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

COLAISTE NA hOLLSCOILE, CORCAIGH
UNIVERSITY COLLEGE, CORK

Autumn Examination 2007
Second Science

Computer Science
CS2204 – Network Computing

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You may use a calculator.
Attempt all 3 questions.

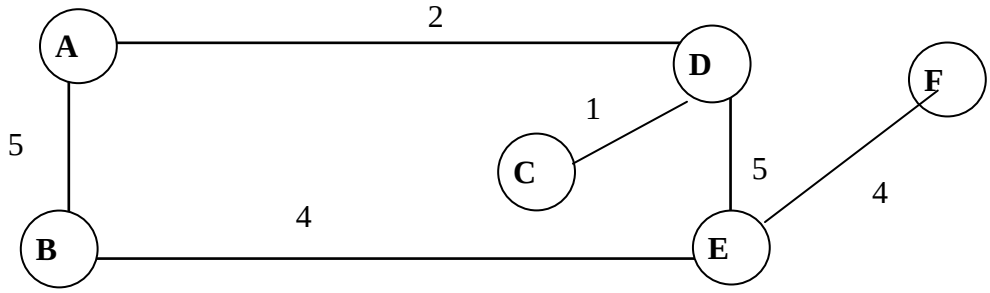
Time allowed: 3 hours

Question 1: Packet Switching [50 marks]

a) Explain the difference between the terms "Ethernet" and "Internet". *[5 marks]*
An Extended LAN is formed from a collection of interconnected Bridges. Show using a diagram an Extended LAN that contains physical loops. Be sure to identify the loops on your diagram. *[5 marks]*
What is the name of the well-known algorithm that is used to eliminate loops in Extended LANs? *[5 marks]*

b) Define the datagram and virtual circuit switching approaches. *[3 marks]*
Compare them using the following three headings. Please keep your comments brief and concise.
1) Differences in communication delay. *[4 marks]*
2) Impact of link/router failures. *[4 marks]*
3) Overhead data in each packet. *[4 marks]*

c) What well-known algorithm forms the basis for Link State Routing? *[3 marks]*
For the network shown in the diagram below, clearly show how node B uses the Link State algorithm to populate its shortest path routing table (*Hint:* using a Tentative list and a Confirmed list). *[7 marks]*



d) With the aid of diagrams, briefly *describe* the following three types of local area network (LAN) topology: bus, ring, star. *[6 marks]*
For each topology explain the impact of a single cable being cut. *[4 marks]*

Question 2: Internetworking [50 marks]

a) Expand the acronym IP and state whether it is a link-layer or network –layer protocol. *[5 marks]*
Explain the main steps that are taken by an IP router in processing a newly arrived packet. (*Hint:* think about the main fields in the IP header and what they are used for). *[10 marks]*

b) Explain the need for fragmentation of packets in IPv4. *[5 marks]*
Three fields in the IPv4 header are used for fragmentation – Ident , Offset, and Flags (specifically the M bit). Explain, using an example, how these three fields are used by a receiver to reassemble fragmented packets to form the single original packet. *[10 marks]*

c) Using an example, explain the motivation for using classless IP addressing instead of class-based IP addressing. *[4 marks]*
Explain the a.b.c.d/x syntax for classless addressing. *[3 marks]*
Assuming that x equals 24, how many unique *host*s can be identified using this address? *[3 marks]*

d) 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, then (a) explain the nature of the issues it addresses *[3 marks]*, (b) describe the salient features of its design and operation *[3 marks]*, and (c) make some observations about its design or deployment *[4 marks]*.

Question 3: End-to-End Protocols [40 marks]

a) Draw a TCP/IP internet that consists of a bus-style Ethernet network and a token-ring network connected by a router. Show a computer attached to each network. Assume one computer runs a web server and the other runs a web browser. *[5 marks]*
Show the protocol stacks used on both the computers *[5 marks]* and the protocol stack used on the router *[5 marks]*.

b) The figure below shows the TCP header (without options). For each field briefly explain how its value is determined *and* how it is used. *[15 marks]*

<table>
<tr><td colspan="3">0 4 10</td><td>16 31</td></tr>
<tr><td colspan="3">SrcPort</td><td>DstPort</td></tr>
<tr><td colspan="4">SequenceNum</td></tr>
<tr><td colspan="4">Acknowledgment</td></tr>
<tr><td>HdrLen</td><td>0</td><td>Flags</td><td>AdvertisedWindow</td></tr>
<tr><td colspan="3">Checksum</td><td>UrgPtr</td></tr>
</table>

c) Explain the 5 aspects of network management defined in the ISO Network Management Model. *[5 marks]*
Define the terms SNMP and MIB and explain their use in Internet network management. *[5 marks]*