors.

b) [10 marks] Copy the diagram below and use it to show, the NRZ, Manchester and NRZI encodings for the bit sequence shown. Assume the clock starts out low as shown.



c) [10 marks] In classic Ethernet, explain using a diagram why a minimum frame size is required. CSMA/CD can detect when collisions occur, but how might a CSMA-style scheme be changed to *avoid* collisions?