School of Management, Technology and Environment

Examination Cover Sheet

Subject Code: . . . . **BITCNE**
Subject Name: . . . . **Computer Networks**
Examination Status: . **Final, Semester 1, 1997**

Reading Time: . . . . **15 mins**
Writing Time: . . . . **3 hours**

Number of Pages: . . **8 (including this page)**
Number of Questions: **5**

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

- All questions should be attempted.
- All questions ***do not*** have equal marks.
- Marks for this paper total 130.
- 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 your personal ***electronic mail address***?

(b) What is the general format of an RFC822 ***electronic mail message***?

(c) 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.

(d) The ***FTP protocol*** has two different modes of operation: ***text*** mode and ***binary*** (sometimes called image) mode. Explain briefly why a binary mode FTP transfer of a PC (or Macintosh) text file to or from a Unix system results in a somewhat corrupted file.

(e) 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? As earlier, detailed description of every aspect of the request is not required here, just an outline of the basic ideas involved.

(iii) The response from a HTTP 1.0 server as a result of the request in part (ii) is a MIME compatible document. What does this mean?

(f) What is ***Electronic Data Interchange*** (EDI)? How is it different to an electronic mail service?

(Question 1 continues on next page)

(g) 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
    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 be displayed on a typical Web browser such as Netscape or Internet Explorer.

(ii) Describe briefly the sequence of events which occurs when this FORM is used to submit data to a Web server. You should describe (briefly) what is sent over the network in each direction, and what happens at the server.

(h) What is an ***applet*** in the context of the World Wide Web, and what does it provide that other WWW technologies cannot?

(i) Applets are normally coded in the ***Java*** programming language, which is then compiled to ***bytecode*** format before being downloaded to a browser. Give at least two reasons why bytecode is used instead of a *real* binary format such as the `.exe` format used in IBM PCs and compatibles.

(j) What is the basic idea behind ***Network Computers***? Why would an organisation buy Network Computers instead of Macs or Windows-based PCs for desktop machines?

(k) What is the principal advantage of the ***MBone*** approach compared to (for example) RealAudio as a means of delivering "streaming" audio and video on the Internet? Give at least one reason why MBone technology isn't commonly used in the Internet.

(2 + 4 + 4 + 2 + (3 + 4 + 4) + 4 + (3 + 4) + 4 + 4 + 4 + 4 = 50 Marks)

Question 2 – Structure of the Internet

(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 *edited* outputs from three runs of the `traceroute` command. For the first two, `traceroute` was run on `redgum` at La Trobe University, Bendigo, and used to find the routes to the main Web servers at Monash and Melbourne Universities. The third output is from a run of `traceroute` from a site outside Victoria, tracing the route to `www.latrobe.edu.au`. The first few entries have been deleted from this last run for space reasons, and because they have no bearing on the question.

```
traceroute to www.monash.edu.au (130.194.11.4)
 1  r-busbgo (149.144.21.254)  1 ms  1 ms  1 ms
 2  r-itsbgo (149.144.10.254)  3 ms  2 ms  1 ms
 3  r-bgowan (149.144.2.1)  4 ms  2 ms  2 ms
 4  bendigo-serial (149.144.1.1)  32 ms  32 ms  33 ms
 5  cisco-ltu-fddi.latrobe.edu.au (131.172.20.12)  33 ms  33 ms
 6  monash-gw.vrn.EDU.AU (203.21.130.135)  36 ms  34 ms  38 ms
 7  clayton-gw.monash.edu.au (130.194.14.254)  149 ms  63 ms
 8  www.monash.edu.au (130.194.11.4)  38 ms  40 ms  36 ms
```

(Question 2 continues on next page)

```
traceroute to www.unimelb.EDU.AU (128.250.6.196)
    [see previous run - the first 4 hops are identical]
 5  cisco-ltu-fddi.latrobe.edu.au (131.172.20.12)  230 ms  234 ms
 6  unimelb-gw.vrn.EDU.AU (203.21.130.130)  302 ms  316 ms
 7  tc1.rtr.unimelb.EDU.AU (128.250.3.11)  77 ms  60 ms  74 ms
 8  www.unimelb.EDU.AU (128.250.6.196)  40 ms  115 ms

traceroute to www.latrobe.edu.au (131.172.20.21) [from elsewhere]
    [the first seven entries have been deleted from this output]
 8  f10-ti-gw.vrn.edu.au (139.130.239.54)  79 ms  63 ms  96 ms
 9  vic-gw.vrn.EDU.AU (203.21.130.162)  102 ms  71 ms  88 ms
10  latrobe-gw.vrn.EDU.AU (203.21.130.133)  64 ms  107 ms  66 ms
11  www.latrobe.edu.au (131.172.20.21)  62 ms  67 ms  64 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) The router `latrobe-gw` has, like all routers, at least two IP addresses, and possibly two or more domain names. What are the two IP addresses and domain names for this router that are revealed by these runs of the `traceroute` command?

(iii) What is a ***nameserver***, and what role would you expect it to have played in these runs of the `traceroute` command?

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

Question 3 – Network Technology

(a) What is a "nailed up" data communications link, and what is the alternative?

(b) What hardware component is normally needed for a dial-in Internet link between a home computer and an Internet Service Provider (ISP)?

(c) A hypothetical student at this campus lives in a small town about 40 km from Bendigo and wants to get access to the on-line WWW course materials. Her options are to dial in to the free Internet access provided at the Bendigo campus at STD rates, or to establish an account with a local ISP in her town. The STD phone call charge for this distance is roughly 15 cents per minute (day rate, mid-1997, Telstra prices). To dial in to an ISP costs 25¢ for the local phone call plus an access rate of typically $5 per hour, ignoring any special "plans" which ISPs tend to offer. How long (approximate answers are OK) does she have to be connected at a dial-in session for the local ISP option to be cheaper?

(d) Point-to-point data links between routers in the Internet are usually configured as IP networks (or subnets) with two IP addresses allocated, for the routers at each end of the link. The point-to-point data links created when a subscriber "dials in" to an Internet Service Provider are not normally allocated IP addresses in this way. How are IP addresses normally managed for dial-in links?

(e) Briefly describe the operation of the ***CSMA/CD*** MAC sublayer protocol which is used in Ethernet and 802.3 LANs.

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

Question 4 – Network Management

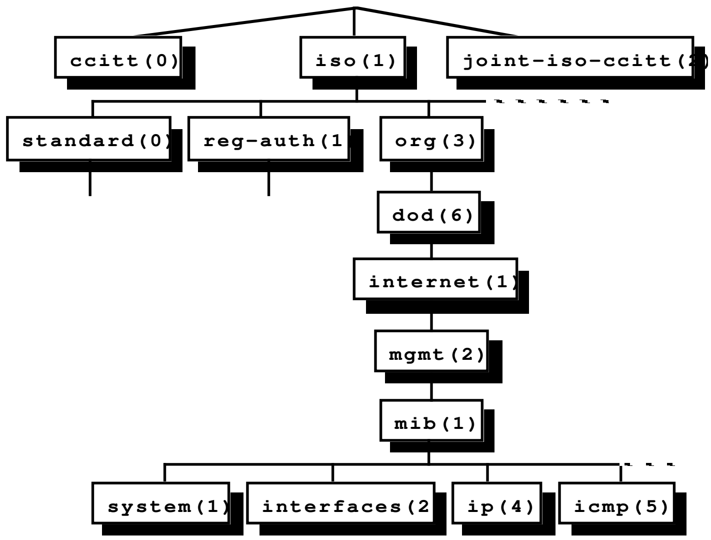
(a) What information can the network manager obtain from the ***ping*** command? Give two examples.

(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.

(i) What is meant by the term ***abstract syntax***, as implemented in ASN.1?

(ii) What is the general format of an ASN.1 data structure which has been encoded for transmission using the ASN.1 ***Basic Encoding Rules*** (BER)?

(c) The following diagram is used to describe the Management Information Base (MIB) of the Simple Network Management Protocol, SNMP.



What is the numerical **`OBJECT IDENTIFIER`** of the MIB variable:

```
ipForwDatagrams OBJECT-TYPE ::= { ip 6 }
```

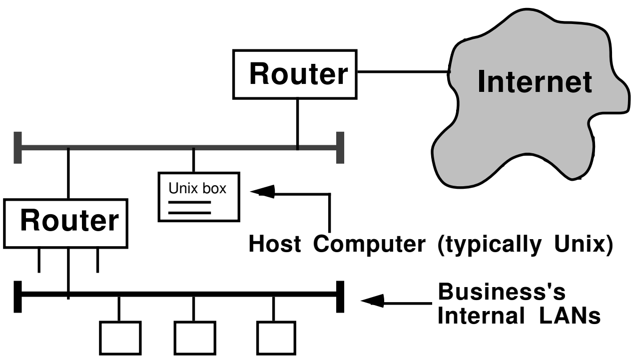
(d) How would you refer to the variable of part (c) if you were interested to obtain its *actual value* using *each* of an SNMP ***get*** request and a ***get-next*** request?.

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

Question 5 – Security

(a) Describe briefly two kinds of ***security attacks*** which can be directed against an Internet-connected computer system.

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



Explain how the Unix host and each of the routers in this structure would be configured to safeguard computers connected to the business's internal LANs against attack originating from the external Internet.

(c) The simplest cryptosystems are ***monoalphabetic substitution cyphers***. Give an example of such a system, and explain why it is not regarded as being very secure.

(d) Explain very briefly the difference between the Electronic Code Book mode and the Chain Block Cypher mode of the ***Data Encryption Standard*** (DES), and explain why CBC mode is normally used in practice.

(e) Explain very briefly how a ***public key cryptosystem*** operates.

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