**TDT4225 – Exercise 1**

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1. **How does the Flash Translation Level (FTL) work in SSDs?**

*The FTL is responsible for mapping logical block addresses (LBAs) to physical block addresses (PBAs). When a host requests data from an SSD, the FTL translates the LBA to corresponding PBA, and the SSD reads data from that location. The FTL is typically implemented in the firmware and is specific to type of SSD model. The FTL is one of key components that makes the SSD work.*

1. **Why are sequential writes important for performance on SSDs?**

*Sequential writes are important for the performance on SSD, because they allow the SSD to write data in large, contiguous blocks. This maximizes the number of I/O operations per second (IOPS) that the SSD can preform and reduces the amount of time required to write data to the SSD.*

1. **Discuss the effect of alignment of blocks to SSD pages.**

Alignment of blocks to SSD pages can have a significant effect on the performance. If the blocks aren’t aligned, the SSD has to preform extra work to read and write the data. This can cause a significant decrease in the performance.

1. **Describe the layout of MemTable and SSTable of RocksDB.**
2. **What happens during compaction in RocksDB?**
3. **Give some reasons for why LSM-trees are regarded as more efficient than B+-trees for large volumes of inserts.**
4. **Regarding fault tolerance, give a description of what hardware, software and human errors may be?**
5. **Give an overview of tasks/techniques you may take/do to achieve fault tolerance.**
6. **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?**
7. **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.**
8. **You have the following values for a column: 43 43 43 87 87 63 63 32 33 33 33 33 89 89 89 33**
   1. **Create a bitmap for the values.**
   2. **Create a runlength encoding for the values**
9. **We have different binary formats / techniques for sending data across the network:**
   1. **MessagePack**
   2. **Apache Thrift**
   3. **Protocol Buffers**
   4. **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?**