

UNIVERSITY COLLEGE DUBLIN

NATIONAL UNIVERSITY OF IRELAND, DUBLIN

An Colaiste Ollscoile Baile Atha Cliath
Ollscoil na hEireann, Baile Atha Cliath

AUTUMN EXAMINATIONS 2004

**SCHDF0018 - HIGHER DIPLOMA IN COMPUTER SCIENCE EXAMINATION
ARBDF0015 – THIRD YEAR ARTS EXAMINATION**

COMPUTER SCIENCE

COMPP303: Networks and Internet Systems
COMP3616: Networks and Internet Systems

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Time allowed: 1 hour and 45 minutes

Answer Question 1 (*COMPULSORY*) and *any two* of Questions 2–5.

All questions carry equal marks.

Loose Rough Work sheets are not to be distributed or used.

READ EACH QUESTION CAREFULLY.

Question 1 (COMPULSORY)

(1-a) Briefly explain the terms *connection-oriented* and *connectionless* service as they apply to computer networks, mentioning the essential features of each type of service.

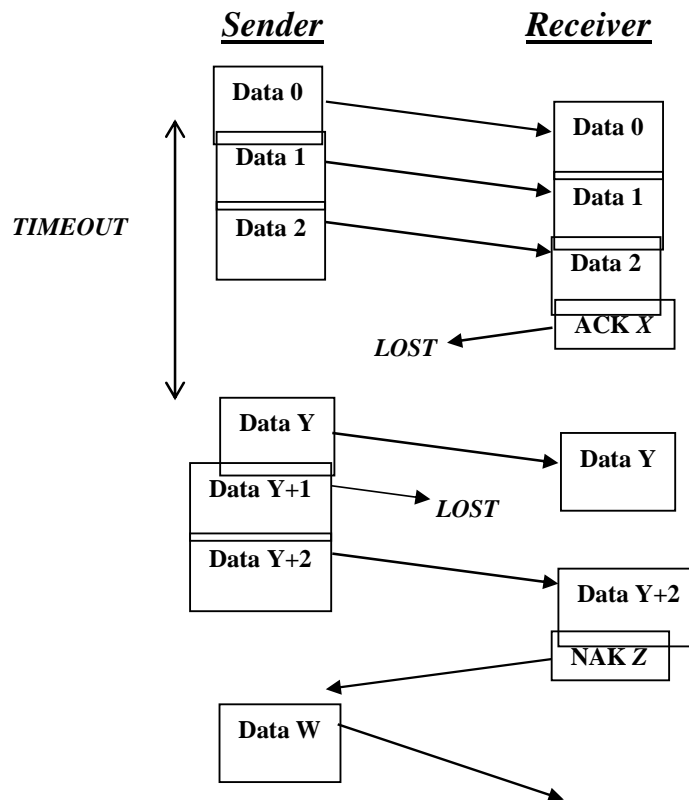
(1-b) 60 nodes are connected to a 1,000 metre length of coaxial cable. Using some protocol, each node can transmit 75 frames/second, where the average frame length is 1,500 bits. The transmission rate at each node is 10 Mbps (in other words: 10,000,000 bps). What is the numerical value for the *efficiency* of this protocol?

(1-c) Draw a diagram to illustrate the data transmission process in the ISO Reference Model for OSI, clearly specifying which protocol layers are implemented in communication devices within the network and which layers are implemented only in the end devices.

(1-d) The router connecting a company's network to the Internet applies the mask **255.255.252.0** to the destination addresses of incoming IP packets. Given a destination IP address of **154.33.7.220**, show how the router determines which *subnetwork* this packet should be sent to, and state the *Netid*, *Subnetid*, and *Hostid* components of this IP address.

Question 2

(2-a) Consider the following timing diagram for a *Go-back-n* ARQ scheme with $n = 3$:



State the values for **X**, **Y**, **Z** and **W** in this diagram.

[Question 2 continues]

[Question 2 continued]

(2-b) Draw example timing diagrams to show how a *Stop-and-wait* ARQ scheme copes with

1. a damaged data frame;
2. a lost data frame; and
3. a lost ACK.

Question 3

(3-a) State whether the following statements are TRUE or FALSE (*no explanation required*):

1. The Single Parity Check can **detect** any odd number of bit errors in a transmitted codeword.
2. In Ethernet, a node wishing to transmit might **never** be allowed to access the channel.
3. The IEEE 802 Medium Access Control (MAC) protocol is **independent** of the particular broadcast Local Area Network technology (Ethernet, Token Ring, Token Bus, etc) being used.

(3-b) Briefly describe the principal differences between UDP and TCP.

Question 4

(4-a) A *routing algorithm* provides the logic used by a router in a packet-switched network to decide, for each incoming packet, which output link the packet should be transmitted on. Briefly describe the desirable properties of a routing algorithm.

(4-b) Briefly describe *datagram packet-switching* and *virtual circuit packet-switching*, mentioning the information required in the network routers in each case.

Question 5

(5-a) Consider a TCP connection using the slow-start congestion control scheme with an initial THRESHOLD value of 64 kB and a Maximum Segment Size (MSS) of 2 kB. The receiver's advertised window is initially 32 kB. The first transmission attempt is numbered 0, and all transmission attempts are successful **except** for Timeouts on attempt numbers 4 and 10. In the ACKs for transmission attempt number 14 and subsequently, the receiver's advertised window is **reset** to 12 kB.

Find the size in kB of the *sender's congestion window* for its first 17 transmission attempts (that is, numbers 0 – 16).

(5-b) In IP-based networks, a sending host can find the physical address which corresponds to the IP address of its intended destination by using the *Address Resolution Protocol (ARP)*. Briefly explain how ARP works.

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