School of Management, Technology and Environment

Examination Cover Sheet

Subject Code:	**BITCNE**
Subject Name: . . .	**Computer Networks**
Examination Status: .	**Final, Semester 1, 1998**
Reading Time: . . .	**15 mins**
Writing Time:	**3 hours**
Number of Pages: . .	**7 (including this page)**
Number of Questions:	**6**

Instructions to Candidates: (Please read the following instructions carefully)

- All questions should be attempted.
- All questions have equal marks.
- Marks for this paper total 120.
- Sixty percent (60%) of the final assessment for this subject will be based on this examination paper.
- No reference material may be used.
- Non–programmable calculators may be used.
- Any assumptions made in answering questions should be stated.

Examiner: Philip Scott, Ext 7277

Question 1 – Application Protocols

(a) What is the ***electronic mail address*** of your lecturer (or tutor) for this subject? If you really don't know it, just give the general format of an email address.

(b) What is the general format of an electronic mail message which includes a ***MIME*** (Multipart Internet Mail Extensions) attachment, or enclosure, in the body of the message? Detailed description of all of the parts of a MIME message is not required here, just an outline of the basic ideas.

(c) Explain briefly how software which implements the ***TELNET*** protocol can be used to investigate (and debug) other Internet application protocols.

(d) The following is an Internet ***URL*** (Uniform Resource Locator):

`http://www.latrobe.edu.au/index.html`

(i) This URL consists of three clearly identifiable parts. What are they?

(ii) A WWW browser, such as Netscape or Internet Explorer, wishes to obtain the “page” pointed to by this URL. What is the general format of the HTTP 1.0 request which would be sent from the browser to the server? Note that detailed description of every aspect of the request is not required here, just an outline of the basic ideas involved.

(iii) Name ***one*** aspect of the (recently introduced) ***HTTP 1.1*** protocol which is clearly superior to the older HTTP 1.0 specification.

(2 + 4 + 4 + (3 + 4 + 3) = 20 Marks)

Question 2 – Network Protocols

(a) What are the three main characteristics of ***IP*** (Internet Protocol) datagram delivery in the Internet?

(b) The Transmission Control Protocol (***TCP***) is the most common protocol used to provide transport layer service in the Internet.

(i) What are the key characteristics of the service supplied to an application process by TCP?

(ii) TCP uses the packet (or datagram) delivery service provided by IP, which allows the possibility that IP packets can be dropped (ie, not delivered). How does the TCP software cope if this happens? Note that detailed description is not required here, just an outline of the basic ideas involved.

(c) The following are the (slightly edited) outputs from two runs of the **`traceroute`** program, on machine **`ironbark.bendigo.latrobe.edu.au`**:

```
traceroute to monash-gw.vrn.edu.au (203.21.130.135)
 1  r-busbgo.bendigo.latrobe.edu.au (149.144.21.254) 4 ms 1 ms
 2  r-bgoatm34.bendigo.latrobe.edu.au (149.144.10.250) 2 ms
 3  cisco-ltu.latrobe.edu.au (131.172.239.7)  3 ms  2 ms
 4  monash-gw.vrn.EDU.AU (203.21.130.135)  3 ms *

traceroute to unimelb-gw.vrn.edu.au (203.21.130.130)
 1  r-busbgo.bendigo.latrobe.edu.au (149.144.21.254) 1 ms  1 ms
 2  r-bgoatm34.bendigo.latrobe.edu.au (149.144.10.250) 2 ms
 3  cisco-ltu.latrobe.edu.au (131.172.239.7)  3 ms  2 ms
 4  unimelb-gw.vrn.EDU.AU (203.21.130.130)  9 ms *
```

(i) Notice that the routers **`monash-gw`** and **`unimelb-gw`** are both connected to a single IP network. What is the *class* (A, B or C) of this network, and what are the host numbers (ie, the host part of their IP address) for the two routers **`monash-gw`** and **`unimelb-gw`**? A note for the serious technical whiz – we are ignoring the possibility that subnetting is in use here.

(ii) Using the information revealed by these runs of **`traceroute`**, draw a labelled diagram showing the routers connecting La Trobe, Monash and Melbourne universities to the Victorian Regional Network (domain "**`vrn.edu.au`**"). Each router should be labelled with its name and/or IP addresses, where appropriate

(iii) These runs of the `traceroute` command would have involved the software querying one or more ***namerservers*** to perform both ***host lookups*** and ***reverse lookups***. What is a nameserver, and what is the difference between a host lookup and a reverse lookup?

(3 + (3 + 3) + (4 + 3 + 4) = 20 Marks)

Question 3 – Network Technology

(a) On most computers, a point-to-point data link implemented using ***modems*** employs ***asynchronous*** signalling on the ***RS232*** interface.

(i) If the RS232 interface used with a particular modem operates at 28.8kbps using asynchronous signalling, how many data bytes per second can be transferred over the interface?

(ii) In fact, on most modern computers the RS232 interface to a 28.8kbps modem is set to operate at 57.6kbps, or higher. Why is this?

(b) The dominant technology for Local Area Networks is currently ***Ethernet/802.3***. Most modern Ethernet/802.3 installations use twisted pair (or UTP) cabling, instead of the older coaxial cable based technology. Describe briefly (perhaps using a diagram) how these technologies differ from one another.

(c) In the lectures for this subject, we distinguished between retail and wholesale ***Internet Service Providers*** (ISPs). What is the fundamental difference between each of these?

(d) What are some of the advantages and disadvantages of an ***ISDN*** service (such as Telstra's OnRamp) compared to a “plain old telephone service”?

(e) Explain how a ***frame relay*** service operating at a port speed of 64 kbps differs from an ISDN semi permanent link at the same speed. In particular, why would you expect the frame relay service to be cheaper?

((2 + 4) + 4 + 4 + 4 + 2 + = 20 Marks)

Question 4 – Network Management

(a) What information can the network manager obtain from the ***ping*** command? Give two examples.

(b) The ***ASN.1*** specification language is an integral part of the OSI Reference Model upper layer architecture, and is used in some protocols in the Internet. ASN.1 data objects are (normally) encoded for transmission using the ***Basic Encoding Rules*** (BER).What is the general format of an ASN.1 data structure which has been encoded for transmission using the BER?

(c) Explain the difference between the ***SNMP*** (Simple Network Management Protocol) request types **`get`** and **`get-next`**, and (using a suitable command syntax) show how each of them could be used to fetch the actual value of the MIB–2 variable:

`ipForwDatagrams ::= {1 3 6 1 2 1 4 6}`

(d) The following diagram is an edited representation of the interface table in the SNMP-managed router **`r-bgoatm34`**, previously mentioned in Question 2 of this exam paper.

	ifIndex	ifDescr	ifType	ifSpeed	ifOperStatus
interface 1	1	ATM0	ATM	34000000	up(1)
interface 2	2	Ethernet0	ethernet-csmacd(6)	10000000	up(1)
interface 3	3	Ethernet1	ethernet-csmacd(6)	10000000	down(2)
interface 4	4	Ethernet2	ethernet-csmacd(6)	10000000	down(2)
interface 5	5	FDDI0	fddi(15)	100000000	up(1)

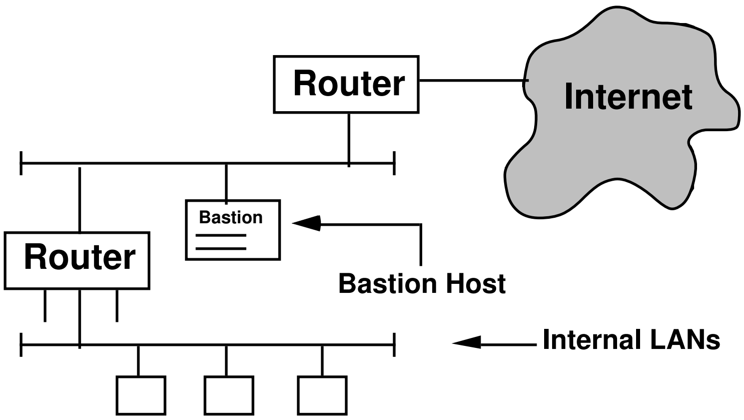
(i) What would be returned in response to a **`get-next`** request for the MIB–2 variable **`interfaces.ifTable.ifEntry.ifSpeed.1`**?

(ii) Describe (using any suitable syntax) how you would structure a **`get`** request to obtain the value of the operational status (**`ifOperStatus`**) of interface 5 for this router.

(4 + 4 + 4 + (4 + 4) = 20 Marks)

Question 5 – Security

(a) The following diagram shows a structure used by many businesses when they connect to the Internet in a secure way:



Explain the security function of each of the routers, the bastion host and the LAN segment which connects them together in this structure

(b) The following is a ciphertext message which has been encrypted using a ***Caesar Cipher***, a very simple (and ancient) monoalphabetic-substitution encryption technique. Break the code and discover the plaintext message:

KHOOR ZRUOG

(c) What are the advantages and disadvantages of a ***public key*** cryptosystem compared to a ***single (secret) key*** system? Give at least one advantage and disadvantage of each.

(d) Explain briefly how a public key cryptosystem can be used to implement ***digital signatures***.

(8 + 2 + 6 + 4 = 20 Marks)

Question 6 – Electronic Commerce

(a) In the lectures for this unit we looked at electronic commerce from two perspectives: the pre-Internet era, and the Internet era. What are the key technologies for each of these periods?

(b) The ***FORM*** markup in HTML is the basic enabling technology for Electronic Commerce on the World Wide Web. The following HTML markup is an example of typical usage of a FORM in a Web page:

```
<FORM
ACTION="http://ironbark.bendigo.latrobe.edu.au/htbin/myprog.cgi
       METHOD="GET">
Name: <INPUT TYPE="TEXT" NAME="Name" MAXLENGTH="64" SIZE="20">
<INPUT TYPE="SUBMIT" VALUE="Submit">
</FORM>
```

(i) Draw a diagram illustrating how this HTML markup would normally be displayed on a typical Web browser such as Netscape or Internet Explorer.

(ii) Note that this FORM uses the ***GET*** method. Describe briefly how the data in the FORM is submitted to a Web server.

(iii) The Web server calls a ***CGI*** (Common Gateway Interface) program to process the data from the FORM. How does the CGI program access the submitted data, and what does it return to the browser?

(c) What is a ***shopping cart application*** in relation to electronic commerce on the Internet?

(d) It is possible to build a CGI-based shopping cart application using either ***hidden fields*** or ***cookies*** (or even both). Explain briefly how each of these technologies works, and briefly mention their respective advantages and disadvantages.

(2 + (2 + 3 + 3) + 4 + 6 = 20 Marks)