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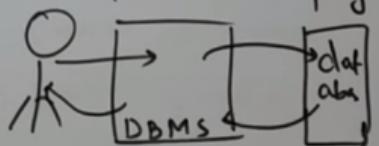
For Engineering Students of GGSIPU, UPTU and Other Universities, Colleges of India

Introduction to Database Management Systems

Database:- Collection of logically interrelated data and a description of this data, designed to meet the info needs of an organization.

Features of data in a database

- Shared → User → Principal
- Persistence → Appl → Admin → DBMS → Database + DBMS S/W
- Validity → Correct
- Security → Unauthorized access
- Consistency → Consistent
- Non-redundancy → 1 > A
- Independence → 3 levels



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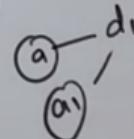
Comparison b/w File Management and Database Management

File Management → Access control
→ Security
→ Data redundancy
→ Data dependency

- i) Small System (C++)
- ii) Cheap
- iii) Simple Structure
- iv) Very low design
- v) Not Secure
- vi) Single User
- vii) Isolated data
- viii) Backup mechanism

Database Management

- i) Large Systems (Oracle)
- ii) Expensive
- iii) Complex Structure
- iv) Designing is imp.
- v) Secure
- vi) Multi User
- vii) Shared data
- viii) Complex



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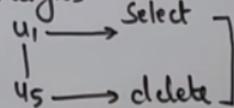
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DBA (Database Administrator)

→ A DBA is an individual person or a group of persons with an overview of one or more databases so that he/she can control the design and the use of these databases.

Functions of an DBA

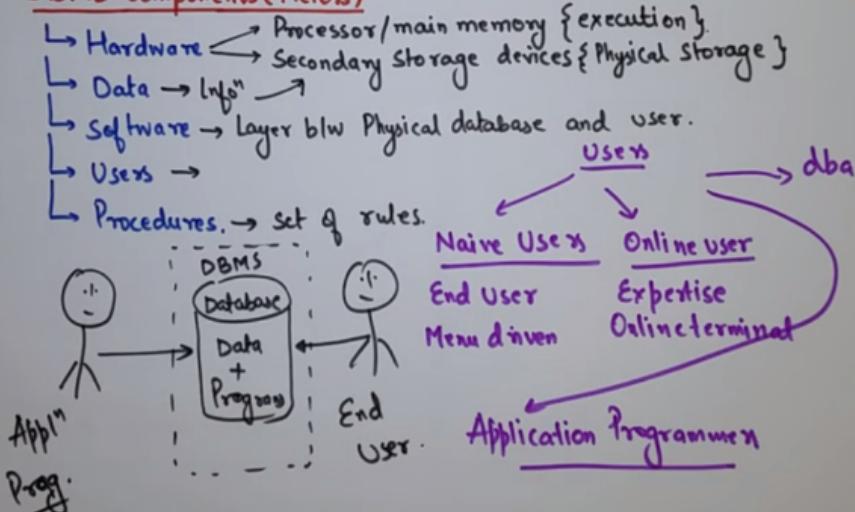
- i) Defining Conceptual Schema.
- ii) Physical database design.
- iii) Security and Integrity checks. { authentication
authorization }
- iv) Backup and Recovery Strategies
- v) Granting Users Access



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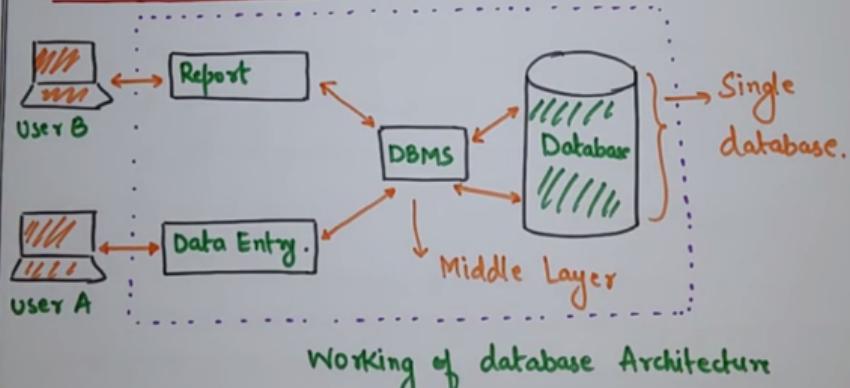
DBMS Components (Actors)



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Database Architecture:



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Database Schemas and Instances

Schemas:- It is the overall description of the database. (3-level architecture)

- ↳ one schema at each level. { eid not null }
- Doesn't specify relationship among files.

| Emp | ename | eid | emobile |
|-----|---------|---------|---------|
| | varchar | Integer | Number |

Instances:- Collection of info stored in the database at a particular moment is called **instances**.

- ↳ all columns access
- 4 records
- one instance.

| Emp | eno | ename | deptno |
|-----|-----|-------|--------|
| | 101 | John | 10 |

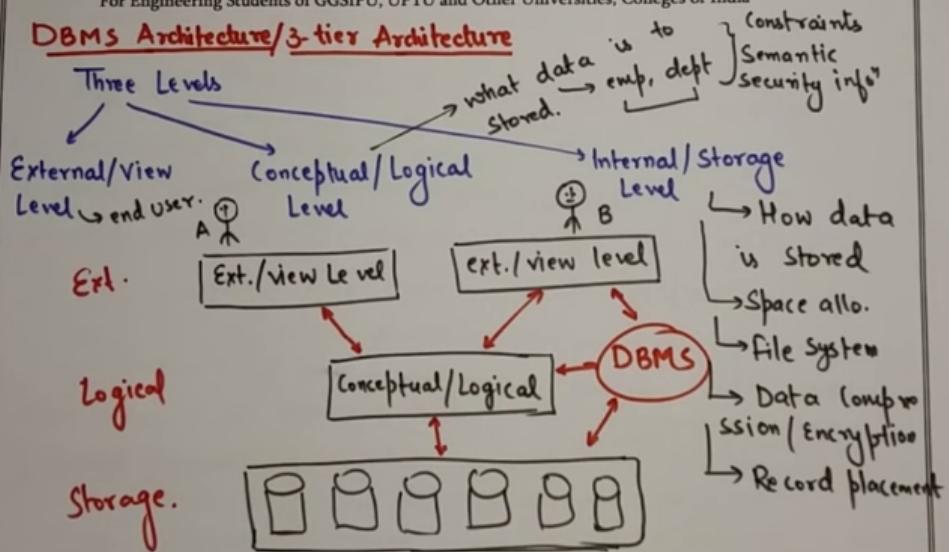
| emp | eno | ename | deptno |
|-----|-----|-------|--------|
| | 102 | David | 20 |

Sub-schemas:- It is an application programmer's or user's view of the data item types and record types, which he or she uses.

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DBMS Architecture/3-tier Architecture



(DBMS Intro-8)

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Data Independence → upper levels are unaffected by changes in lower level.

Physical Data Independence

→ Physical Storage Str. or devices
Can be changed without affecting
Conceptual schema.

- Improve performance
- Not difficult
- Conceptual and external

Logical Data Independence

- Conceptual schema can be changed without affecting external schema.
- Structure of database is altered.
- difficult
- external Schema.

(DBMS Intro-9)

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Database Languages

Select → DQL (Data Query Lang.)

Transaction

Language of DBMS

DDL Data Def Language

- Create
- Alter
- Drop

Data Manipulation Language

DML
Procedural DML
l (How)
PL-SQL

Insert

→ update

→ delete

→ (commit-
Savepoint
Rollback)

Non-Procedural DML
(what)

DCL (Data Control Language)

- Grant
- Revoke

Formal Query Lang
Relational Algebra
Relational Calculus

(commercial
Query)

SQL

(DBMS Intro-10)

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Data Associations (ER Model)

Important Defn:-

(1) Entity:- An entity is a "thing" or "object" in the real world

-that is distinguishable from all other objects.

↳ each person in a org. is a entity.

- An entity has a set of properties, and values for some set of properties -that may uniquely identify an entity.

person → id
 └─ mobile no. } }

- An entity set is a set of entities of the same type

-that share their same properties or attributes.

Bank ← Employee (eid) }
 Customer (Bank-acct no.) }

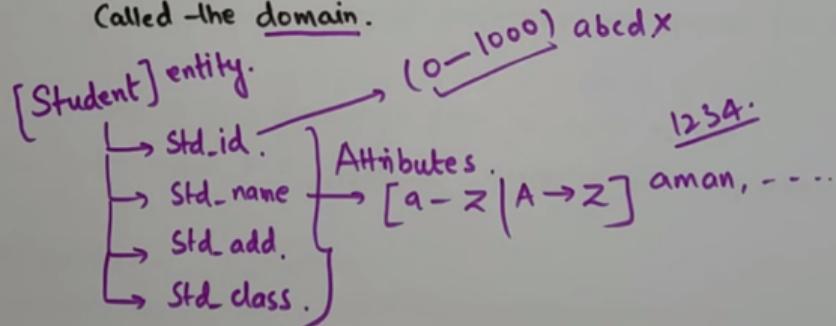
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Attributes - An entity is represented by a set of attributes.

- Attributes are descriptive properties possessed by each member of an entity set.

- For each attribute, there is a set of permitted values, called -the domain.



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Types of Attributes

Simple/Composite

Simple → are not divided Sub-parts.
e.g.: unique_id.

1234 → 12
 34.

Composite → Can be divided into Sub-parts.
e.g.: city_name → street_no., first_name, last_name

Attribute Types

Single/Multi-Valued

Single-Valued
↳ Has Single Value at a instance.
e.g.: Order_id. 1234

Multi-Valued
↳ Can have multiple Values
e.g.: phone_no.

Derived

↳ Can be derived from other related attribute Values.
e.g.: Age

ename | D.O.B.

Current_date - D.O.B

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E-R Model (Entity Relationship model)

Notations used.

- i) Entity type
- ii) Weak Entity
- iii) Relationship
- iv) Identifying relationship type
- v) Attribute

- vi) Primary Key
- vii) Multi-Valued attribute
- viii) Composite attribute
- ix) Derived attribute
- x) Total participation of E2 in R
- xi) Cardinality

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Strong and Weak Entity Sets (Difference)

→ It is an entity set which does not have sufficient attributes to form primary key.

Example: Entity-set 'Payment'

Attributes:

- Payment - Number ^{emi_no}
- Payment - date
- Payment - Amount

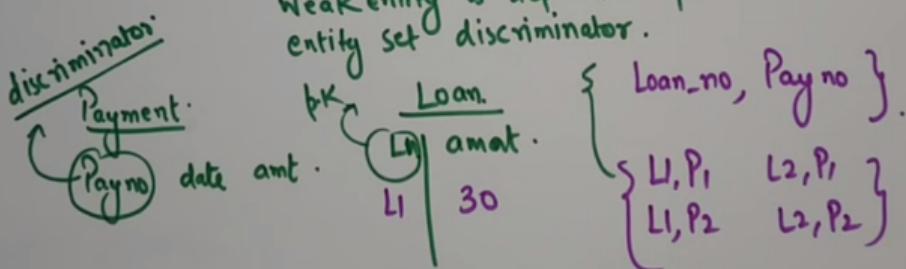
| Payment | Loan |
|-----------------------------------|-------------------|
| P ₁ d ₁ 10 | v ₁ 2. |
| P ₂ d ₂ 20 | v ₂ 2. |
| P ₁ d ₁ 30 | |
| P ₂ d ₃ 40. | |

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How to form the Primary Key of a Weak Entity Set? } Important

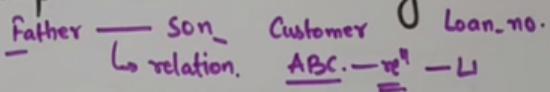
→ primary key of strong entity set on which weak entity is dependent plus the weak entity set discriminator.



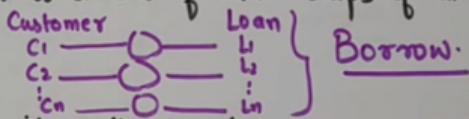
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Relationship Sets - A relationship is an association among several entities.



→ A relationship Set is a set of relationships of the same type.



Connectivity/Cardinality: It describes the mapping of associated entity instances in the relationship.

or

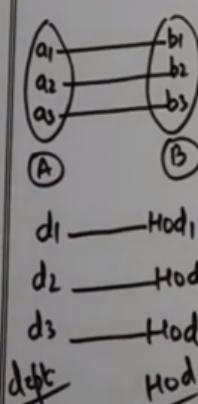
It expresses the no. of entities to which an entity can be associated via a relationship set.

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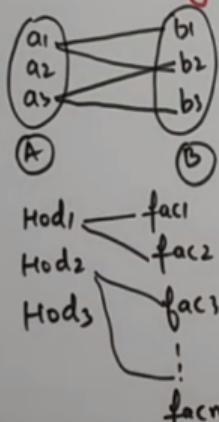
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Mapping Cardinalities

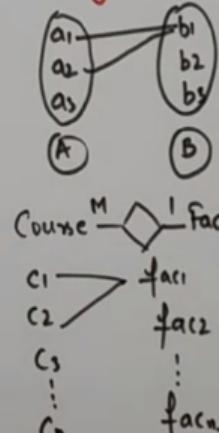
One-to-One



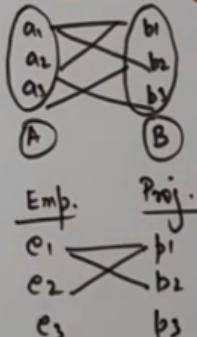
One-to-many



Many-to-One



Many-to-many



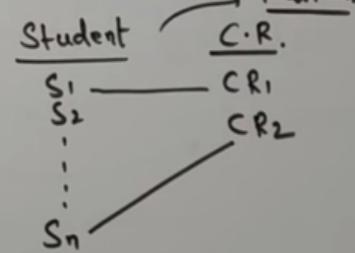
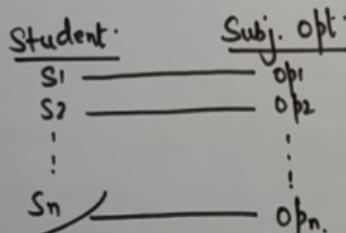
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Participation constraints → How an entity participates in a relationship.

Total → if every entity in 'E' participates in atleast one relationship in 'R'.

Partial → Some entities in 'E' participates in the relation 'R'.



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Keys in a Relation: A Key allows us to identify a set of attributes that suffice to distinguish entities from each other.

| | |
|---|---|
| 1 | A |
| 2 | A |

Types of Keys.

i) SuperKey - Set of one or more attributes that allows identifying an entity uniquely.
↳ it may contain extra attributes.
 $\{ \text{Std-id}, \text{Std-name} \} \rightarrow \text{S.K.}$

ii) Candidate Key - It is minimal set of SuperKey which can uniquely identify an entity.
 $\{ \text{Std-id} \} \rightarrow \text{C.K.}$ { Superkey for which no subset is a Superkey }

gfbkj

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Types of Keys

Note:- More than one C.K.
4 C.K.

iii) Primary Key → Chosen by the dba as the principal means of identifying entity. $1 \quad 4 - 1 = 3$

iv) Alternate Key → CK - PK. = AK $4 - 1 = 3$ Group by.

v) Secondary Key → used for data retrieval. $2 \quad \begin{array}{|c|c|c|c|} \hline \text{Emp} & \text{empid} & \text{ename} & \text{deptno} \\ \hline \end{array} \quad \begin{array}{|c|} \hline \text{Secondary} \\ \hline \text{Key.} \\ \hline \end{array}$

vi) Foreign Key $2 \quad \begin{array}{|c|c|c|c|} \hline \text{emp} & \text{dept} & \text{eid} & \text{dname} \\ \hline \end{array} \quad \begin{array}{|c|c|c|c|} \hline \text{f.k.} & \text{P.K.} & \text{is a attribute whose value matches} \\ \hline \end{array}$ P.K. the P.K. in the related table.

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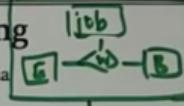
Type of Keys

vii) Composite Key → Comb' of two or more columns in a table. $(\text{Cust-id}, \text{order-id})$ uniquely identify a tuple:

| <u>Cust_id</u> | <u>order_id</u> | Sales-detail |
|----------------|-----------------|--------------|
| A1 | O1 | Pen |
| A2 | O2 | Pencil |
| A3 | O3 | Pen |
| A4 | O4 | Rubber |
| A1 | O5 | Eraser |

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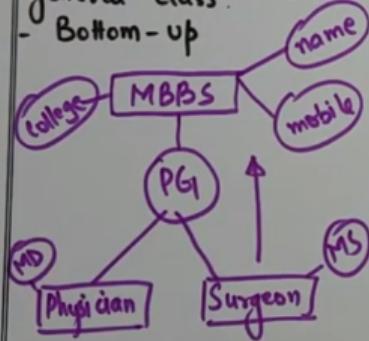
Extended ER- Features (Short Notes)

Doctor:

① Generalization

- Abstracting process of viewing sets of objects as single general class.

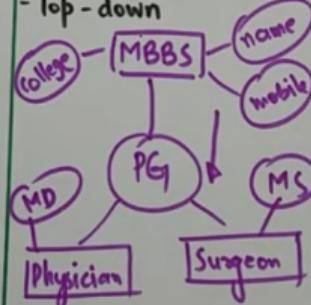
- Bottom - up



② Specialization

- Introducing new characteristics to an existing class of objects to create new classes

- Top - down



③ Aggregation

- "Compiling info" on an object, thereby abstracting higher-level object.

