TDT4225 – Exercise 1 (theory)

Deadline: 16. Sep. Deliver individually on Blackboard. Please deliver in pdf format.

1. **SSD:** How does the Flash Translation Level (FTL) work in SSDs?
2. **SSD:** Why are sequential writes important for performance on SSDs?
3. **SSD:** Discuss the effect of alignment of blocks to SSD pages. See e.g. Figure 2.5 of Dybvik.
4. **RocksDB**: Describe the layout of MemTable and SSTable of RocksDB.
5. **RocksDB:** What happens during compaction in RocksDB?
6. **LSM-**trees vs B+-trees. Give some reasons for why LSM-trees are regarded as more efficient than B+-trees for large volumes of inserts.
7. Regarding fault tolerance, give a description of what hardware, software and human errors may be?
8. Give an overview of tasks/techniques you may take/do to achieve fault tolerance.
9. Compare SQL and the document model. Give advantages and disadvantages of each approach. Give an example which shows the problem with many-to-many relationships in the document model, e.g., how would you model that a paper has many sections and words, and additionally it has many authors, and that each author with name and address has written many papers?
10. When should you use a graph model instead of a document model? Explain why. Give an example of a typical problem that would benefit from using a graph model.
11. **Column compression**: You have the following values for a column:
    43 43 43 87 87 63 63 32 33 33 33 33 89 89 89 33
    a) Create a bitmap for the values.
    b) Create a runlength encoding for the values

12. We have different binary formats / techniques for sending data across the network:

    - MessagePack
    - Apache Thrift
    - Protocol Buffers
    - Avro

    In case we need to do schema evolution, e.g., we add a new attribute to a Person structure: Labour union, which is a String. How is this supported by the different systems? How is forward and backward compatibility supported?