Heidelberg University
Distributed Systems 1 (IVS1)
Winter Semester 2018/19

Duc Anh Phi,
Michael Tabachnik,
Edgar Brotzmann

Solutions to Problem Set 1

Due: 30.10.2018, 2pm

Exercise 1

The human brain...
can be considered as a distributed system (**DS**). You are not aware of its many components, the neurons, which are linked together, forming a network. The neurons can be seen as multiple autonomous processors which do not share primary memory but cooperate by sending messages to each other.

A modern laptop...
cannot be considered as a DS. You are physically aware of its components. The processing unit can consist of multiple processor cores which are not autonomous, because they share primary memory to cooperate.

A bee colony…
can be considered as a DS, because each bee works as an autonomous unit with its own brain and memory. However, they are still connected with each other, knowing their membership to the colony, forming a network. They communicate with each other by “passing messages” instead of sharing “primary memory”.

The entirety of all Android devices...
can be considered as a DS under the condition, that there is a system which combines all devices to a cooperating system. (Declaring the IP-protocol as the managing system isn’t valid, because it’s the fundament for a DS and not the managing system itself.) Each Android device has an own processing unit and memory, which will not be shared and they communicate by passing messages to each other.

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Exercise 2

The Transport Control Protocol (**TCP**) is a **reliable connection-oriented** protocol. Reliable, meaning that all sent packages are going to arrive at the receiver. Connection-oriented, meaning that both sender and receiver have to perform a “handshake”, establishing a connection for a stream communication. The connection also ensures package order and prevents package duplication.

The User Datagram Protocol (**UDP**) is a **connectionless** protocol which does not guarantee a reliable transmission in contrast to the TCP. Because the protocol is connectionless both sender and receiver do not have to perform a “handshake”. Without the overhead of establishing and having a connection, the UDP is faster than the TCP which can produce delays. As drawbacks the UDP does not ensure package order and does not prevent package duplication in comparison to TCP.

Exercise 3

Basically, the receiver can never be sure, that no errors have occurred while the package was transmitted, but it is rather unlikely. If a single bit was flipped, the transmitted checksum will not match the computed checksum, but as soon as more bits are flipped, both checksums might match again. The problem with creating a checksum is, that the computing methods are very simple, because they need to be fast, especially for UDP.

Exercise 4 & 5

Code and test cases were submitted into Moodle.