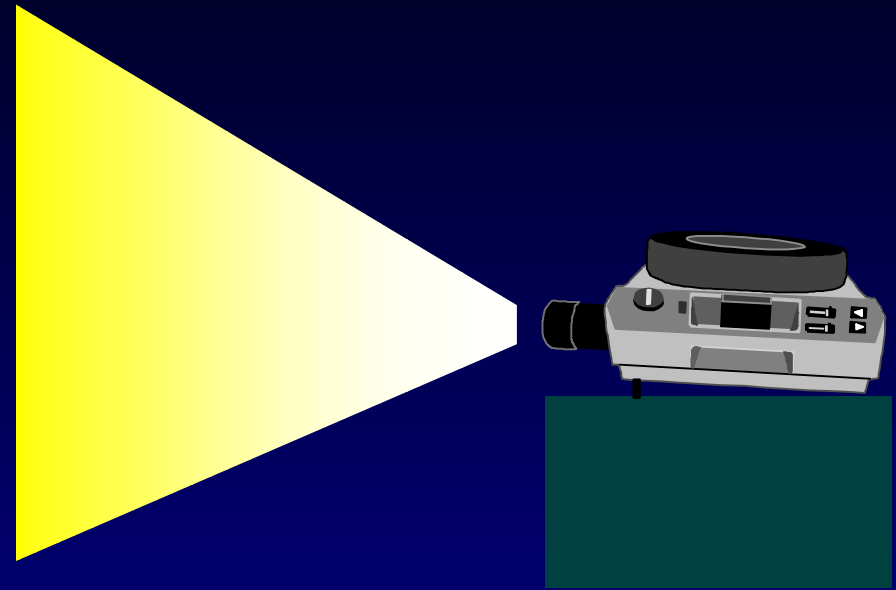
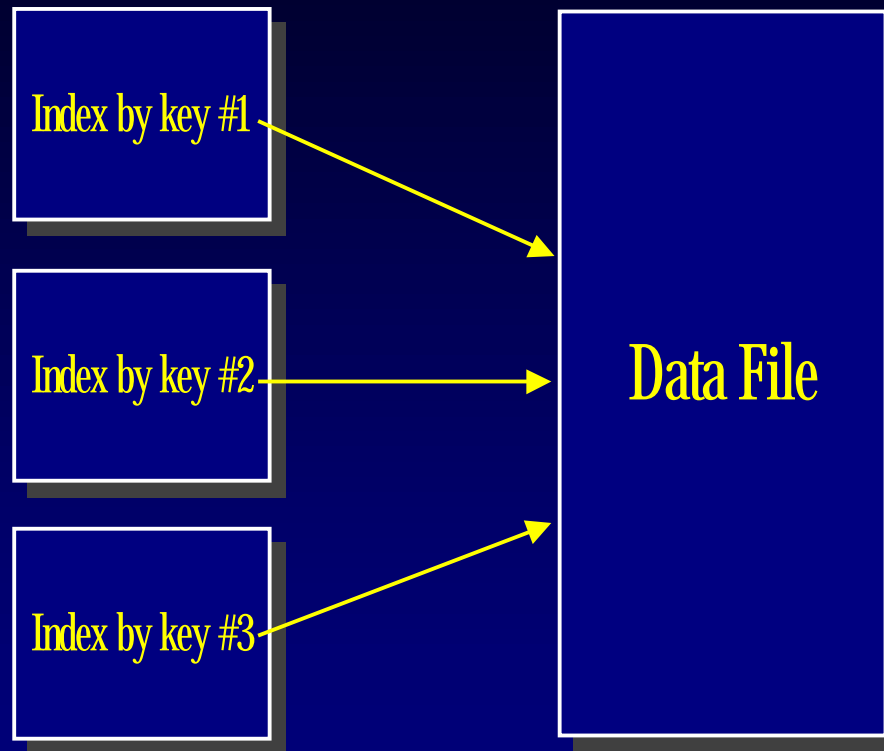


# Multi-Indexed Files : Outline

- Introduction
- Inverted Files
- Multilist Files



# Organization



# Multi-indexed Files

- ▼ Data file associated with one or more logically separated index files.
- ▼ Any changes that affect key values or data locations must be made on both the data file and the indexes.
- ▼ Retrieval of records by more than one key is possible.

# Indexes

- ▼ Each index may be a separate file.
- ▼ All of the indexes may share one file.
- ▼ The indexes may occupy a separate part of the data file.
- ▼ Usually, B-tree is used for index structure.

# Inverted Files

|           |   |
|-----------|---|
| Admin     | 3 |
| Admin     | 4 |
| Admin     | 6 |
| Admin     | 8 |
| Admin     | 9 |
| Architect | 5 |
| Engineer  | 1 |
| Engineer  | 2 |
| Engineer  | 7 |

index

|   |   |
|---|---|
| F | 2 |
| F | 3 |
| F | 6 |
| F | 8 |
| M | 1 |
| M | 4 |
| M | 5 |
| M | 7 |
| M | 9 |

index

|   |         |         |   |           |
|---|---------|---------|---|-----------|
| 1 | 1023230 | Somchai | M | Engineer  |
| 2 | 1249822 | Somma   | F | Engineer  |
| 3 | 1255938 | Somsri  | F | Admin     |
| 4 | 1290393 | Somchai | M | Admin     |
| 5 | 2938492 | Somsak  | M | Architect |
| 6 | 2989828 | Somrak  | F | Admin     |
| 7 | 3039484 | Somwang | M | Engineer  |
| 8 | 3122939 | Somma   | F | Admin     |
| 9 | 4399291 | Somchai | M | Admin     |

Data file

# Inverted Files

|               |               |
|---------------|---------------|
| Admin         | 1255938       |
| Admin         | 1290393       |
| Admin         | 2989828       |
| Admin         | 1249822       |
| Admin         | 1255938       |
| Architect     | 2989828       |
| Engineer      | 3122939       |
| Engineer      | M 10 10232301 |
| Engineer      | M 12 12498222 |
|               | M 29 12559383 |
| Secondary key | M 30 12903934 |
|               | M 43 29384925 |
|               | 29898286      |
|               | 30394847      |
|               | 31229398      |
| Primary key   | 43992919      |

|   |         |         |   |           |
|---|---------|---------|---|-----------|
| 1 | 1023230 | Somchai | M | Engineer  |
| 2 | 1249822 | Somma   | F | Engineer  |
| 3 | 1255938 | Somsri  | F | Admin     |
| 4 | 1290393 | Somchai | M | Admin     |
| 5 | 2938492 | Somsak  | M | Architect |
| 6 | 2989828 | Somrak  | F | Admin     |
| 7 | 3039484 | Somwang | M | Engineer  |
| 8 | 3122939 | Somma   | F | Admin     |
| 9 | 4399291 | Somchai | M | Admin     |

Data file

Indexes

# Multilist Files

|   |   |
|---|---|
| M | 1 |
| F | 2 |

index

|           |   |
|-----------|---|
| Admin     | 3 |
| Architect | 5 |
| Engineer  | 1 |

index

|   |         |         |   |   |   |           |   |   |
|---|---------|---------|---|---|---|-----------|---|---|
| 1 | 1023230 | Somchai | M | x | 4 | Engineer  | x | 2 |
| 2 | 1249822 | Somma   | F | x | 3 | Engineer  | 1 | 7 |
| 3 | 1255938 | Somsri  | F | 2 | 6 | Admin     | x | 4 |
| 4 | 1290393 | Somchai | M | 1 | 5 | Admin     | 3 | 6 |
| 5 | 2938492 | Somsak  | M | 4 | 7 | Architect | x | x |
| 6 | 2989828 | Somrak  | F | 3 | 8 | Admin     | 4 | 8 |
| 7 | 3039484 | Somwang | M | 5 | 9 | Engineer  | 2 | x |
| 8 | 3122939 | Somma   | F | 6 | x | Admin     | 6 | 9 |
| 9 | 4399291 | Somchai | M | 7 | x | Admin     | 8 | x |

Data file

# Multilist Files

## ▼ Advantages :

- small indexes (may be kept in RAM)
- ability to navigate through the data file

## ▼ Disadvantages :

- space required for links in the data file
- complexity for maintaining the linked list



# Choice of Pointers

- ▼ Static files : use record numbers
- ▼ Dynamic files :
  - use record number :
    - ▼ change all the indexes
    - ▼ more complicated
  - use primary key :
    - ▼ change only primary index
    - ▼ require additional accesses