~~DATA STRUCTURE~~

SBG STUDY

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DBMS - Data Base Management System (BCST-402)

Introduction

Data: Collection of information; The facts that can be recorded & which have implicit meaning known as Data

Ex: An element like customer (entity) can have implicitly following information

- C_Name
- C_No.
- C_city
- C_Address

} Attributes of customer

Data Base: Collection of inter-related data; These can be stored in the forms of tables; these can be of any size & varying complexity.; it's creation & manipulation can be done either manually or computerised.

Ex.

C_No.	C_Name	C_City	C_Contact	C_Address

Data Base System: Computerised system whose overall purpose is to maintain the info. & to make that info. available on demand; it's easy to create, insert, delete & manipulate the database system

⇒ **Advantages**

- Redundancies can be reduced
- Inconsistency can be avoided
- Data can be shared
- Standards can be enforced.

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- security restrictions can be applied
- Integrity can be maintained.
- Data gathering can be possible
- Requirement can be balanced.

DBMS

- It is a collection of programs that enables user to create, and manipulate in a database
- It is a general purpose software that provides the user with the processes of defining, constructing / creating & manipulating the database for various applications.

Disadvantages in file processing

- Data redundancy & inconsistency
- Difficulty in accessing data
- Data isolation
- Data integrity
- Concurrent acesses is not possible
- Security problem

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Advantages of DBMS:

- Data ~~Inde~~ Independence.
- Efficient Data Access
- Data Integrity and Security
- Data Administration.
- Concurrent Access and Crash recovery.
- Reduced Application Development time.

Application of DBMS:

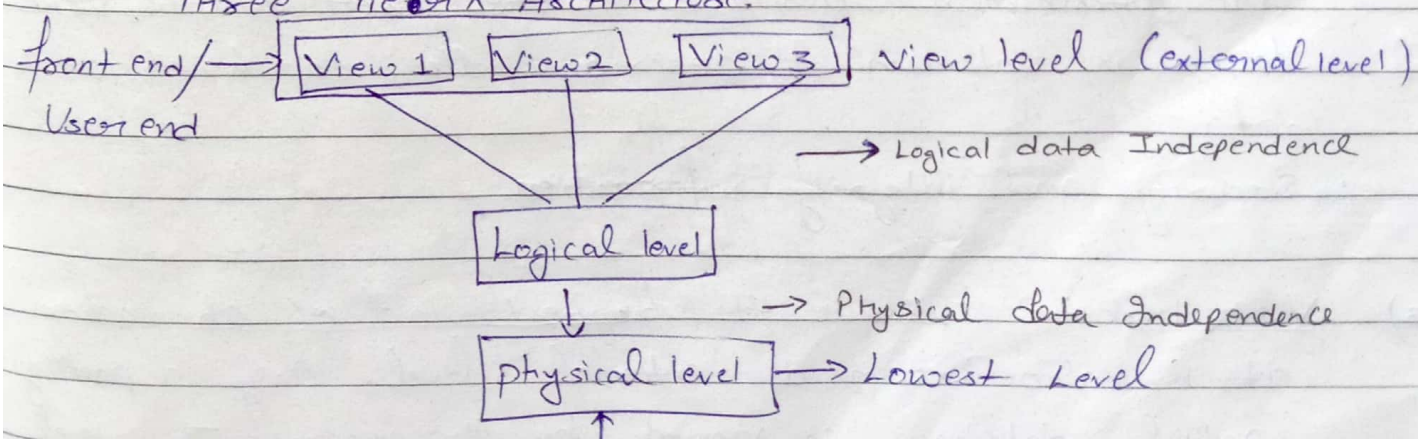
- Banking - All transactions like debit, credit, loan etc.
- Airlines/Railways - Reservation, schedule
- Universities - Registration, grades.
- Sales - Customers, products & purchases info.
- Online retailers - order, tracking, Customerise recommendation
- Manufacturing - production, inventory, orders, supply chain.
- Human resources - Employee record, salary, tax deduction

Disadvantages of DBMS:

- Software is very costly.
- Cost of Hardware & software.

Database System Architecture

Three Tier Schema Architecture.



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Data Abstraction

Data Base Systems comprise of complex data structures In order to make the system efficient in terms of retrieval of data and reduce complexity in terms of usability of users, developers use abstraction to hide irrelevant details from users. The approach simplifies database design.

There are mainly 3 level of data abstraction. It is also known as 3 tier schema Architecture.

Now Previous Diagram

Three Tier Schema Architecture

1) Physical level :- It describes how the data are actually stored. It describes storage space allocation for data and indices. It describes record description for storage as well as data compression and encription techniques. This is the lowest level of data abstraction.

2) Logical level :- This level comprises the information that is actually stored in the database in the form of tables. It also stores the relationship among the entities in relatively simple structures. At this level the information available to the user at the view level is unknown. It describes the constraints on the data.
   - Security and integrity information.

3) View level :- This is the highest level of abstraction. It is also known as external level. Only a part of actual database is viewed by the users. This level

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exists to ease the accesibility of database by an individual user. Users view data in the form of rows and columns. Tables and relations are used to store data.

The main purpose of data Abstraction is achieving data independence in order to save time and cost required when the database is modified or altered.

Data Independence

Draw same diag of data abstraction.

The capacity to change the schema at one level of the database schema without having change the schema at the higher level is known as data independence.

It is of two types:

1) Physical level Data Independence

It refers to the characteristics of being able to modify the physical schema without having any alterations to the conceptual or logical schema, done for optimization purposes. For eg:- Modifying indices, hashing algorithms.

2) Logical level Data Independence

It refers characteristics of being able to modify the logical schema without affecting the external schema or application program.

The user views of the data would not be affected by any changes to the conceptual view of the data.

For eg:- Insertion & Deletion of attributes, altering table structures, entities or relationships to the logical schema etc.

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Schema and Instance

The overall discription or design of database is called schema or intension. For e.g:- employee schema or student schema

Ex:-

Employee

Emp_Id	Emp_name	Emp_Phone	Dept
→			

Data is stored at a particular moment is called Instance or extension.

Schema can be divided into two parts:

1) Physical schema :- It describes physical level
2) Conceptual schema :- It describes conceptual level

A schema is logical database description & is drawn as a chart of the types of data that are used. It gives the names of the entities and attributes and specify the relationship b/w them

A database schema include such information as

(i) characterstics of data items such as entities and attributes
(ii) logical structure and relationship among these data items
(iii) Format for storage representation
(iv) Integrity parameters such as physical authorisation & backup policies

Sub Schema:- A database may have several schema at view level, sometimes they are called sub-schema

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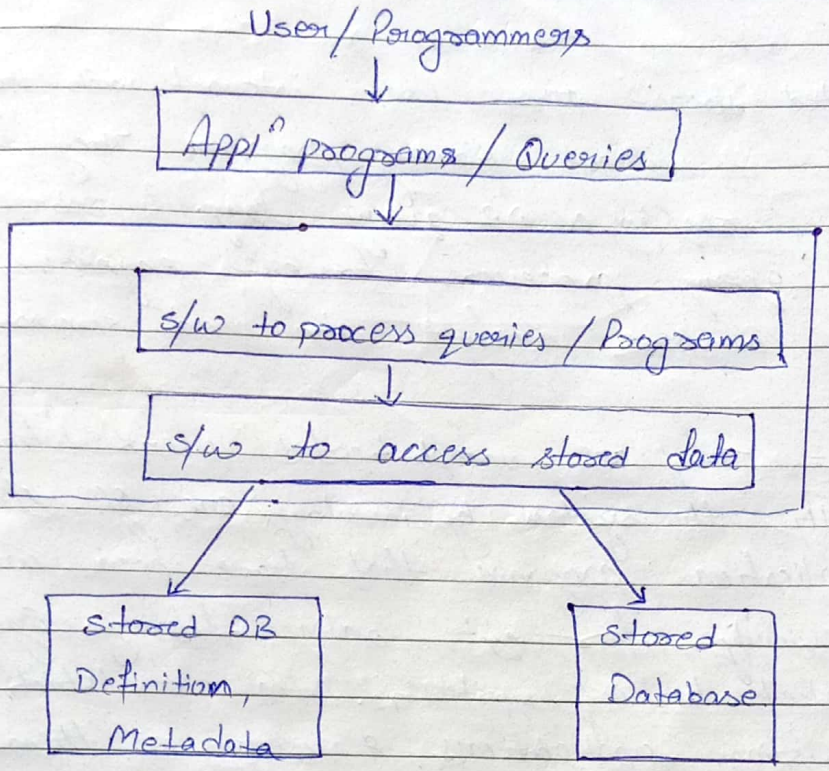
DBMS Environment



Components of DBMS

1) User :- In DBMS following classes of user are there & for each type of user diff. interfaces have been designed

(a) Appl^n programers :- These are computer professionals who write appl^n programs to develop user interfaces. These appl^n programs can manipulate DB in all possible ways. using rapid appl^n development tool appl^n programers create forms & reports rapidly without writing programs.

(b) Specialised user :- These are sophisticated users who write specialise DB appl^n that don't fit into traditional data processing frameworks. They

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are the developers who develop complex programs to the req.

(c) Sophisticated users:- These users interact with the system without writing program. They form their req in a DB query lang. & submit it to the query processor for eg: engineers, scientist, Business analyst who need summarised data.

(d) Name user:- They are unsophisticated users who interact with the system by invoking one of the application program that have been written previously for eg: online library system, ticket booking systems, atm etc which have existing applications & users use them to interact with the data base to fulfill their request

Database Administrators:

DBA is the person whose is responsible for designing creation & maintainance of DB. DBA is responsible for overall control of the system & technical level

→ DDL is the domain of DBA

2) Software:- software for DBMS include the DBMS, operating system network soft. & app program

3) Hardware:- H/w of system can range from a pc to a network of computers. It also includes various storage devices & H/w devices

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1) Data:- Data stored in DB include numerical data including whole no's, floating pt. no's & non-numerical data such as characters.

Characteristics of Good DataBase

1) Self describing nature of a database system.
2) Isolation b/w data & app. program
3) It should be able to map or relate entities / tables
4) There should not be dat duplication as it will result in unnecessary database space usage
5) Support multiple users.
6) Sharing of data & multiuser transaction processing.
7) It should provide security.

Data Models

Data models is a collect^ of concepts that can be used to describe the structure of database & provides the necessary means to achieve the abstraction whereas structure of database means the datatype relationship & constraints that should hold on the data. The & external level & conceptual level use certain data structures to help utilised the DB efficiently. How are these data structures decided what data structure and associated operators should the system support The ans depends upon the approach or model being used for database management. Following are some of the data models:

1) ER Models :- It is based on perception of real world that consist of collection of basic objects

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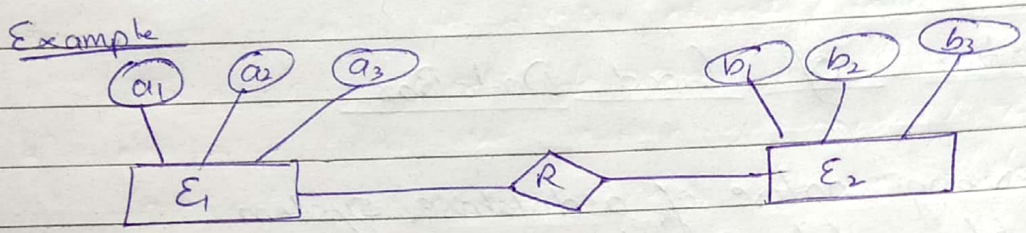
called entities & relationships among them. The overall structure of data base can be expressed graphically by an ER diagram. It is a popular high level conceptual data model.

Example



(2) Object-oriented Model

- It is based on collection of objects. Object contains value stored in instance variable within the object. Object also contain bodies of code that operate a object called method.

For eg:- Account no & balance are instance variable and pay interest is method

(3) Semantic Model

They are characterised by their provision of richer facilities for capturing the meaning of data object & hence of maintaining data integrity. In contrast to object oriented model they are used to specify the overall logical structure of DB. The three main widely accepted models are relational, hierarchial & network model.

→ The relational model represents data in form of tabels & these collection of tabels are used to represent both data & relationship

→ Network model:- In network model many users can access & share the one or more databases located on a network. The network model is the entity-relationship model with all relationship restricted

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to be either binary or many to one relationship. The data is represented by collection of records & relationship among data are represented as links which can be viewed as pointers. The pointers are used to locate a particular record.

→ Hierarchial model :- In this model data storage is arranged in the form of parent-child relationship or in hierarchial manner. The origin place of data tree is root. Data located at various levels along a particular branch from the root is called node. Last node is known as leaf node.

DBMS Language

~~1) DDL (Data definition language):~~

→ ~~It~~ is method to create all the ~~multiple~~ logical objects like tables, views, procedures etc. and we need some interface b/w user and database.

→ A database system provides a data def language which specifies database schema & data manipulation lang. which expresses database queries and updates.

1) DDL (Data definition language):- It is used to define database structure or pattern ie. those sql statements which help you in creating DB structure or altering DB structure like tables, indexes, constraints etc. In the DB can be termed as DDL statements.

- Using DDL we can create skeleton of database
- It is used to solve the information of metdata like no. of tables, schemas, their names, indexes constraints etc.

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Commands of DDL

1) Create :- used to create object/ tables in the DB
2) Alter :- used to alter the structure of DB
3) Drop :- used to delete object / tables from DB
4) Truncate :- used to remove all records from table
5) Rename :- used to rename an object/ Table
6) Comment :- used to comment on data dictionary.

Note :- These commands are used to update database schema that's why they come under DDL

2) DML (Data Manipulation Language) :- It is used for accessing and manipulating data in a database i.e. those SQL statements which helps you in manipulating the information inside the DB can be called as DML Sql statement.
It handles user request.
DML can be categorised into two types
(i) Procedural DML :- It require a user to specify what data are need and how to get those data

(ii) Non-procedural DML :- It require a user to specify what data are needed without specifying how to get those data

Commands of DML

1) Insert :- It is used to insert data into the table.
2) Update :- It is used to update existing data within the table.

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3) Delete :- It is used to delete all records from a table
4) Merge :- used to perform insert or update operations
5) Call :- used to call a structure query language or java subprog.
6) Lock :- used for concurrency control.

3) DCL (Data Control Language) :- It is used to retrieve stored or save data i.e. we need to explicitely tell the database who is going to get access to this DB table and what kind of excess like read, write delete should be given.

- So DCL controls the access to the DB tables, views procedures etc.

Commands of DCL

1) Grant :- It gives user access privilages to user on the database
2) Revoke :- used to take back permissions from the user.

4) SDL (Storage Definition Language) :- It is used to specify the internal schema.

5) TCL (Transactional control lang.) :- It is used to run the changes made by DML statements. It can be grouped into logical transaction.

Commands

1) Commit :- save the transaction of DB
2) RollBack :- used to resolve the DB to original since last commit

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ER Model

ER Model Concepts

Conceptual Modeling is a very ~~or~~ impt. phase in designing a successful DB application. Generally the term DB application ~~refers~~ to a particular DB & the associated program that implements the database query and updates. ~~Gener~~ Eg:- Bank DB applications

Entity :- An entity represents an object of the real world that has an independent existence. An entity has attribute/properties that describe it. Entity may be an object with physical existence ~~for~~ eg:- a particular person, car, house or employee.
~~Employ~~ Entity may be an object with conceptual existence ~~For~~ eg:- a company or job or university code.

Attributes:- ~~It~~ is property or description of an entity.
~~For~~ eg:- An employee entity may be described by employee's ~~or~~ name, age, address, salary & job

Types of Attributes

① Simple Vs Composite
A composite attribute is made up of one or more simple or composite attributes. Eg:- Name

② Single valued Vs Multivalued
A single valued attribute is described by one value
~~for~~ eg:- age of a person
A multivalued attribute is describe by many values
for eg:- phone no. of a person.

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(3) Stored Vs Derived

An attribute whose value can be inferred from the value of other attributes is called derived attributes. For eg:- age can derived from D.O.B & current date. If this is not the case then it is a stored attribute

(4) Null Values

Attributes that do not have any applicable values.
Unknown values or missing values are eg:-

(5) Complex attributes

Combination of composite and multivalued attribute. For eg:- a person can have more than one address and each address can have diff. parts.

Entity type and Entity Set

An entity type defines a collection of diff. entities having the same type For eg:- department defined earlier is an entity type defining several departments having the same attribute structure.
Any specific collection of entities of a particular type is called an entity set

Domain

It is the set of possible values for an attribute

Relationship Association

An association ~~exit~~ b/w 2 attributes indicates that the values of the associated attributes are interdependent. Associat^ b/w the attributes of an entity is called attribute association.
Association b/w entities is called relationship
Relationship types relate one or more ~~type~~ entity types & defines a relationship set. Any given depiction of a

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relationship type is called a relationship instance.

Relationship set.

It is an association among collection of similar relationship

Eg: Two entities employees E_1 and company C_1 & their attributes

Degree of relationship Type

The no. of participating entity types in a relationship type is known as a degree of relationship type.

Constraints on relatioship type

- Entity
- Weak entity
- Relationship
- Identifying relationship/ weak relations.
- Attribute
- Key attribute
- for weak entity
- Multivalued attribute.
- Composite attribute
- Derived attribute
- Total participation of E_2 in R
- Cardinality Ration is 1:N for E_1 & E_2 in R

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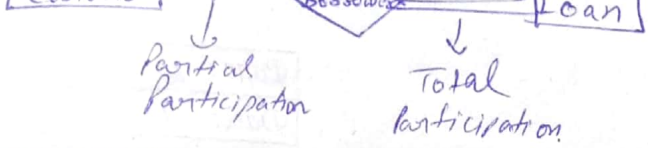


- structural constraint (min, max) on participation of E in R

Total Participation

Each entity in the entity set occurs in atleast one relationship in that relationship set

Each loan entity is associated with atleast one associated customer

Partial Participation

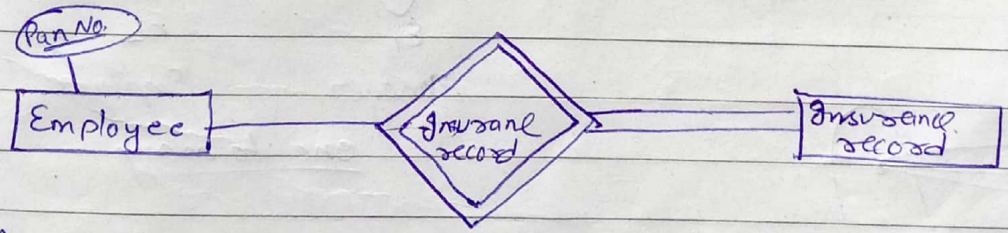
There may exist some customer who may not have any loan

Each entity in the entity set may not occur in atleast one relationship in the relationship set.

~~Cardinality of relationship~~

Identifying relationship

The relationship type that relates a weak entity type to it's owner is called the identifying relationship.



Insurance record in the weak entity type with no key. It has no existence without it's association with entity type employee

The relationship insurance details is an identifying relationship

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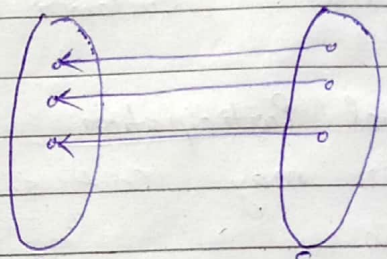
Cardinality of Relationship

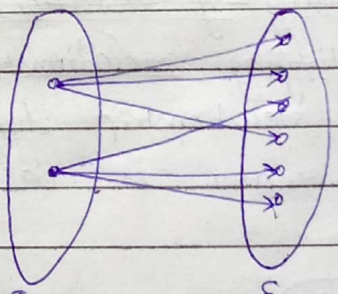
Relationships are mapped with entities in various ways. Re mapping cardinalities define the no. of association b/w two entities ie. how many no. of instances of one entity are mapped with instances of another entity.

Mapping Cardinalities

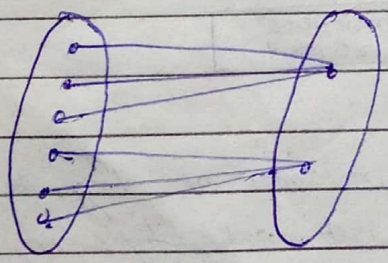
1) one-to-one
When only one instance of an entity is mapped to only one instance of other entity
For eg:- HOD of department
There is only one HOD in one department



2) one-to-many / many to one
Entity has relationship with multiple instances of another entity and vice-versa



one to many



many to many

3) Many to Many

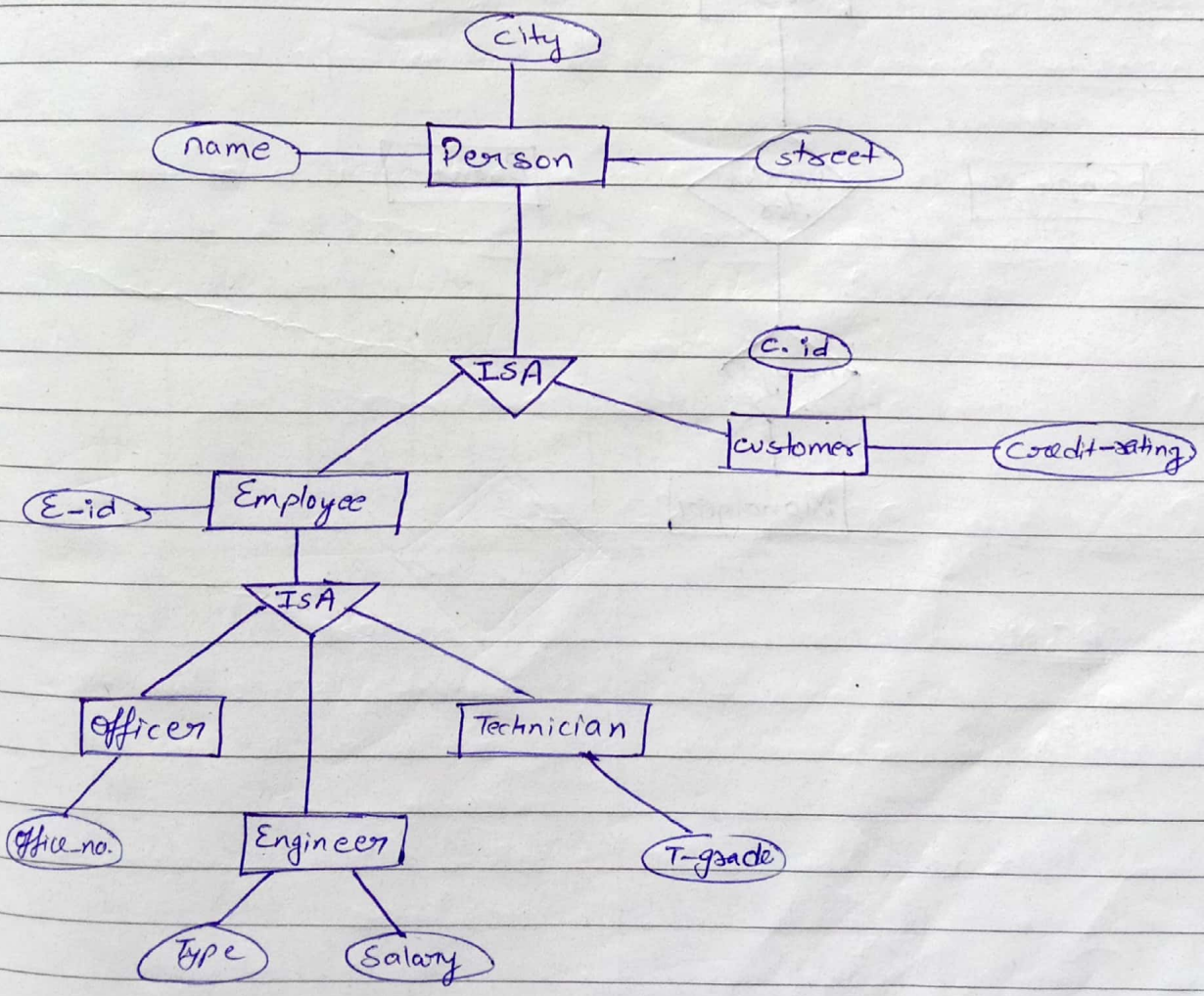
Multiple instances of entity are related to multiple instances of another entity.

Directed link (—>)

Undirected link (-)

EER (Extended E-R Model)

1) Specialization
2) Generalization
3) Aggregation.



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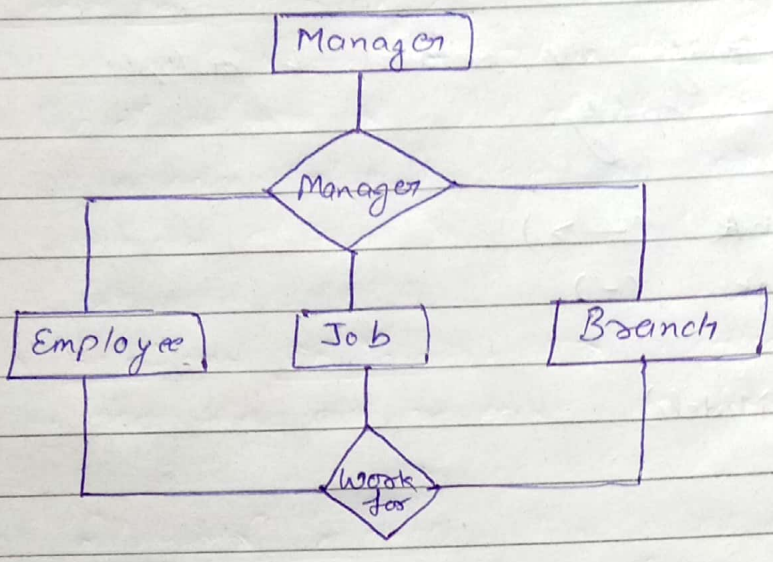

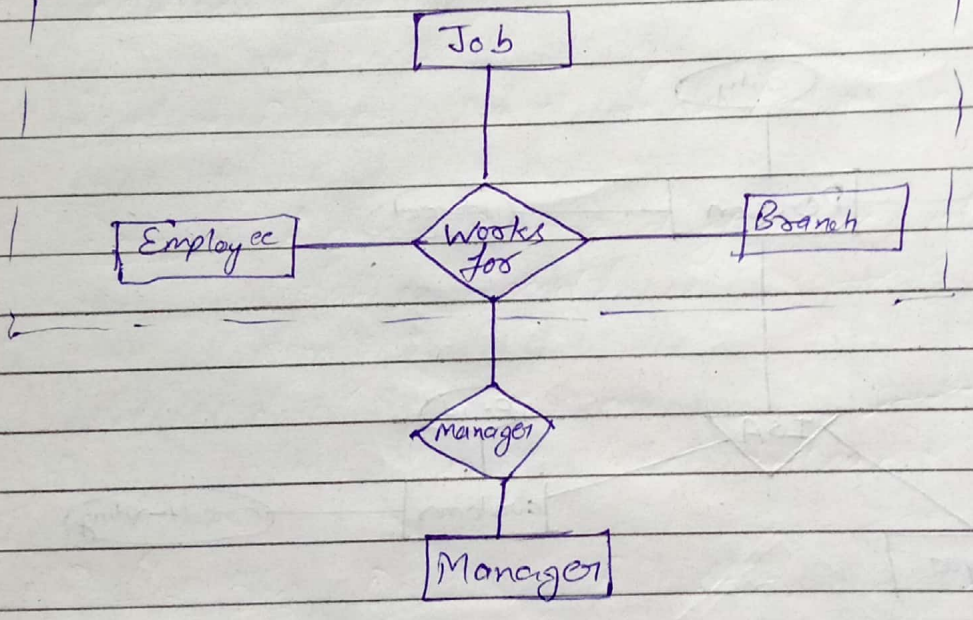

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