Dept. Computer Science	Computer Networks
Vrije Universiteit	27.08.2004

Always explain your answers concisely and be sure to be to-the-point.

1a There is one feature that truly distinguishes a home network from an office network. What is it? *5pt*

1b "In a connection-oriented service, packets follow the same route." Is this statement correct? Explain your answer. *5pt*

2a What is the purpose of modulation, and which three forms are commonly applied? *5pt*

2b Explain the difference between frequency-division multiplexing and time-division multiplexing. *5pt*

3 The reliability of a channel can be increased by applying error-correcting codes. The price to pay for this increased reliability is lower effective bandwidth. Explain this trade off. *5pt*

4a Ethernet follows a CSMA/CD protocol scheme. Explain how this scheme works. *5pt*

4b How big should the contention period be in a CSMA/CD protocol? *5pt*

4c A 10 Mbps Ethernet segment can be as long as 2500 meters. If frame specifications stay the same, how does an increase in supported bandwidth affect the segment length? *5pt*

4d The Ethernet specifications are fundamentally unsuited for wireless networks unless it is assumed that all stations are always in each other's range. Explain why. *Hint: think of the way frame collisions are detected in Ethernet.* *5pt*

5a What is an Autonomous System (AS)? *5pt*

5b Explain what an exterior gateway routing protocol is, and give an example of such a protocol. *5pt*

5c Explain what a peer-to-peer overlay network is. *5pt*

5d Consider an IPv6 packet that is being sent from *A* to *B*, but which can reach *B* only by traversing an intermediate network that supports only IPv4. How can this problem be solved? *5pt*

6a Below is an excerpt from a DNS response. Explain which DNS query was submitted, and what the returned answer was. *5pt*

```
; <<>> DiG 9.2.1 <<>> mx vu.nl
;; global options:  printcmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 26939
;; flags: qr rd ra; QUERY: 1, ANSWER: 2, AUTHORITY: 4, ADDITIONAL: 3

;; QUESTION SECTION:
;vu.nl.                         IN      MX

;; ANSWER SECTION:
vu.nl.                  60      IN      MX      20 mail.it.vu.nl.
vu.nl.                  60      IN      MX      10 mail.vu.nl.

;; AUTHORITY SECTION:
vu.nl.                  86400   IN      NS      star.cs.vu.nl.
vu.nl.                  86400   IN      NS      ns.vu.nl.
vu.nl.                  86400   IN      NS      ns1.surfnet.nl.
vu.nl.                  86400   IN      NS      ns2.vu.nl.

;; ADDITIONAL SECTION:
mail.vu.nl.             86400   IN      A       130.37.129.161
mail.it.vu.nl.          56003   IN      A       130.37.129.165
ns2.vu.nl.              86400   IN      A       130.37.129.5

;; Query time: 85 msec
;; SERVER: 192.168.1.6#53(192.168.1.6)
;; WHEN: Mon Aug 16 12:41:12 2004
;; MSG SIZE  rcvd: 199
```

6b DNS root servers do not support recursive queries. Why not? *5pt*

7a Explain how mutual authentication with public/private key pairs works. *5pt*

7b Explain the Diffie-Hellman key exchange protocol. *5pt*

7c Construct a certificate issued by an authority *CA*, telling that E_A is the public key of *A*. Explain the content of your certificate. *5pt*

Grading: *The final grade is calculated by accumulating the scores per question (maximum: 90 points), and adding 10 bonus points. The maximum total is therefore 100 points.*