

1) Yes, it is possible to do all these operations using indexing. A clustered index can be created on empname. However, it is only possible IF every employee has a unique name. If this is ensured, the tuples must be organized such that empname \Rightarrow alphabetical.

If empid is a clustered index, it is possible as every employee already has a unique id. The tuples are then organized according to empid.

If both empname & empid are used as clustered indices, it may not be possible. It ~~can be~~ is possible to do these operations if we have one clustered or one non-clustered index.

2) • database queries
• updates

2) • representing information
• external schema
• logical schema

• access
• update
• representing

TRUE.

3) A DBMS is shared among users. The transactions from these users can be interleaved to improve execution time of users' queries. By interleaving queries, users don't have to wait for the completion of other users' transactions before their transaction begins. Without interleaving, if a user takes / has a transaction that takes t seconds to complete & another user wants their transactions to begin, they (the latter) have to wait for an extra t seconds before their transaction begins (as transaction of first user takes t seconds).

4) a. A user must guarantee that their transaction must not corrupt data or insert non-sensical or with duplicates of data in the data-base. Also, any transaction (credit or withdrawal), the user must ensure that the transaction models the amount he/she adds to or removes from his/her account. The database application will be worthless if a user removed a small amount of money from their account but the transaction set their balance to zero.

b. A DBMS must guarantee that all transactions are executed fully, successfully & independent of other transactions. An important property of DBMS would be the atomic ~~the~~ execution of a transaction or in other words, it must seem that it is the only transaction running. Transactions will either fully complete, or will be aborted & the database is returned to initial state. This ensures database consistency.

5) Yes, the primary ~~of~~ key of a relation can be determined with the help of an instance. For eg: in a 1:m relation,

the columns/attributes can be considered / be given unique values as primary key.

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6) • Create Clustered index `ix_empname_index` on
`STUDENTTABLE (StudentName DESC)`

"Select Email from STUDENTTable"

Student ID	Student Name	Email	Age
1005	Krishna	krishna@pqr.com	22
1030	John	Null	23
1026	John	Jh@xyz.com.	22

7) $P(R_1, \text{catalog})$
 $P(R_2, \text{catalog})$

$$\pi_{R_1.pid} \sigma_{R_1.pid = R_2.pid \wedge R_1.sid \neq R_2.sid} (R_1 \times R_2)$$

using:

SID	PID	Cost
1	1	₹ 10.00
2	1	₹ 9.00
2	3	₹ 34.00
3	1	₹ 11.00

$R_1 \times R_2$ gives:

SID	PID	Cost(₹)	SID	PID	Cost(₹)
1	1	10.00	1	1	10.00
1	1	10.00	2	1	9.00
1	1	10.00	2	3	34.00
1	1	10.00	3	1	11.00
2	1	9.00	1	1	10.00
2	1	9.00	2	1	9.00
2	1	9.00	2	3	34.00
2	1	9.00	3	1	11.00
2	3	34.00	1	1	10.00
2	3	34.00	2	1	9.00
2	3	34.00	2	3	34.00
2	3	34.00	3	1	11.00
3	1	11.00	1	1	10.00
3	1	11.00	2	1	9.00
3	1	11.00	2	3	34.00
3	1	11.00	3	1	11.00

$\sigma_{R1.pid = R2.pid}$ gives:

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SID	PID	Cost	SID	PID	Cost
1	1	10.00	1	1	10.00
1	1	10.00	2	1	9.00
1	1	10.00	3	1	11.00
2	1	9.00	1	1	10.00
2	1	9.00	2	1	9.00
2	1	9.00	3	1	11.00
2	3	34.00	2	3	34.00
3	1	11.00	1	1	10.00
3	1	11.00	2	1	9.00
3	1	11.00	3	1	11.00

$\sigma_{R1.pid = R2.pid \wedge R1.sid \neq R2.sid}$ gives:

SID	PID	Cost	SID	PID	Cost
1	1	10.00	2	1	9.00
1	1	10.00	3	1	11.00
2	1	9.00	1	1	10.00
2	1	9.00	3	1	11.00
3	1	11.00	1	1	10.00
3	1	11.00	2	1	9.00

Projecting on PID gives us a single part number - 1
(eliminating the duplicates)

SQL QUERY

SELECT c.sid

FROM CATALOG C.

WHERE EXISTS (SELECT c1.sid FROM ~~Catalog~~ Catalog C1

WHERE C1.pid = C.pid and C1.sid = C.sid)

8)
=

This is because the relational algebra statement doesn't return anything because of the sequence of projection operators. Once, sid is projected, it is the only field in the set. Therefore, projecting on the same will not return anything.

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8) $\pi_{\text{name}}(\pi_{\text{sid}}((\sigma_{\text{color} = \text{'red'}}(\text{Parts})) \times (\sigma_{\text{cost} < 100}(\text{Catalog}))) \times \text{Suppliers}))$

INVALID QUERY

9) The following view on Emp can be updated automatically by updating Emp:

```
CREATE VIEW SeniorEmp (eid, name, age, salary)
AS SELECT E.eid, E.ename, E.age, E.salary
from Emp E
WHERE E.age > 50
```