## Dept. Math. & Comp. Sc. Vrije Universiteit

## Computer Networks 17.08.2001

1a	Explain the concepts of interface, protocol, service, and implementation in the context of a layered network model as used, for example, in the OSI reference model.	10pt
1b	Java provides a separate networking library with methods to send and receive messages. Does this mean that Java provides its own communication protocol? Explain your answer.	5pt
1c	Is it possible to let a protocol at layer $L_i$ be completely unaware of the protocol(s) used at a higher layer $L_{i+1}$ ? Explain your answer.	5pt
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	What is an Autonomous System in the Internet?	5pt
2b	The Border Gateway Protocol (BGP) uses distance vector routing. It advertises complete routes instead of the "best" neighbor. Name two important advantages of this approach.	10pt
2 <i>c</i>	Does it make sense to build a "virtual" network of hosts on top of the Internet with its own routing protocol? Explain your answer.	5pt
3	In the following questions, you are asked to develop reliable connectionless communication based on UDP.	
<i>3a</i>	How would you let error control take place?	5pt
<i>3b</i>	How would je let flow control take place?	5pt
<i>3c</i>	How would you implement reliable multicasting based on UDP? Assume the recipients are known in advance.	5pt
3d	How would you implement atomic multicasting, that is, a message is delivered to all recipients, or to none at all? Again, assume that all recipients are known in advance.	10pt
4a	Explain how authentication with public/private key pairs can be established.	5pt
4b	Explain how Alice can electronically send Bob a signed contract without encrypting the contract for confidentiality.	5pt
<i>4c</i>	What is a (cryptographic) certificate?	5pt
4d	Explain how Diffie-Hellman key exchange works.	10pt

**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.