# CS454 Assignment 1
# Winter 2016

Due: 3 February 2016 (5:00pm)*
Returned: 12 February 2016
Appeal deadline: 19 February 2016

**Question 1 (15%)** If a client and a server are placed far apart, we may see network latency dominating overall performance. How can we tackle this problem?

**Question 2 (20%)** Are there advantages of using synchronous RPC over asynchronous RPC? If so, describe them. If not, provide an explanation of why not.

**Question 3 (20%)** A single data request message is sent by a client to a single application server. The application server uses the content of this message to create a pair of request messages, one for each specific database at the backend tier. Responses to these messages are returned from the two databases to the application server and are forwarded on by the application server as two separate responses to the client. Explain the transparency implications of this design decision.

**Question 4 (25%)** Compare, and discuss briefly, connectionless (UDP) and connection-oriented (TCP) communication for the implementation of each of the following application-level or presentation-level protocols:

1. virtual terminal access (for example, Telnet);
2. file transfer (for example, FTP);
3. user location (for example, rwho, finger);
4. information browsing (for example, HTTP);
5. remote procedure call.

**Question 5 (20%)** Assume $n$ computers are interconnected and the availability of each computer is needed to maintain a distributed service, and each of these computers has a probability $p$ ($0 \leq p \leq 1$) of failing at any time.

1. What is the probability $p_s$ that the service will not be available at any time, assuming that no other components in the distributed system will fail? Express $p_s$ as a mathematical function of $n$ and $p$?
2. Based on your answer for part (1), what is the probability $p_s$ when computing is not distributed, i.e., for the case where $n = 1$?

*Please see the Evaluation section under the General Course Information web page for late submission policy.

3. Based on your answer for part (1), use $p = 0.2$ and $n = 3$ to compute probability $p_s$. How does this probability compare with the failure probability if the same computing is performed on only one computer?
4. Now assume that the service requires only one of the three computers (not each one of them), with the other two computers serving as backups (that is, each of the three computers, on its own, is capable of providing the service). What is the probability that the service will not be available at anytime, assuming that no other components in the distributed system will fail? How does the failure probability of this system compare with the failure probability if the same computing is performed on one computer only?