Advanced Topics in Databases

Exercise 1

1. Compare disk-based DBMSs and main-memory DBMSs! What advantages and disadvantages emerge using main memory as primary storage?

2. What is the reason for the main-memory access bottleneck? Why is the main-memory access bottleneck a problem in main-memory DBMSs, but not in traditional disk-based DBMSs? How can the main-memory access bottleneck be addressed?

3. Which of these database algorithms benefit from spatial and/or temporal locality?
   - Block Nested Loop Join
   - Merge Join on sorted Tables
   - Full-Table Scan
   - Range Selection using a B+-Tree
   - Hash-based Aggregation

4. What is the memory hierarchy? How is it used during memory access? Describe the basic principle behind caches?

5. Name and explain three approaches for block placement within caches. What are their advantages and disadvantages?

6. For each of the following scenarios, name the best block placement strategy. Explain why it is the best.
   - minimal amount of cache line evictions
   - minimal search cost for a cache line
   - very small caches
   - accessed memory addresses are evenly distributed
   - accessed memory addresses are skewed, but minimal search cost is needed

7. Explain the terms poor data locality and poor code locality with respect to the traditional processing model (tuple-at-time processing) using the following query plan.