

The University of Nottingham

SCHOOL OF COMPUTER SCIENCE

A LEVEL 2 MODULE, SPRING SEMESTER 2008-2009

COMPUTER COMMUNICATIONS AND NETWORKS (Module G52CCN)

Time allowed TWO hours
Answer THREE questions

Candidates may complete the front cover of their answer book and sign their desk card but must NOT write anything else until the start of the examination period is announced.

Answer 3 out of 5 questions

Marks available for sections of questions are shown in brackets in the right-hand margin

Only silent, self-contained calculators with a single-line display are permitted in this examination.

Dictionaries are not allowed with one exception. Those whose first language is not English may use a dictionary to translate between that language and English provided that neither language is the subject of this examination.

No electronic devices capable of storing and retrieving text, including electronic dictionaries, may be used.

DO NOT turn your examination paper over until instructed to do so

1. Data transmission (25 marks)

- a) Describe the following transmission media:
(i) Twisted pair cable
(ii) Co-axial cable
(iii) Fiber optic cable
(iv) Radio
(v) Microwave
(vi) Satellite (4)
- b) Compare these transmission media in terms of their capacity, current cost, range, reliability and directionality. (5)
- c) With the aid of diagrams, explain, compare and contrast time division multiplexing and frequency multiplexing. (6)
- d) How many levels of signal for encoding should be used in order to achieve 8000 Kbits/s data rate over an error free medium that has bandwidth of 1000 Kbits/s? (2)
- e) Describe RS-232 standard and draw a RS-232 waveform graph for a sequence of seven bits: 1011010. (3)
- f) Describe how radio and microwave communications systems can be extended through the use of satellites. Explain the difference between geosynchronous and LEO (Low Earth Orbit) satellites. (5)

2. Local area networks (25 marks)

- a) Briefly describe and compare the three approaches of parity bits, checksums and cyclic redundancy check of detecting transmission errors in packets of data. (7)
- b) Describe the idea of a single shared communication medium as the basis for Local Area Network (LAN) technologies. What are the advantages of this approach? (4)
- c) Compare and contrast repeaters and bridges as ways of extending LANs. (4)
- d) Describe the mechanisms of frame filtering that is used by bridges. (4)
- e) Figure 1 shows a bridge that connects two LAN segments, each containing three computers. The table lists a sequence of events. Each event involves one of these computers transmitting a packet to another. This table also contains a column to summarise the knowledge that the bridge has accumulated up to that point about which computers are on which segments. A further column is included to show on which segments each packet will appear. Assuming that the packets are transmitted in the order they appear in the table, write down a completed version of this table.

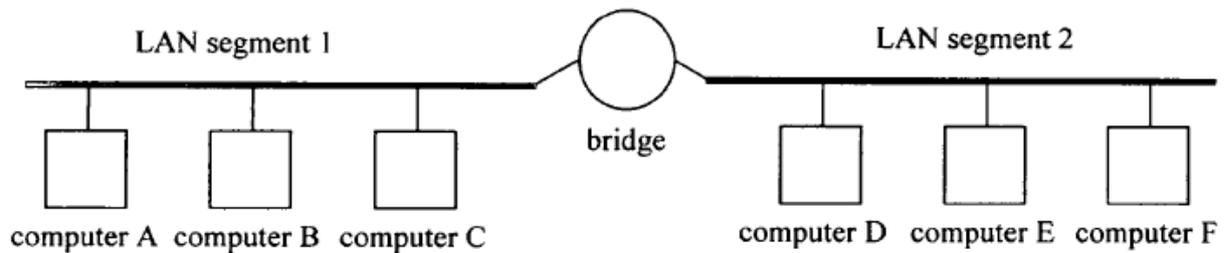


Figure 1.

Event (transmission of a packet)	Knowledge of bridge about which computer on which segments	Packet appears on which segments.
B sends packet to A		
B sends packet to F		
C broadcasts		
D sends packet to C		
A broadcasts		
F sends packet to B		
D sends packet to F		
E sends packet to F		

(6)

3. Wide area networks (25 marks)

a) Define the term "packet switch" and explain how packet switches are used to create Wide Area Networks. (WANs) (4)

b) Explain the principle of next-hop forwarding. Describe the structure of routing table within a packet switch and explain how it is used in next-hop routing. (4)

c) Explain what is meant by the term the shortest path from one packet switch to another. (2)

The graph in Figure 2 summarises the connection between six packet switches that form the backbone of a wide area network, including the communication distances between them.

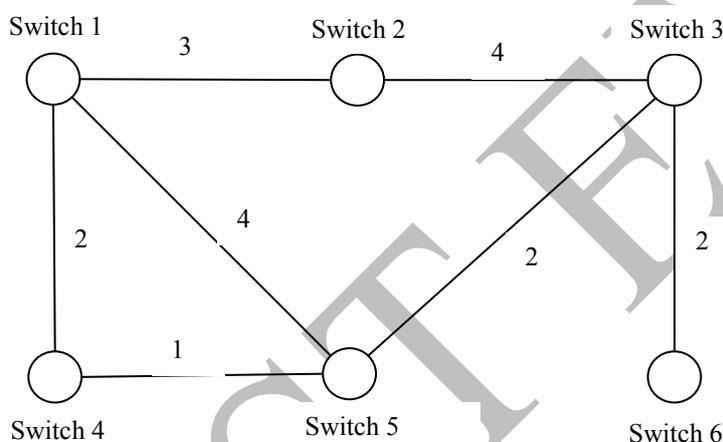


Figure 2

d) Write down the route of the shortest path between switch 1 and switch 6. Write down the total distance travelled along this path. (2)

e) Write down the next hop routing table for Switch 1. (5)

f) Write down a description, including pseudo-code of how Dijkstra's algorithm can be used to compute a next-hop routing table. (5)

g) What is meant by the terms connection-oriented and connection-less services and what are the pros and cons of each? (3)

4. The internet and TCP/IP (25 marks)

- a) Describe how the technique of layering is used to create protocol stack in the design of network technologies. Illustrate your answer by describing the Internet protocol stack, including the names and purposes of each layer. Describe the difference and relationship between the TCP and IP protocols. (7)
- b) Explain why the IP protocol distinguishes between class A, class B, and class C addresses, and describe the differences between them. (5)
- c) What are the directed broadcast, limited broadcast and loopback special IP addresses used for and how are they structured? (3)
- d) Write down the major new features of the Ipv.6 protocol that has been designed to replace the current IP v.4 protocol. (4)
- f) Describe the following three problems with achieving reliable transmission and the mechanisms that TCP uses to deal with them:
- i) Lost/erroneous packets. (2)
 - ii) Data overrun. (2)
 - iii) Congestion. (2)

5. Client-server interaction and applications (25 marks)

- a) Define the client-server paradigm of communication and list the primary characteristics of clients and servers. (5)
- b) Give an overview of the key functions of the BSD UNIX socket library. (6)
- c) Explain with the aid of diagrams how the technique of dynamic server creation enables a server to support multiple concurrent clients. (5)
- d) Describe how the mechanisms of *traders* and *factories* in distributed object platforms attempt to make the development of distributed applications easier. (4)
- e) Briefly describe functionality of the Domain Name System (DNS)? (2)
- f) Describe how is the database of a DNS distributed among multiple servers? (3)

END OF EXAM