1a Explain what we mean by *distribution transparency* and mention at least five kinds of transparency.   *10pt*

1b Give an example that illustrates why it is not a good idea to always aim at complete distribution transparency.   *5pt*

1c Why is it impossible to realize complete distribution transparency? Hint: think of fault tolerance in so-called asynchronous systems?   *10pt*

1d To what extent does it make sense to talk about distribution transparency when executing a network application on a single machine? Motivate your answer!   *5pt*

2a Distributed objects generally consist of two parts. One part is a traditional object that is placed at a so-called object server. The other part is made out of proxies which are placed at clients, and which are virtually the same as client stubs in RPC systems.

What do you think is the most important difference between a client/server application based on RPCs, and one that is based on distributed objects? Motivate your answer clearly.   *10pt*

2b An object reference is actually nothing else but a name for a (distributed) object. Mention a number of properties that an object reference should preferably have. Hint: think of naming in distributed file systems.   *5pt*

2c What are the advantages of using object technology for realizing distributed shared memory?   *5pt*

3a What is *strict consistency*? Explain why this concept works for uniprocessors, but is impossible to implement for multiprocessor machines.   *5pt*

3b Explain clearly what *weak consistency* is.   *5pt*

3c Weak consistency requires that a programmer indicates when the memories in a DSM system should be synchronized. To what extent is this a burden for the programmer?   *10pt*

4a What is a *session key* and what specific advantages do they offer?   *5pt*

4b Explain what the *birthday attack* is, and why it may actually work.   *10pt*

4c What is wrong with the following authentication protocol, which is based on the *shared key* K_{AB}:   *5pt*

Step	Sender	Receiver	Message
1	Alice	Bob	A, R_A
2	Bob	Alice	$R_B, K_{AB}(R_A)$
3	Alice	Bob	$K_{AB}(R_B)$

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.*