1. Übung

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1 Exercise 1.1

1. Layers:
   Logical data structures:
   concepts: translate and optimize queries
   interface: set-oriented interface: relations, tuples, views

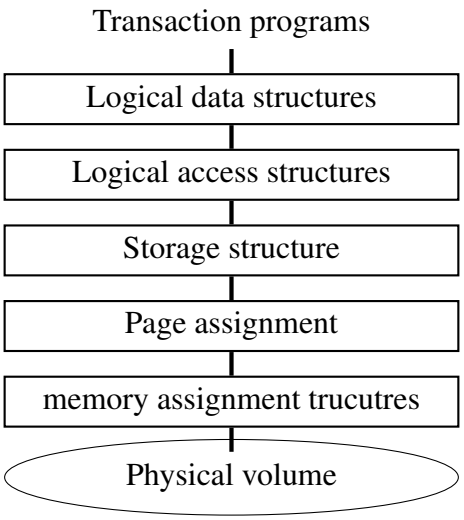
   Logical access structures:
   concepts: manage cursor, sort components and dictionary
   interface: record oriented interface: records, sets, keys, access paths

   Storage Structures:
   concepts: manage record and index
   interface: internal record interface: records, B* trees

   Page assignment:
   concepts: manage buffer and segments
   interface: system buffer interface: pages, segments

   Memory assignment structures:
   concepts: manage files and external memory
   interface: file interface: blocks, files

   physical volume:
   interface: device interface: tracks, cylinders, channels



2. Order: $e \to b \to d \to a \to c$

3. (a) **data independence**: the view on the data is independent of its organized structure inside of the DB
   Physical data independence: the underlying logical organization is independent of the physical representation. So restructuring or changing the implemented structure does not affect the schema

logical data independence: the logical schema might change without any affect on the external schema

(b) Data independence is important because it can provide an encapsulated split between development of programs on an external given structure independent of its internal handling.

(c) answer:

Layer	What is hidden?
Logical data structures	Position indicator and explicit relations in the schema
Logical access paths	Number and kind of the physical access paths; internal representation of records
Storage structures	Management of buffers, logging
Page assignment structures	File mapping, indirect page assignment
Memory assignment structures	Technical features and technical details of external storage media

Problems:

Due to high specialization, functionality of operating system often not usable

- Segment-file mapping
- Paging
- Shadow memory
- Buffer management
- Dispatching

2 Exercise 1.2

1. relational algebra

   (a) $\pi_{country}(\sigma_{percentage=100 \wedge Continent='Africa'}(encompasses))$

   (b) $\pi_{lake}(riverthrough \bowtie_{river=river1} \rho_{river1 \leftarrow river}(\sigma_{Country="F"}(located)))$

   (c) $\pi_{name}(sea) - \pi_{name}(sea \bowtie_{depth1>depth} (\rho_{name1,depth1}(sea)))$

   (d) $\rho_{CountryWithTheHighestMountain}(\pi_{name}$
   $(\pi_{name}(Mountain) - \pi_{name}(Mountain \bowtie_{elevation<elevation1}$
   $\rho_{name1,mountains1,elevation1,type1,coordinates1}(Mountain))$
   $\bowtie geo\_Mountain \bowtie \rho_{cName \leftarrow name}(Country))$

2. SQL queries

```
1  -- a)
2  SELECT DISTINCT l.country FROM language l
3          WHERE l.name = 'German' OR l.name = 'English';
4
5
6  -- b)
7  SELECT DISTINCT l.name FROM
8          Religion r JOIN Language l ON r.country=l.country
9          WHERE r.name = 'Buddhist';
10
11 -- c)
12 SELECT river FROM River EXCEPT
13 SELECT river FROM encompasses
```

```
14          NATURAL INNER JOIN geo_source
15          WHERE continent='Europe';
16
17  -- d)
18  SELECT DISTINCT c.name, lake, mountain FROM
19          Country c LEFT OUTER JOIN geo_lake l ON c.code=l.country
20                    LEFT OUTER JOIN geo_Mountain m ON c.code=m.country
21          WHERE lake IS NOT NULL OR mountain IS NOT NULL;
```