Dept. Math. & Comp. Sc. **Computer Networks**
Vrije Universiteit **14.04.1998**

1a Explain the following terms:
- *circuit-switched* and *packet-switched* networks
- *connection-oriented* and *connectionless* services

Give an example of a connectionless service running over a circuit-switched network. *10pt*

1b Explain briefly how you can do long-distance communication through microwave transmission. *5pt*

1c What is *time division multiplexing*? *5pt*

2a Under which circumstances are *contention* protocols generally better than *collision-free* protocols. Explain your answer. *5pt*

2b Give an example of a protocol that can behave both like a contention protocol as a collision-free protocol. *5pt*

2c Explain clearly why 802.3 LANs (Ethernet 10 Mbit) have a minimal frame length specified. *10pt*

2d Why are *token bus* networks generally considered more suitable for factory automation than, for example, 802.3 networks? *5pt*

3a What is the difference between *distance vector routing* and *link state routing*? *10pt*

3b Explain what the *count-to-infinity* problem is with distance vector routing. *5pt*

3c What is *tunneling* and how was it applied to initially set up the MBone? *5pt*

4a Why does Tanenbaum state that "without the transport layer, the whole concept of layered protocols would make little sense?" *10pt*

4b In a new protocol, called *transaction TCP*, communication between a client (C) and a server (S) can proceed as follows:

C: Send a TCP packet with SYN = 1, FIN = 1, and the request (i.. the data).
S: Return a TCP packet with SYN = 1, FIN = 1, ACK = 1, and a reply.
C: Send a TCP packet acknowledging the receipt of the reply.

How does this protocol relate to client/server communication through UDP, and to traditional TCP? *10pt*

4c Why is a *stop-and-wait* protocol generally lead to low network utilisation in the case of wide-area gigabit networks? *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.*