Exercise 1: Explain the multiversion concurrency control (MVCC).

1. Which advantages does this technique have?
2. Explain which tasks must be solved to use the MVCC!
3. Describe the process of the MVCC based on the following example.

\[
\begin{array}{c|c}
T1 & T2 \\
\hline
r_1(x) & r_2(x) \\
w_1(x) & w_2(y) \\
r_1(y) & \\
w_1(z) & \\
commit; & commit;
\end{array}
\]

Exercise 2: Which problems occur in the following schedule?

- How can these problems be avoided?
- Which further isolation levels do you know?
- Explain which problems of multi-user operation can be avoided with the discussed isolation levels.

\[
\begin{array}{c|c}
T1 & T2 \\
\hline
r(K) & r(K) \\
 & K:=K-1 \\
 & w(K) \\
 & commit; \\
B:=K-0,5 & \\
w(B) & \\
commit; & 
\end{array}
\]

Exercise 3: Which new requirements must commit fulfill considering distributed transaction? On that point, explain the basic assumptions of the existing commit!

Exercise 4: Explain the basic concept of the 2PC-protocol!

1. Show the process of the 2PC-protocol based on an example.
2. Which problems can occur during the process?
3. How can these problems be solved?

Exercise 5: Which difference between the 2PC- and 3PC-protocol exist?
1. Show the difference in the process of both protocols!
2. Do the innovations have effects on the states of teh protocols?
3. How does the error treatment of the 3PC-protocol works (Compare with the 2PC-protocol)?