MIS 301 Relational Database Management System

DATABASE MANAGEMENT SYSTEM

Indexing concepts: Ordered indices (primary , secondary, dense, sparse, multilevel)

Lecture 28&29

INDICES

- Indexing is used to optimize the performance of a database by minimizing the number of disk accesses required when a query is processed.
- It is a data structure which makes our search simpler and quicker.
- Records are stored in the form of files in different data blocks in secondary memory.
- The link between the records and the data block is called index.
- Index in databases is the pointer to the block address in the memory.
- An index structure is usually defined on a single Attribute of a Relation, called the **Search Key.**

ORDERED INDICES

- The indices which are sorted are known as ordered indices.

Rollno	Recno(){record pointer}
2	3
4	1
5	5
7	7
8	2
10	6
13	4

Index

Rollno	Name	City	Marks
4	John	Patna	75
8	Peter	Mumbai	80
2	Rohit	Chennai	88
13	George	Cuttack	67
5	Sourav	Kolkata	56
10	Sunita	Mumbai	70
7	Jane	Cuttack	74

Database Table

PRIMARY INDEX

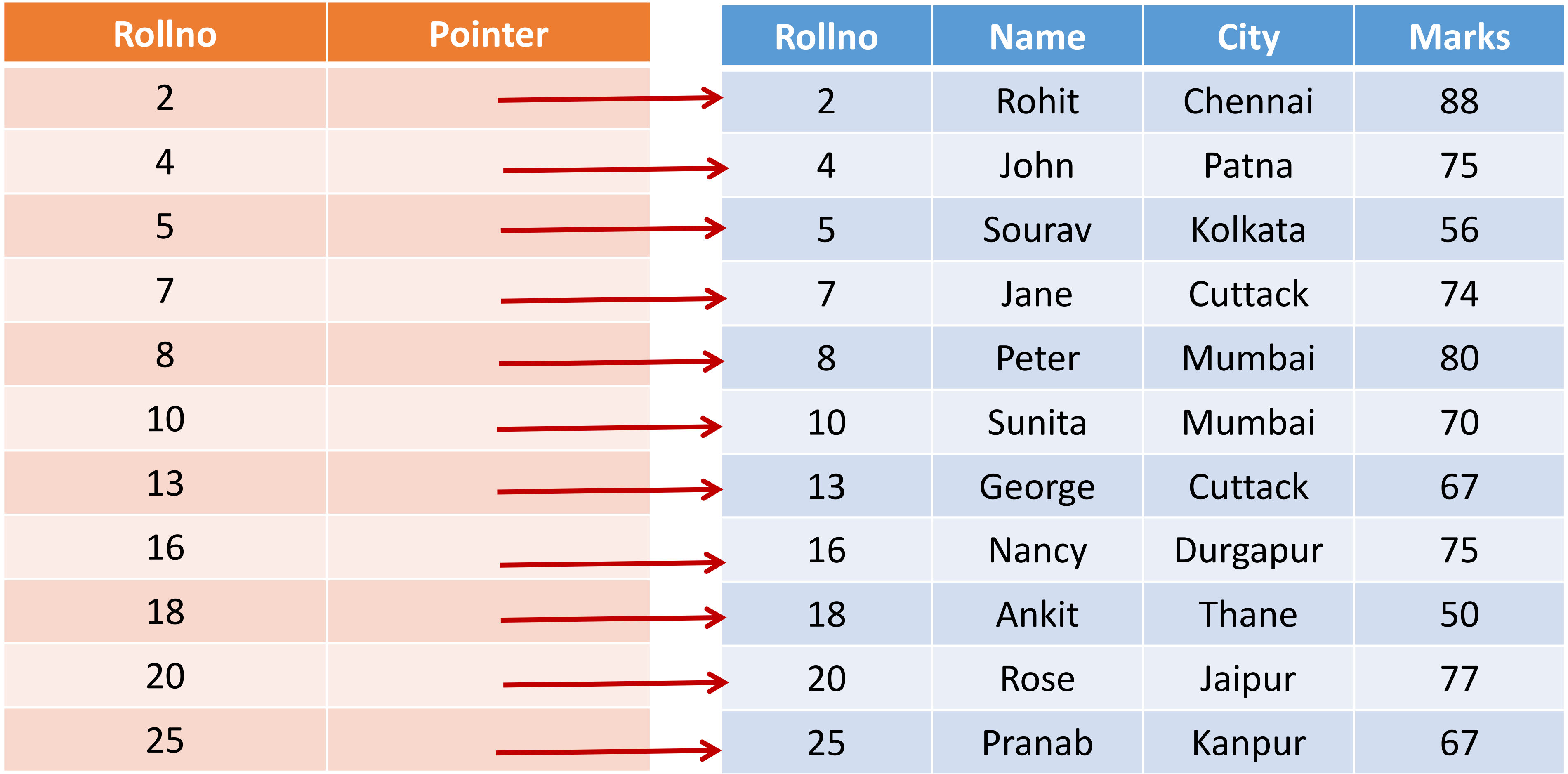
❖Here the primary key is used for indexing the table.

❖Since primary keys are kept in sorted order, search operation efficiency of the index is high.

❖There are two types of primary index namely sparse index and dense index

1. **Dense**: One entry in the index file for every record in the data file
2. **Sparse**: One entry in the index file for each block of the data file

DENSE INDEX

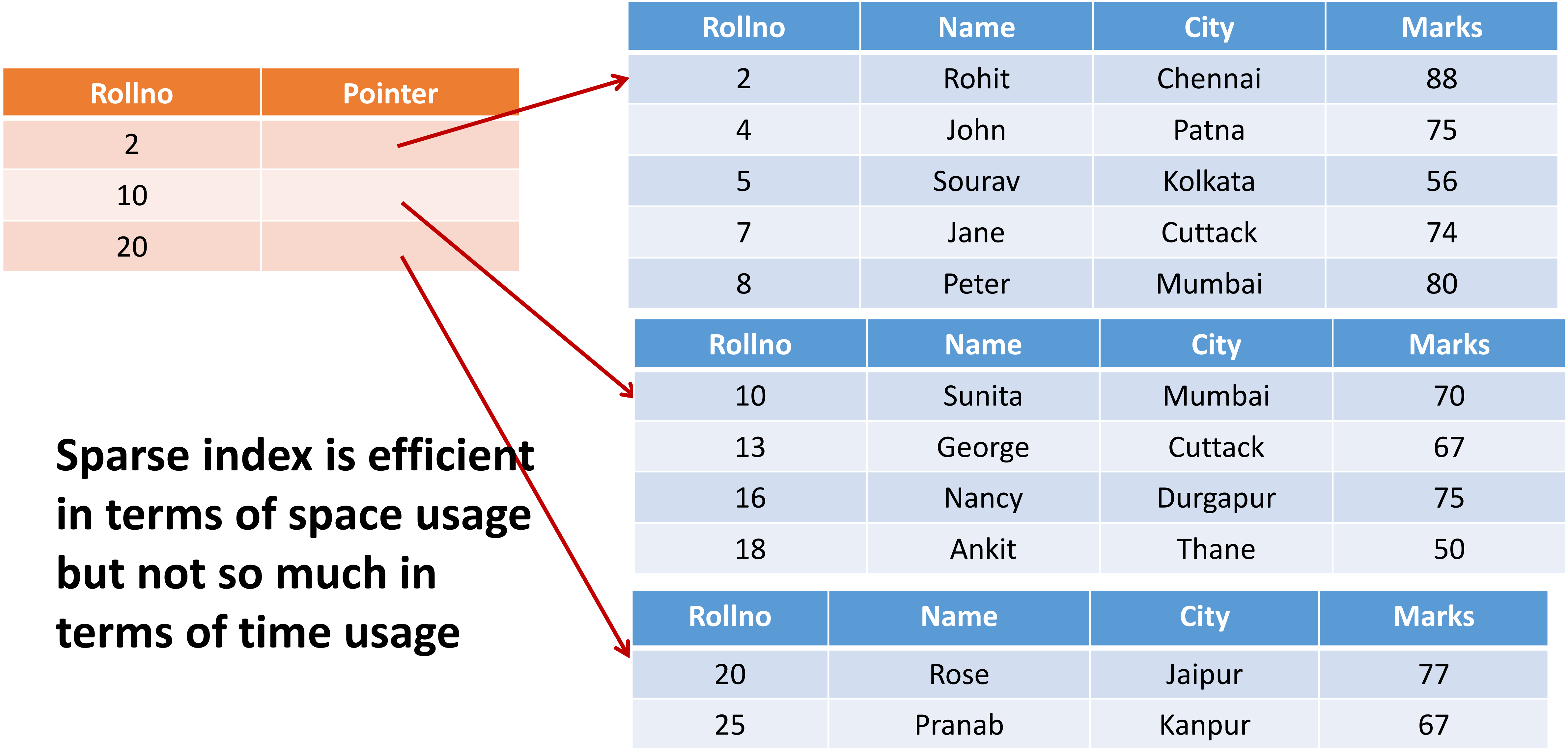


Rollno	Pointer
2	
4	
5	
7	
8	
10	
13	
16	
18	
20	
25	

Rollno	Name	City	Marks
2	Rohit	Chennai	88
4	John	Patna	75
5	Sourav	Kolkata	56
7	Jane	Cuttack	74
8	Peter	Mumbai	80
10	Sunita	Mumbai	70
13	George	Cuttack	67
16	Nancy	Durgapur	75
18	Ankit	Thane	50
20	Rose	Jaipur	77
25	Pranab	Kanpur	67

Dense index is efficient in terms of time usage but not so much in terms of space usage

SPARSE INDEX



Rollno	Pointer
2	
10	
20	

Rollno	Name	City	Marks
2	Rohit	Chennai	88
4	John	Patna	75
5	Sourav	Kolkata	56
7	Jane	Cuttack	74
8	Peter	Mumbai	80

Rollno	Name	City	Marks
10	Sunita	Mumbai	70
13	George	Cuttack	67
16	Nancy	Durgapur	75
18	Ankit	Thane	50

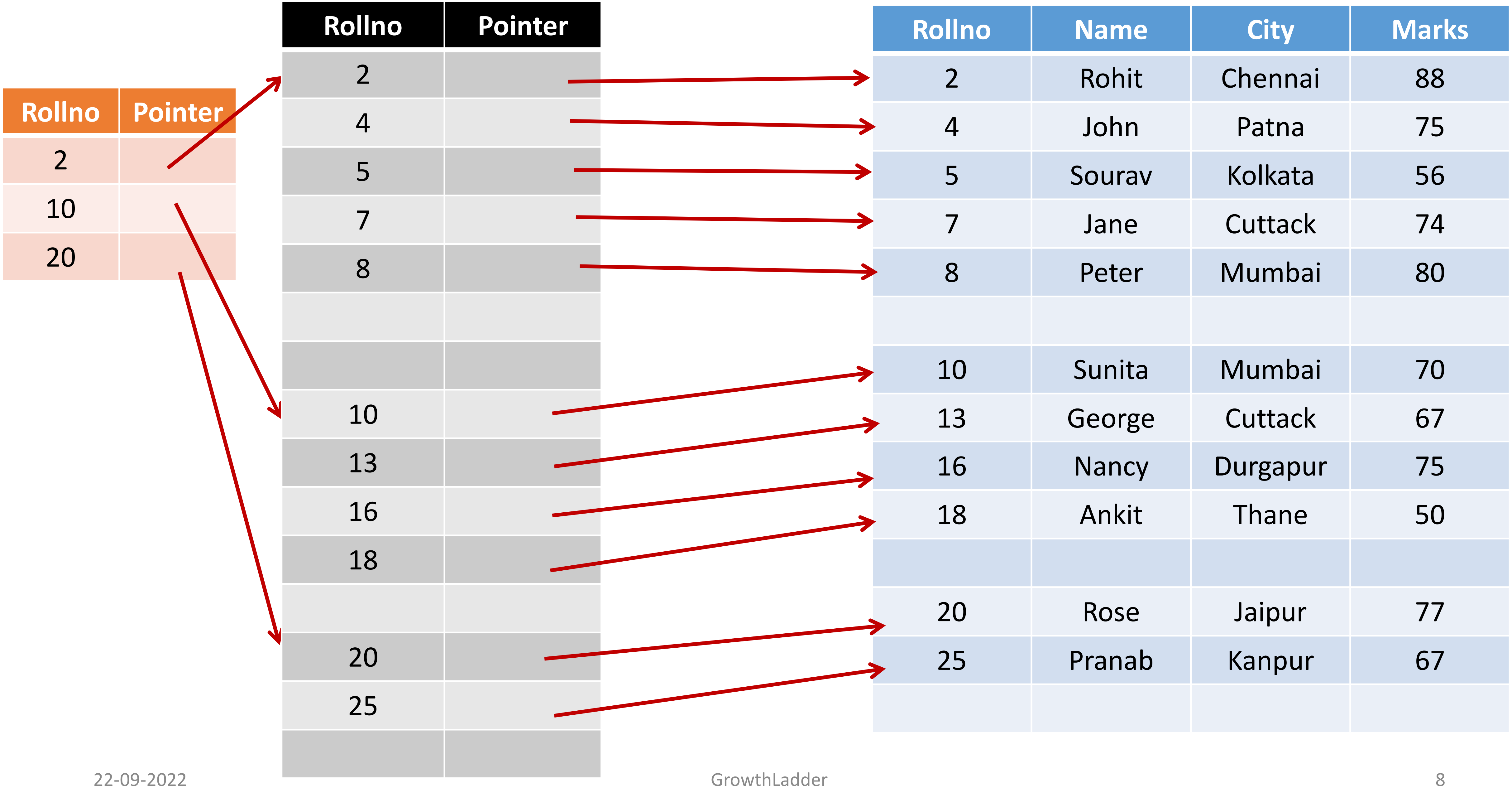
Rollno	Name	City	Marks
20	Rose	Jaipur	77
25	Pranab	Kanpur	67

Sparse index is efficient in terms of space usage but not so much in terms of time usage

SECONDARY INDEXING

- In sparse indexing, as the size of the table grows, the size of mapping also grows.
- If the mapping size grows, fetching the address itself becomes slower, rendering sparse index inefficient
- 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.

SECONDARY INDEX



Rollno	Pointer
2	
10	
20	

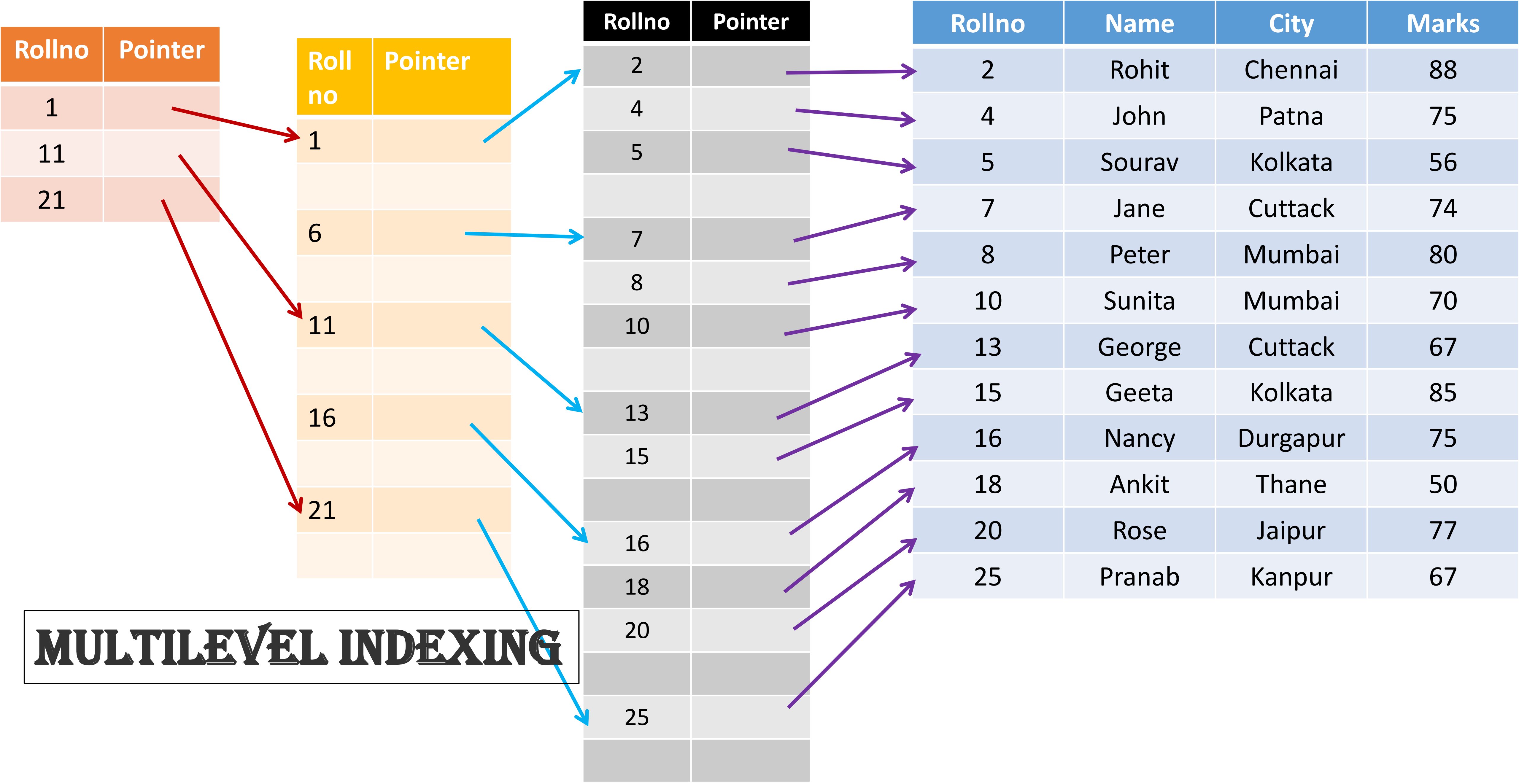
Rollno	Pointer
2	
4	
5	
7	
8	
10	
13	
16	
18	
20	
25	

Rollno	Name	City	Marks
2	Rohit	Chennai	88
4	John	Patna	75
5	Sourav	Kolkata	56
7	Jane	Cuttack	74
8	Peter	Mumbai	80
10	Sunita	Mumbai	70
13	George	Cuttack	67
16	Nancy	Durgapur	75
18	Ankit	Thane	50
20	Rose	Jaipur	77
25	Pranab	Kanpur	67

MULTILEVEL INDEXING

- ❖ Index records comprise search-key values and data pointers. Keeping index records in primary memory speeds up operations.
- ❖Multilevel index is stored on the disk along with the actual database files.
- ❖If a single-level index is used for large data, a large size index cannot be kept in memory which leads to multiple disk accesses.
- ❖A multilevel index reduces the number of blocks accessed when searching for a record, given its indexing field value.
- ❖In dynamic multilevel indexing, the multilevel index leaves some space in each of its blocks for inserting new entries.
- ❖Multi-level Index helps in breaking down the index into several smaller indices in order to make the outermost level so small that it can be saved in a single disk block(in primary memory).
- ❖Multilevel indexing segregates the main block into various smaller blocks so that the same can be stored in a single block.

MULTILEVEL INDEXING



Rollno	Pointer
1	
11	
21	

Roll no	Pointer
1	
6	
11	
16	
21	

Rollno	Pointer
2	
4	
5	
7	
8	
10	
13	
15	
16	
18	
20	
25	

Rollno	Name	City	Marks
2	Rohit	Chennai	88
4	John	Patna	75
5	Sourav	Kolkata	56
7	Jane	Cuttack	74
8	Peter	Mumbai	80
10	Sunita	Mumbai	70
13	George	Cuttack	67
15	Geeta	Kolkata	85
16	Nancy	Durgapur	75
18	Ankit	Thane	50
20	Rose	Jaipur	77
25	Pranab	Kanpur	67

- TILL WE MEET AGAIN IN THE NEXT CLASS……….