CS 275:
Introduction to Databases

Disk Storage and Basic File Structures

- What impacts the performance of the execution of a query?
  - SELECT * FROM WorkOrder WHERE DeptID=4 ORDER BY WorkOrderDate?

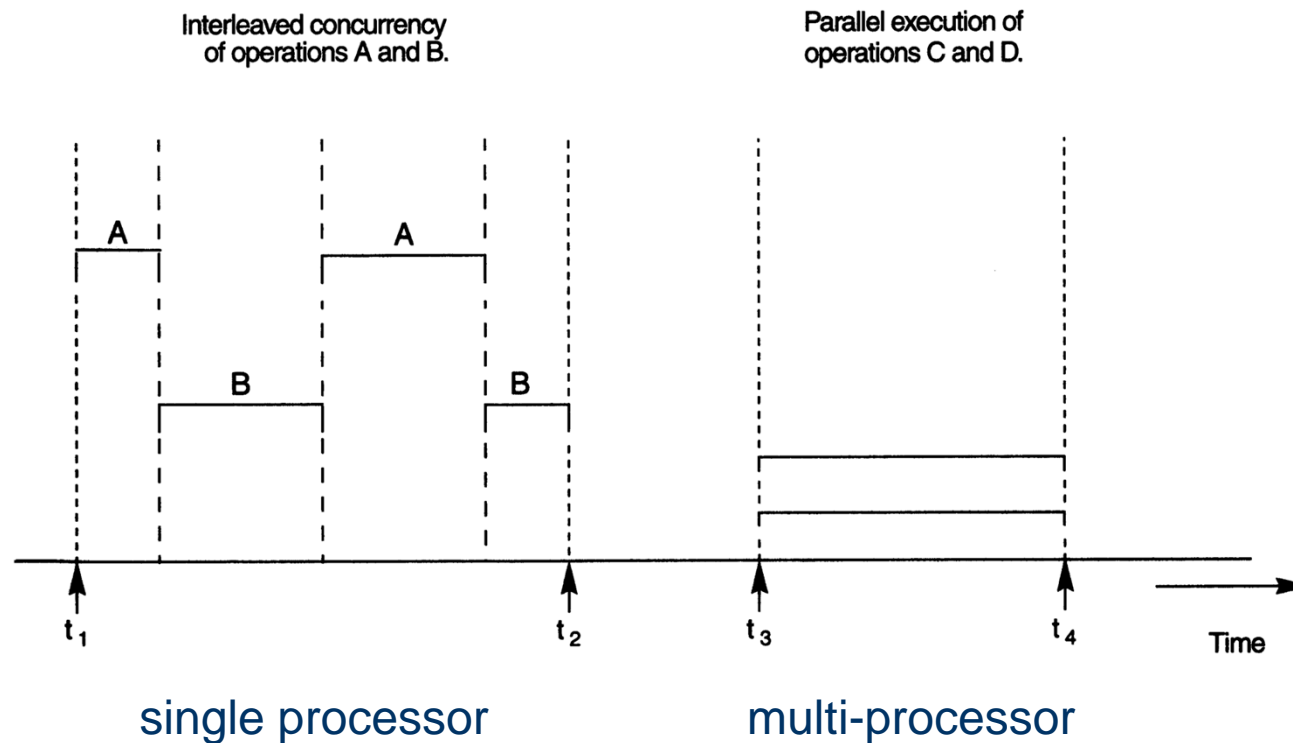# Disk Storage and Basic File Structures

- What impacts the performance of the execution of a query?
  - Data storage format
  - Query execution plan

Disk Storage and Basic File Structures

- Storage medium:
  - Primary storage: can be accessed directly by the CPU
    - Fast
    - Limited in capacity
  - Second storage: magnetic disks, optical disks, tapes
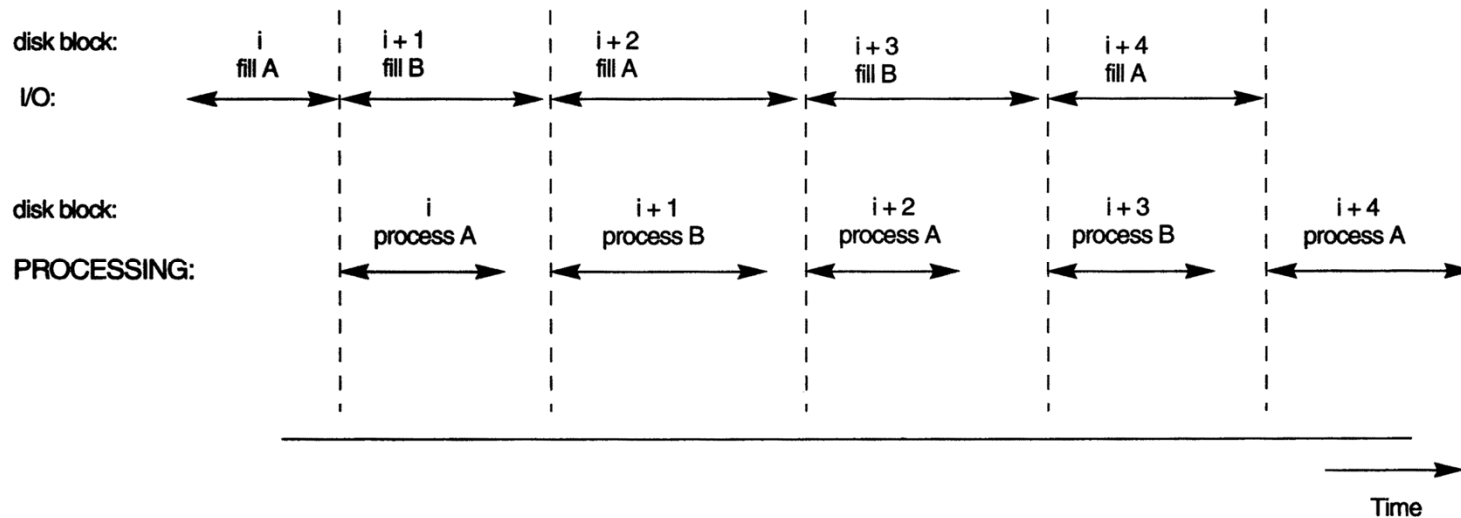   - Larger capacity
    - Slower

Disk Storage and Basic File Structures

- ## Buffering of Blocks

Interleaved concurrency
of operations A and B.

Parallel execution of
operations C and D.

A

A

B

B

t_1

t_2

t_3

t_4

Time

single processor

multi-processor

Disk Storage and Basic File Structures

- Two buffers (computer graphics uses a similar idea)

disk block:	i fill A	i + 1 fill B	i + 2 fill A	i + 3 fill B	i + 4 fill A
I/O:					

disk block:	i process A	i + 1 process B	i + 2 process A	i + 3 process B	i + 4 process A
PROCESSING:					

Time

Disk Storage and Basic File Structures

- How is data in a database stored?
  - Files
    - Records
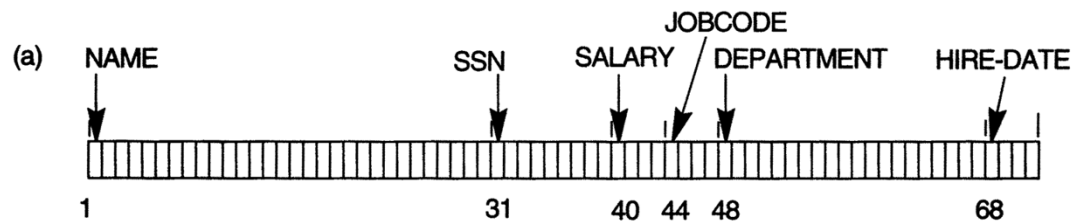   - Record types

Primary File Organization

- ## Record:
  - A row in a table (a tuple)

- ## Record type (format)
  - A collection of field names and corresponding data types

```
struct employee {
    char name [30];
    char ssn[9];
    int salary;
    date bdate;
    char department[20];
}
```

Primary File Organization

- File:
  - A sequence of records
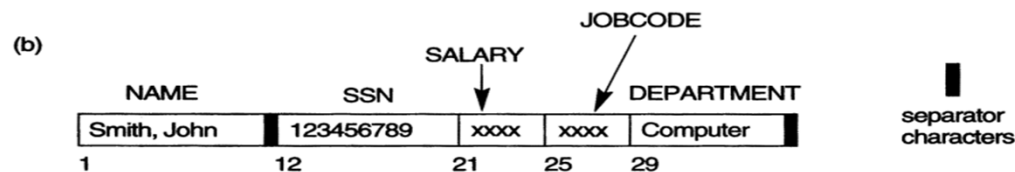 - Fixed-length records

Primary File Organization

- Fixed-length records
  - Field size is fixed, so the size of each record is fixed
  - Can find the starting byte of each field relatively easily
  - Can also handle certain variable-length records
    - Maximum size for each field is known
    - Always allocate space even if NULL values can appear

Primary File Organization

- File:
  - Variable-length records
    - Same record type, variable field sizes
    - Same record type, multi-valued fields
    - Same record type, some fields optional
    - Different record types (mixed)

Primary File Organization

- Variable-length records
  - Rely on a separator character: e.g., comma delimited, or
  - Store the length in bytes of the field in the record
  - Optional fields: ???
  - Repeating fields: ???
  - Different record types: ???

Primary File Organization

- Record blocking and spanned records

(a)

block i: record 1 | record 2 | record 3 | ▨

block i + 1: record 4 | record 5 | record 6 | ▨

(b)

block i: record 1 | record 2 | record 3 | record 4 | P

block i + 1: record 4 (rest) | record 5 | record 6 | record 7 | P