Macquarie University

SAMPLE EXAMINATION 2006

Unit: Comp347 – Computer Networks

Date:

Time Allowed:

Number of Questions:

Total Marks:

Instructions: Answer ALL questions.
The questions are not of equal value.
Use separate books for each part.
Indicate the section clearly on the outside of each book.
Write your name and student number clearly on each book.
Calculators are not permitted.
The marks allocated to a question are written next to the question.
If you wish to spread your time evenly, you should spend approximately one minute for each mark.
PART A  (Use a separate book)

1. Multiple choice. Each question is worth 1 mark for a correct answer. If you believe that options A-D are inappropriate, choose option E and provide your own answer.

(a) Which of the following is NOT an Internet protocol:
   A. IP
   B. TCP
   C. DNS
   D. ATM
   E. All of the above are Internet protocols.

(b) A file transfer application protocol has the following characteristics:
   A. It can tolerate data loss and requires a minimum of 10Kbps data rate.
   B. It cannot tolerate data loss and requires a minimum of 10Kbps data rate.
   C. It can tolerate data loss and requires response times within a few seconds.
   D. It cannot tolerate data loss and is not time sensitive.
   E. None of the above – the correct answer is…

(c) When using the socket interface, a client program establishes a TCP connection to a server using the system call:
   A. connect
   B. listen
   C. accept
   D. socket
   E. None of the above – the correct answer is…

(d) When using the socket interface, a server program waits for a connection request from a client using the system call:
   A. connect
   B. listen
   C. accept
   D. socket
   E. None of the above – the correct answer is…

(e) The telnet protocol defines a new line as:
   A. The ASCII linefeed character
   B. The ASCII carriage-return character
   C. The ASCII NUL character
   D. The sequence ASCII carriage-return followed by NUL
   E. None of the above – the correct answer is…

(f) The HTTP protocol:
   A. Is stateless but allows the client to access server state through cookies.
   B. Has state and supports both persistent and non-persistent connections.
   C. Is stateless and requires the client to reconnect for each transfer.
D. Has state and requires the client to remain connected for the duration of a session.
E. None of the above – the correct answer is…

(g) A Web cache (proxy server):
A. Stores the IP addresses of Web hosts that you have accessed recently.
B. Stores copies of recently accessed Web pages for the local area network.
C. Stores copies of Web pages recently accessed by a single user.
D. Stores authorization credentials so that the user does not have to retype their password.
E. None of the above – the correct answer is…

2. [12 marks]

Design a protocol for a TCP/IP server application whose task is to provide system information to client processes. Your protocol should be stateless and use non-persistent connections. Clients may request the following types of information:

- CPU load statistic – server will return a CPU load percentage value.
- User count – server will return the number of users currently logged in to the machine.
- Login count – for a specified user name, the server will return the number of times that user has logged into the machine and whether or not they are currently logged in.
- Disk utilisation statistics – server will return the disk name(s) and disk usage data as disk capacity in bytes, disk bytes used, and percentage used values.

In your answer, describe clearly the interaction between the client and the server – the sequence of steps performed by each process and how they interact to perform the various tasks listed above. Also describe in some detail the syntax of messages that the client can send to the server and the server send to the client. Your descriptions should be detailed enough that a programmer who was skilled in writing TCP/IP applications could implement either the client or server process correctly. Consider also that the client and server may be running on different hardware and different operating systems.

3. [12 marks]

Consider the following e-mail message.

Date: Wed, 20 Apr 2005 14:09:48 +1000
From: Some Person <sperson@ics.mq.edu.au>
MIME-Version: 1.0
To: Another Person <aperson@ics.mq.edu.au>
Subject: Message and file
Content-Type: multipart/mixed;
boundary="------------030804030502080302040801"

This is a multi-part message in MIME format.
------------030804030502080302040801
Content-Type: text/plain;
Content-Transfer-Encoding: 7bit

AP,

I'm attaching my file for your information.

Regards,

SP
(a) [2 marks] What is the purpose of the mime version header?
(b) [3 marks] What is the purpose of the lines containing
--------------030804030502080302040801?
(c) [3 marks] Explain each of the three content type headers that occur in this e-mail -- what
does each header tell you?
(d) [2 marks] Explain each of the two content transfer encoding headers that occur in this e-
mail -- what does each header tell you?

4. [5 marks]

Short answer. Each part is worth five marks.
(a) Suppose you are using the host elephant.babar.com which is part of the DNS domain
babar.com served by dns.babar.com. You wish to access the Web server
www.tigger.com which is part of the DNS domain tigger.com served by dns.tigger.com. Assuming that no cached DNS information is available, and assuming that iterative
queries are used, sketch the sequence of communications between hosts by which your
host is able to find out the IP address of www.tigger.com.

5. [10 marks]

Compare IPSec transport mode with tunnel mode. What are the benefits of each technique? Why is tunnel mode mandated for gateways securing a channel whereas hosts are permitted
to use transport mode?

6. [15 marks]

A VoIP system uses SIP and RTP. Briefly explain the role of each of SIP and RTP in the
VoIP system. SIP is an ASCII protocol but RTP uses binary messages. Discuss why you
think this may be true?

7. [6 marks]

You have been assigned one class A address of 124.0.0.0 by the InterNIC. Your private
internet currently has 5 subnets. Each subnet has approximately 500,000 hosts. In the near
future, you'd like to divide the 5 subnets into 25 smaller, more manageable subnets. The
number of hosts on the 25 new subnets could eventually increase to 300,000.
(a) How many bits did you use for the subnet mask?
(b) How much growth did you allow for additional subnets?
(c) How much growth did you allow for additional hosts?

8. [6 marks]

An organization has a network ID 130.145.0.0. It decides to have six subnets and therefore uses a mask of 255.255.224.0. This results in six valid subnets.

One of the hosts H1 (IP: 135.140.32.1) in the subnet 135.140.32.0 has an invalid subnet mask of 255.255.0.0. Explain what would happen in each of the following cases?

(a) H1 sends a packet to host H2 (IP: 135.140.60.4).

(b) H1 sends a packet to host H4 (IP: 135.140.96.4).

(c) H1 sends a packet to a host in a remote network 200.10.10.0

9. [5 marks]

What do you understand by the term “proxy ARP”? Identify some scenarios where this technique can be deployed.

10. [8 marks]

Explain “the count to infinity” problem. Identify and describe some remedial solutions to fix this problem.

11. [6 marks]

(a) [4 marks] A TCP connection is in the ESTABLISHED state. The following events occur one after another:

   i) The application sends a “close” message.

   ii) A FIN segment is received.

What is the state of the connection after each event? What is the action after each event?

(b) [2 marks] Lost TCP acknowledgements do not necessarily force retransmissions. Why?
12. [6 marks]

A router R1 has the following routing table:

<table>
<thead>
<tr>
<th>Mask</th>
<th>Destination</th>
<th>Next Hop</th>
<th>Flag</th>
<th>Reference Count</th>
<th>Use</th>
<th>Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>255.0.0.0</td>
<td>111.0.0.0</td>
<td></td>
<td>U</td>
<td>0</td>
<td>0</td>
<td>M0</td>
</tr>
<tr>
<td>255.255.255.224</td>
<td>193.14.5.160</td>
<td></td>
<td>U</td>
<td>0</td>
<td>0</td>
<td>M2</td>
</tr>
<tr>
<td>255.255.255.224</td>
<td>193.14.5.192</td>
<td></td>
<td>U</td>
<td>0</td>
<td>0</td>
<td>M1</td>
</tr>
<tr>
<td>255.255.255.0</td>
<td>192.16.7.1</td>
<td>111.20.18.14</td>
<td>UGH</td>
<td>0</td>
<td>0</td>
<td>M0</td>
</tr>
<tr>
<td>255.255.255.0</td>
<td>194.17.21.0</td>
<td>111.20.18.14</td>
<td>UG</td>
<td>0</td>
<td>0</td>
<td>M0</td>
</tr>
</tbody>
</table>

(a) The first three entries do not have the G flag set indicating the destination is local. How can we have three different destination addresses for the local network?

(b) The last two entries indicate that the destination addresses are not local. What is the fundamental difference between the two addresses specified?

(c) Suppose that the flag field “U” entry was not present for the first entry. What would this mean?

13. [9 marks]

(a) [3 marks] How does multicast routing differ from conventional routing techniques?

(b) [2 marks] In IGMP, a host need not send a report when processes leave a group. Assuming the last process belonging to a group G decides to leave G. How does the router know that there are no members for G in the subnet? How does IGMP version 2 address this problem?

(c) [4 marks] How is the DVMRP forwarding table different from the DVMRP routing table? Why is there a need for these two different tables?

14. [5 marks]

Define the term “quality of service” (QoS). Highlight some of the advantages of differentiated services architecture over Integrated services model of QoS.

-- That's all! Now check your answers --