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1. **The answer:**
   - Data: are units of individual information
     Examples of Data: Images, Words, Numbers
   - Information: are facts that are provided or earned from something or someone
     Examples of Information: Odd numbers, even numbers, your friend's address
   - Database: is an organized collection of data
     Examples of Database: Library Database, University Database, School Database
   - DBMS: is a software package designed to manipulate, retrieve, and manage data in a database
     Example of DMS: IBM DB2, Microsoft Access, Microsoft Excel
2. **The answer:**
   a. Data Modeling is the process where we create data models that will be stored in the Database, why we need data modeling? because data modeling designed data in database so that they are accurately represented, because of this data modeling, it can help to create a logical concept of a database, it also can help to defines data relation, so data modeling can also help the user identify the missing data and it is easier to maintain the database.
   b. The basic data-modeling building blocks are:
      - Entities
      - Attributes
      - Relationship:
        ➔ One-to-Many
        ➔ Many-to-Many
        ➔ One-to-One
      - Constraint
   c. Business rules are statements which determine some form of constraint on a specific aspect of the database, a business rules make up some relation of aspects of the database.
      For example:
      "A ship date cannot be prior to an order date for any given order"
      That is one of the examples of business rules, customers have to order first, after that they can have their ship date, it cannot be the opposite, this business rule gives birth to a relation of ship date and order date which its relation has already explained.
      Business rules also become a communicator tool between the user and the designer itself
   d. The database evolution model happened in four waves:
      - The first phase(1960-1999), the development is known as hierarchical model, inverted list, and network model
      - The second phase was described as relational as was started about the 1990s, in this phase, SQL and SQL products were introduced
      - The third phase supported Online Analytical Processing (OLAP), which also started in the 1990s

- In the fourth phase, the introduction of NoSQL in 2008, in this phase also supports the use of Big Data, nonrelational data, and graphs.

e. The data models:

- Hierarchical Model→ Formed by a collection of relations, so they look like a family tree

  This model is very simple, but its implementation is complex, it is very simple that the changes can change into a butterfly effect, which means when we change one aspect, it can change the entire structure of database.

- Network Model→ This model is like a collection of links and handles many-to-many relation unlike its parent, hierarchical Model

  This model is also simple, just like its parent, but the complexity of the pointers written in the model makes the model seems very complex and it is hard to change it. This model is like its parent, there are some anomalies and changes when you have to change certain aspects.
- Relational Model→ This model groups data into one or more tables.

  Unlike its parents, network and hierarchical model, this model doesn't have any issues when you change one aspect, the changes don't affect the complete database, but this model is inefficient when the model has large volumes of data and it does need powerful hardware and devices.

- ERD Model → This model uses a graphic representation of a model database components

  This model has a very good visual design and it is very simple and more enjoyable to see than the others, and also like the relational model, one changes do not affect the entire database system, and also it is efficient when handling large volumes of data.

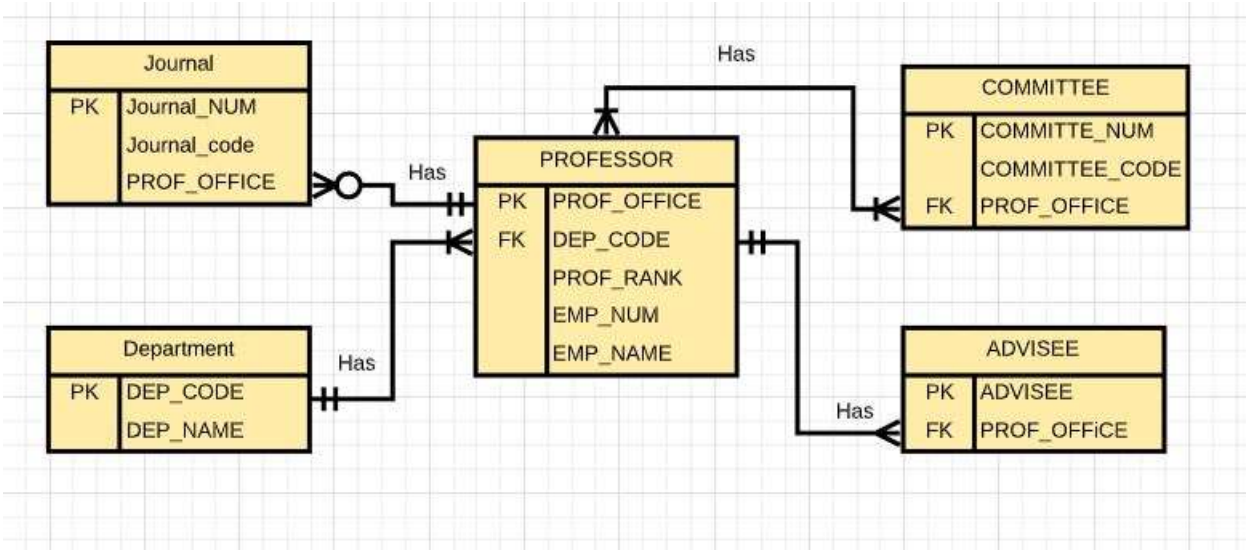
  But its simplicity comes with a cost, it has limited constraints and relations.

3. The answer:

a) The new tables:

- Journal
  PK: JOURNAL_NUM
  FK: PROF_OFFICE
- Professor
  PK: PROF_OFFICE
  FK: None
- Advisor
  PK: ADV_NUM
  FK: PROF_OFFICE
- Committee
  PK: COMMITTEE_NUM
  FK: PROF_OFFICE
- Department
  PK: DEP_CODE
  FK: None

b) ERD Database



c) These pictures show that all tables conform to

3NF Table name: Journal

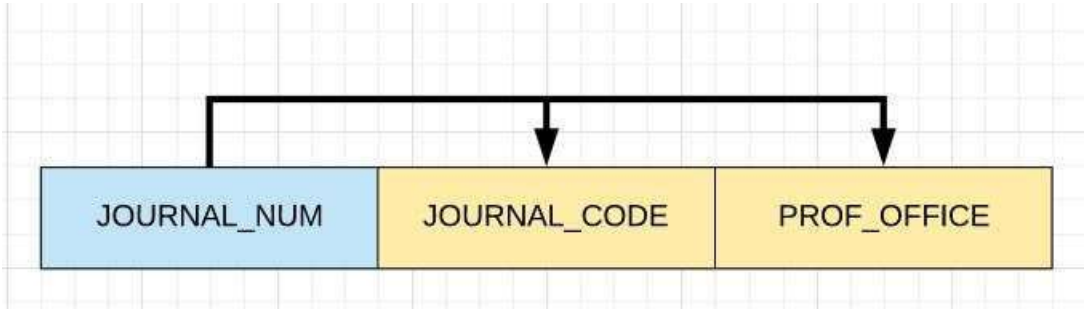


Table name: Committee

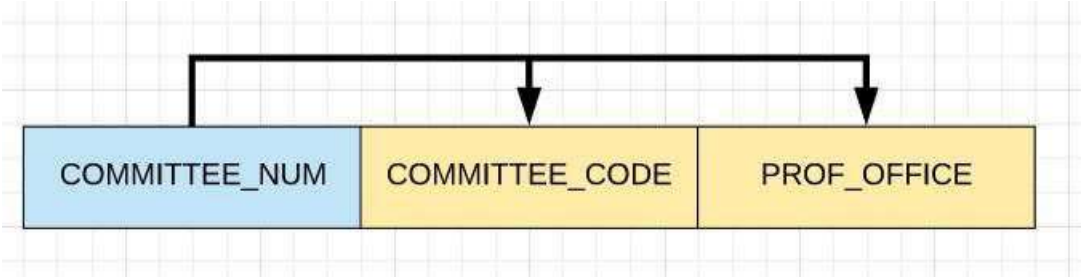


Table name: Advisor

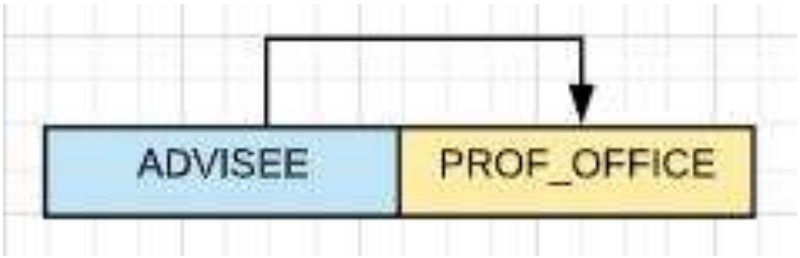


Table name: Department

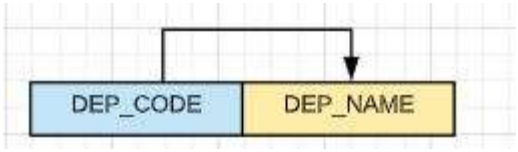
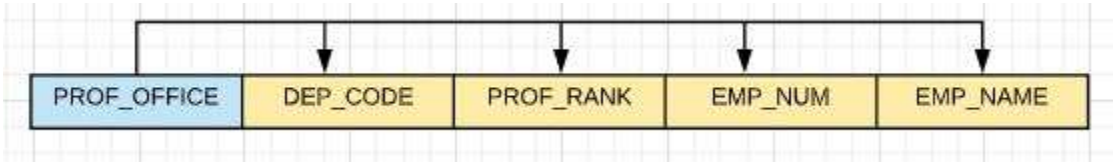


Table name: Professor



The arrows above shown desirable dependencies (based on PK)

d) These are the tables for the ERD system

Table name: Journal

Journal Num	Journal Code	Professor Office
0001	JMIS,QED,JMGT	KDD-567
0002		BLF-119
0003	JCIS,JMGT	KDD-562
0004		PRT-345

Table name: Professor

Professor Office	Department Code	Proffesor Rank	EMP_NUM	EMP_Name
KDD-567	CIS	Professor	123	Ghee
BLF-119	CHEM	Asst. Professor	104	Rankin
KDD-562	CIS	Assoc. Professor	118	Ortega
PRT-345	ENG	Assoc. Professor		Smith

Table name: Advisor

Advisee	Professor Office
1215, 2312, 3233, 2218, 2098	KDD-567
3102, 2782, 3311, 2008, 2876, 2222, 3745, 1783, 2378	BLF-119
2134, 2789, 3456, 2002, 2046, 2018, 2764	KDD-562
2873, 2765, 2238, 2901, 2308	PRT-345

Table name: Committee

Committee Num	Committee Code	Professor Office
0001	PROMO, TRAF, APPL, DEV	KDD-567
0002	DEV	BLF-119
0003	SPR, TRAF	KDD-562
0004	PROMO, SPR, DEV	PRT-345

Table name: Department

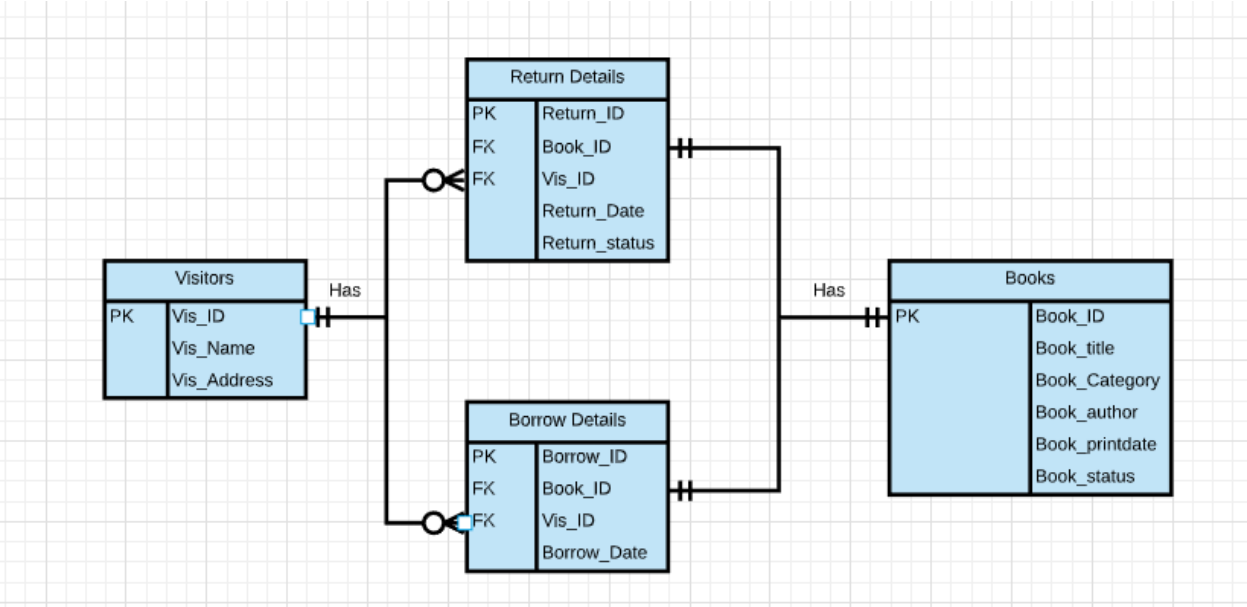
Department Code	Department Name
CIS	Computer Info. Systems
CHEM	Chemistry
CIS	Computer Info. Systems
ENG	English

4. The answer:

a) The new Tables:

- Visitors
  PK: Vis_ID
  FK: None
- Borrow Details
  PK: Borrow_ID
  FK: Book_ID,Vis_ID
- Return Details
  PK: Return_ID
  FK: Book_ID, Vis_ID
- Books
  PK: Book_ID
  FK: None

b) row Foot Table



c) These pictures show that all tables conform to

3NF Table name: Visitor

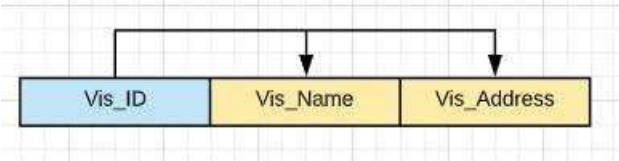


Table name: Borrow Details

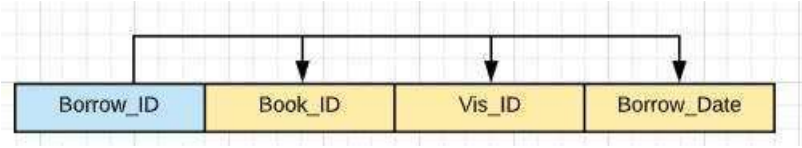


Table name: Return Details

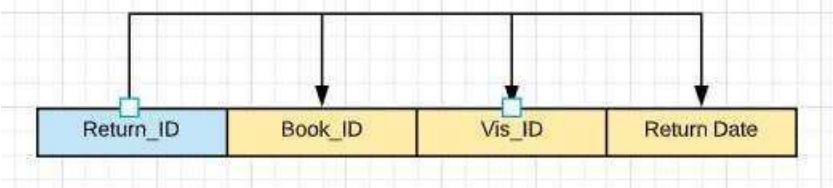
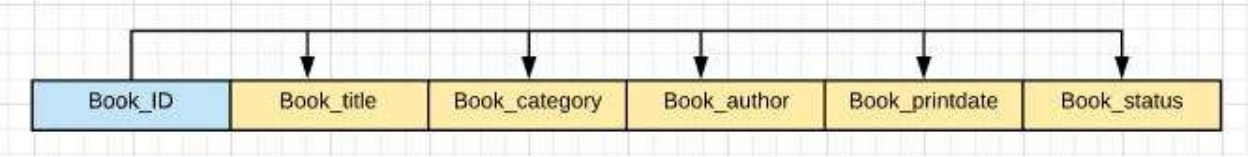


Table name: Books



The arrows above shown desirable dependencies (based on PK)

d) The table for the ERD system

Visitors

Visitors ID	Visitor Name	Visitor Address
0001	John	92 Winchester Road Lafayette, IN 47905
0002	Doe	Sheffield Street Oshkosh, WI 54901
0003	Pepper	9 Wakehurst Dr. Marcus Hook, PA 19061
0004	Nick	75 N. Park Drive Memphis, TN 38106
0005	Jack	71 SW. Courtland Dr. Attleboro, MA 02703
0006	Queen	74 Dogwood Street Nampa, ID 83651
0007	King	7631 Ann Lane Loganville, GA 30052
0008	Jonathan	8340 Smith St. Hampton, VA 23666
0009	Jojo	9728 Stonybrook Court Cranberry Twp, PA 16066
0010	Patrick	1 Court Street North Brunswick, NJ 08902

Borrow Details

Borrow ID	Book ID	Visitor ID	Borrow Date
0011	0034	0001	10/2/20
0012	0055	0002	11/2/20
0013	0066	0003	12/2/20
0014	0073	0004	13/2/20
0015	0052	0005	14/2/20
0116	0062	0006	15/2/20
0017	0346	0007	16/2/20
0018	0234	0008	17/2/20
0019	0345	0009	18/2/20
0021	0111	0010	19/2/20

Return Details

Return ID	Book ID	Visitor ID	Borrow Date
0042	0034	0001	17/2/20
0056	0055	0002	18/2/20
0063	0066	0003	19/2/20
0066	0073	0004	20/2/20
0077	0052	0005	21/2/20
0082	0062	0006	22/2/20
0084	0346	0007	23/2/20
0095	0234	0008	24/2/20
0097	0345	0009	25/2/20
0100	0111	0010	26/2/20

Books

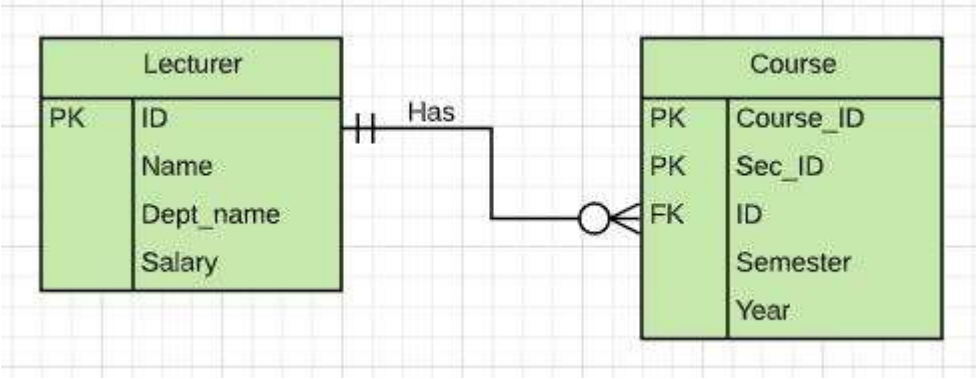
Books ID	Book Title	Books Category	Book Author	Book printdate	Book Status
0034	The little Red	Mystery	John Luther	12-02-2000	Available
0055	The Riding Hood	Mystery	Great King	28-10-2006	Not Available
0066	The Red Nose	Fiction	Kate	29-10-2001	Not Available
0073	The Pinnochio	Fiction	Polan	30-10-2009	Available
0052	The Gregor	Fiction	Andrew	31-10-2001	Not Available
0062	My Fish	Drama	Drake	01-11-2001	Not Available
0346	My other Fish	Drama	Budi Jack	05-04-2006	Available
0234	My third Fish	Drama	John Weak	02-06-1955	Available
0345	I'm Swear, It's my last Fish	Drama	Lisman	06-04-2001	Not Available
0111	Probably my last Fish	Drama	Hero	04-03-2005	Available

5. The answer:

a) The new tables:

- Lecturer
  PK: ID
  FK: None
- Course
  PK: Course_ID
  FK: ID

b) Crow Foot Table



c) These pictures show that all tables conform to

3NF Table Name: Lecturer

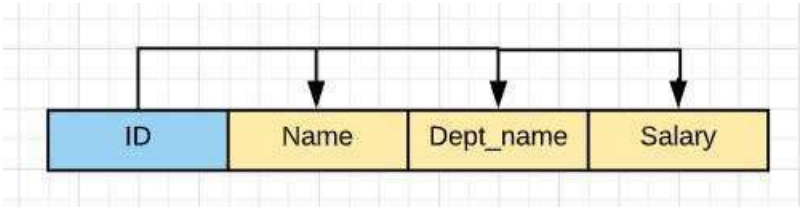
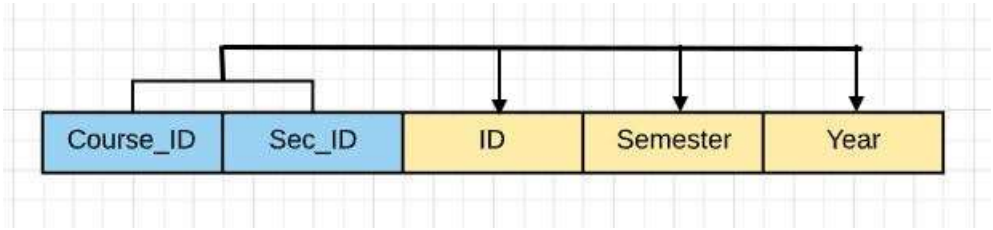


Table Name: Course



The arrows above shown desirable dependencies (based on PK)

d) The table for the ERD system

Lecturer

ID	Name	Dept Name	Salary
10101	Srinivasan	Comp.Sci	65000
10101	Srinivasan	Comp.Sci	65000
10101	Srinivasan	Comp.Sci	65000
12121	Wu	Finance	90000
15151	Mozart	Music	40000
22222	Einstein	Physics	95000
32343	El Said	History	60000
33456	Gold	Physics	87000
45565	Katz	Comp. Sci	75000
45565	Katz	Comp. Sci	75000
58583	Califieri	History	62000
76543	Singh	Finance	80000
76766	Crick	Biology	72000
76766	Crick	Biology	72000
83821	Brandt	Comp.Sci	92000
83821	Brandt	Comp.Sci	92000
83821	Brandt	Comp.Sci	92000
98345	Kim	Elec. Eng.	80000

Course

Course ID	Sec ID	ID	Semester	Year
CS-101	1	10101	Fall	2009
CS-315	1	10101	Spring	2010
CS-347	1	10101	Fall	2009
FIN-201	1	12121	Spring	2010
MU-199	1	15151	Spring	2010
PHY-101	1	22222	Fall	2009
HIS-351	1	32343	Spring	2010
null	null	33456	null	null
CS-101	1	45565	Spring	2010
CS-319	1	45565	Spring	2010
null	null	58583	null	null
null	null	76543	null	null
BIO-101	1	76766	Summer	2009
BIO-301	1	76766	Summer	2010
CS-190	1	83821	Spring	2009
CS-190	2	83821	Spring	2009
CS-319	2	83821	Spring	2010
EE-181	1	98345	Spring	2009