1. Storage hierarchy

   Explain the storage hierarchy.
   Which advantages and disadvantages do the different storage types have?
   Why does the use of different storage types with varying sizes and access speeds help accelerating DBMSs?

2. Hard-disks vs. Flash storage

   Which advantages and disadvantages do hard-disks and flash storage provide?
   Discuss the operating principles of both storage media based on the following operations:
   - Sequential read
   - Read of blocks (Random-Access)
   - Read of bits (Random-Access)
   - Sequential write
   - Write of blocks (Random-Access)
   - Write of bits (Random-Access)

   How can flash-storage be considered within the memory architecture?

3. RAID Systems

   (a) Which RAID-Levels (Raid0-6) are suitable to ensure the following requirements of DBMSs:
   - Persistence
   - Access speed
   - Throughput

   Which disadvantages do Raid systems have?
(b) On a RAID-3 system with 5 disks the following records are stored:
1. Platte: D1 = 10100101
2. Platte: D2 = 11110000
3. Platte: D3 = 00111100
4. Platte: D4 = 10111001

Explain a procedure for the computation of the parity bit P = ???????!
Assume, that disk No. 3 is defective. How can D3 be computed from the remaining information?

4. Assigning Records to Pages

In an exemplary DBMS, tuples are stored on pages with a size of 100 Byte. Every page contains header information (each with 1 Byte), page number, references to former and next page as well as offsets. TIDs are stored in the header with 2 Bytes as tuple consisting of page number and position.

(a) Why does a DBMS use pages instead of (a) Files or (b) Blocks of the OS?

(b) For the management of meetings with other people, a student uses a DBMS (characterized above). The following table structure is used:
   • Name: varchar(10)
   • Date: char(10)
   • Time: char(5)
   • Place: varchar(15)
   • Aktivity: varchar(15)
   • Bring along: varchar(10)

Describe two possible ways to represent a record of this type on a page of a DBMS.

(c) .

Simulate stepwise the insertion of data from the following table:

| Name  | Date       | Time  | Place    | Aktivity       | Bring along 
|-------|------------|-------|----------|----------------|--------------
| Kai   | 16.06.2008 | 11:00 | Layla    | Brunch         | none         
| Jana  | 30.07.2008 | 15:00 | City park| Skating        | Skates       
| Nicole| 11.08.2008 | 18:30 | Fountain | Coffe and cake | Roses        |

(d) Simulate the following updates:
   • Last-minute the student detects an embarrassing fault? Skating is not with Jana but with Ann-Mary!
   • Furthermore, Ann-Mary selects a different venue: car park/shopping mall.

Good Luck!