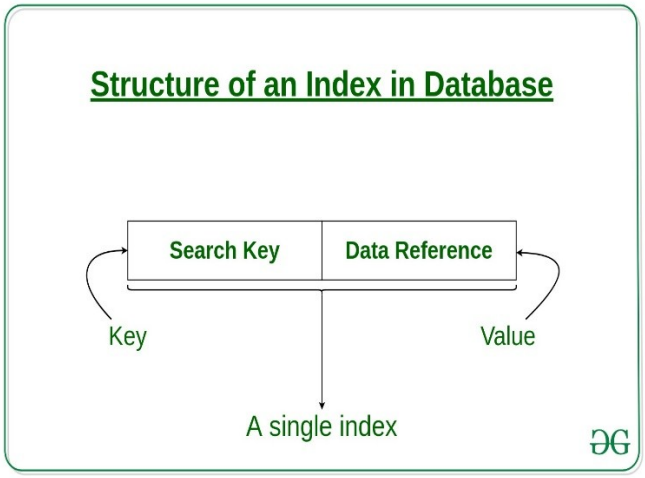
Indexing

Indexing is a data structure technique to efficiently retrieve records from the database files based on some attributes on which the indexing has been done.

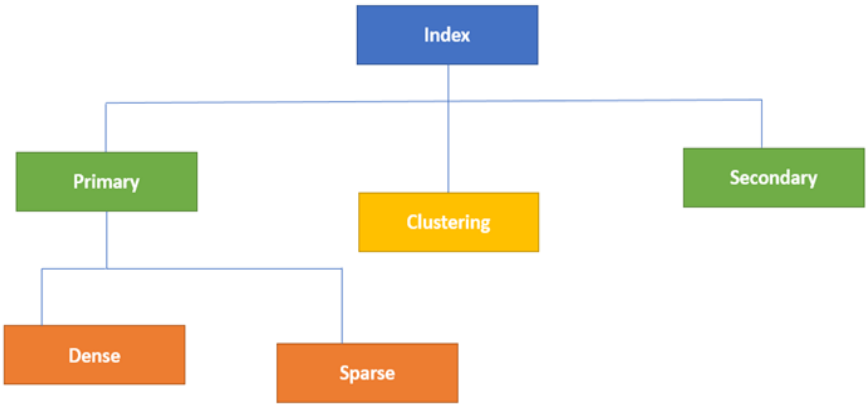


- The first column of the database is the search key that contains a copy of the primary key or candidate key of the table. The values of the primary key are stored in sorted order so that the corresponding data can be accessed easily.

- The second column of the database is the data reference. It contains a set of pointers holding the address of the disk block where the value of the particular key can be found.

The indexing has various attributes:

- **Access Types**: This refers to the type of access such as value based search, range access, etc.
- **Access Time**: It refers to the time needed to find particular data element or set of elements.
- **Insertion Time**: It refers to the time taken to find the appropriate space and insert a new data.
- **Deletion Time**: Time taken to find an item and delete it as well as update the index structure.
- **Space Overhead**: It refers to the additional space required by the index.



Indexing is defined based on its indexing attributes.

- **Primary Index** − Primary index is defined on an ordered data file. The data file is ordered on a **key field**. The key field is generally the primary key of the relation.
- **Secondary Index** − Secondary index may be generated from a field which is a candidate key and has a unique value in every record, or a non-key with duplicate values.
- **Clustering Index** − Clustering index is defined on an ordered data file. The data file is ordered on a non-key field.

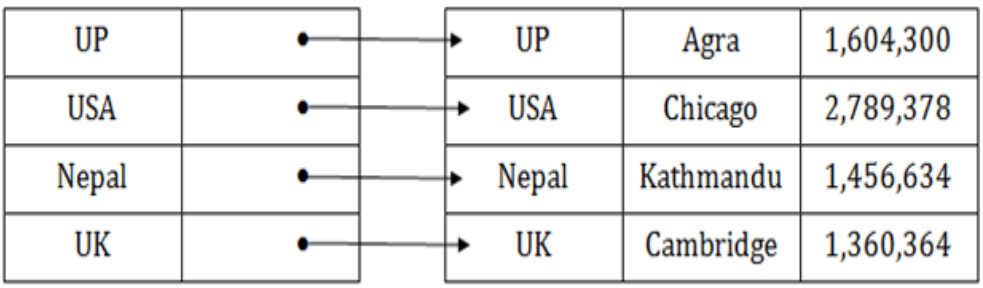
Ordered Indexing is of two types −

- Dense Index
- Sparse Index

Dense Index

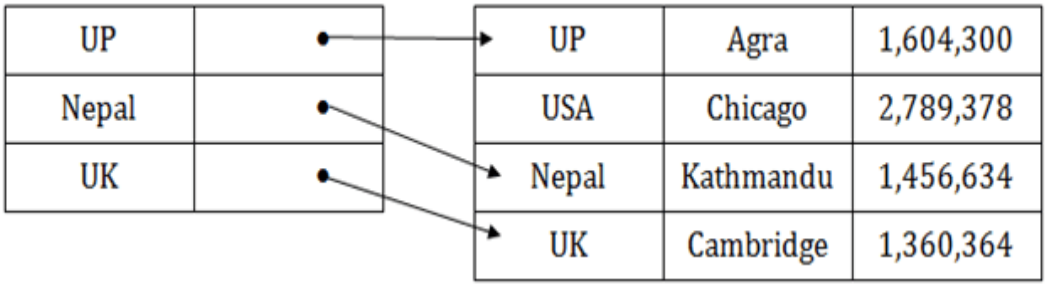
In dense index, there is an index record for every search key value in the database. This makes searching faster but requires more space to store index records itself.

In this, the number of records in the index table is same as the number of records in the main table.



Sparse Index

- In the data file, index record appears only for a few items. Each item points to a block.
- In this, instead of pointing to each record in the main table, the index points to the records in the main table in a gap

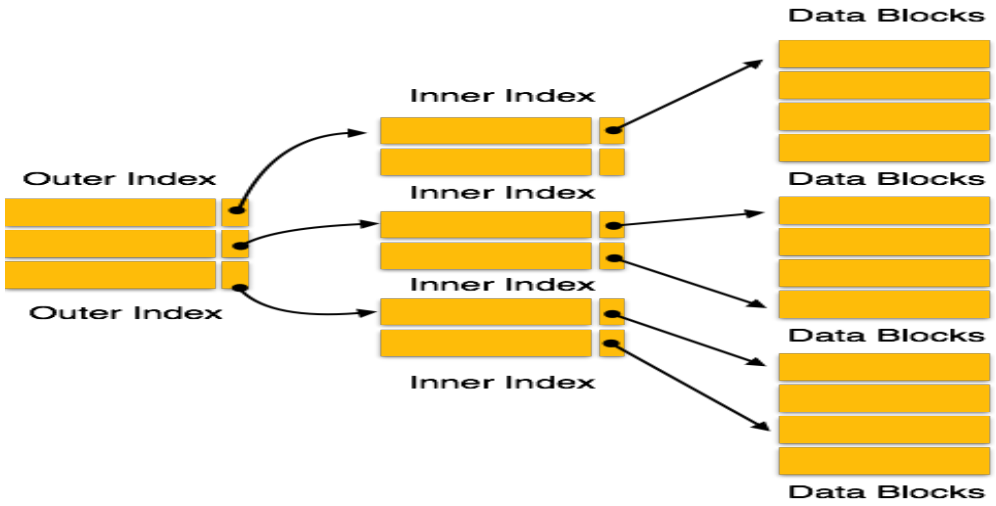


Clustering Index

- A clustered index can be defined as an ordered data file. Sometimes the index is created on non-primary key columns which may not be unique for each record.
- In this case, to identify the record faster, we will group two or more columns to get the unique value and create index out of them. This method is called a clustering index.
- The records which have similar characteristics are grouped, and indexes are created for these group.

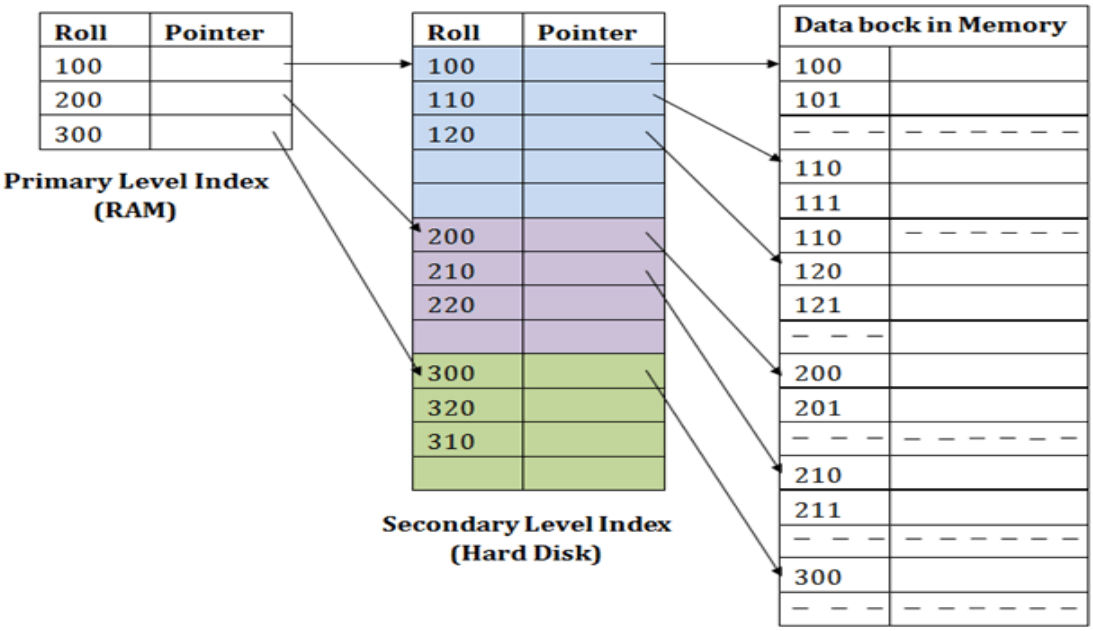
Multilevel Index

Index records are combination of search-key values and data pointers. As the size of the database grows, so does the size of the indices.



Secondary Index

In secondary indexing, to reduce the size of mapping, another level of indexing is introduced. The mapping of the first level is stored in the primary memory, so that address fetch is faster. The mapping of the second level and actual data are stored in the secondary memory (hard disk).


Roll
Pointer
100
200
300
Primary Level Index
(RAM)
Roll
Pointer
100
110
120
200
210
220
300
320
310
Secondary Level Index
(Hard Disk)
Data bock in Memory
100
101
110
111
110
120
121
200
201
210
211
300