1a What is the difference between data-centric consistency models and client-centric consistency models?   *5pt*

1b Researchers often distinguish caching from replication. Explain the difference between the two.   *5pt*

1c Content Delivery Networks in the Web such as Akamai often use existing caching mechanisms to establish replication of Web documents. Explain how this works.   *5pt*

2a A k-fault tolerant process group can withstand the failure of k processes before failing to meet its specifications. Discuss the relation between the size of such a group and the assumptions that are made with respect to failure semantics and process behavior.   *5pt*

2b Why is it so hard to implement *exactly once semantics* in the presence of server crashes and reliable RPCs? Assume a client receives an acknowledgement when its request has been delivered at the server.   *10pt*

2c Explain how an orphan process comes into existence when dealing with message-logging systems.   *5pt*

3a How can we protect a certificate from being successfully used by an unauthorized user?   *5pt*

3b Public-key cryptosystems are claimed to scale better than shared-key systems. Does this claim really hold? *Hint:* think of certificate revocation.   *5pt*

Grading: *The final grade is calculated by accumulating the scores per question (maximum: 45 points), and adding 5 bonus points. The maximum total is therefore 50 points.*