Mahmoud Essam

Introduction to Database

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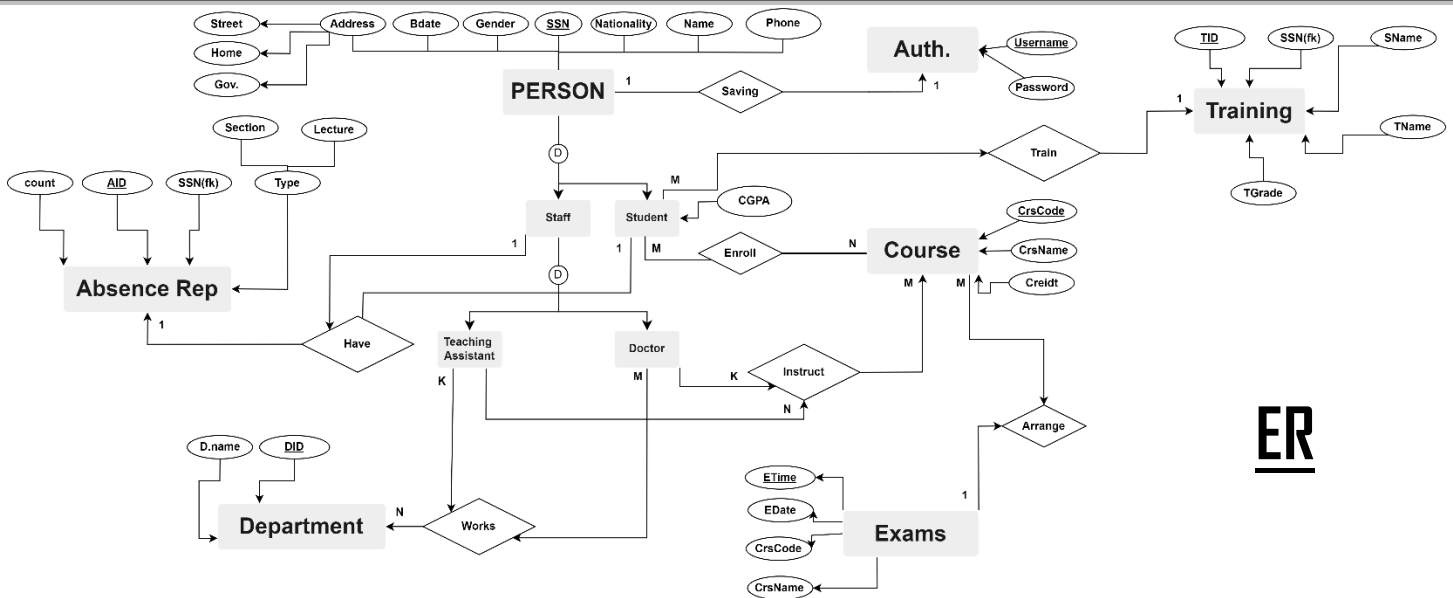
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Simple design with code for Ibn-Elhaitham

ER

Schema

Entities

Person (SSN, PName, PNationality, Pgender, PBdate, Pstreet, Phone, PGov)

Authentication (SSN, Username, Password)

#Using OO notation

Student (SSN, PName, PNationality, Pgender, PBdate, Pstreet, Phone, PGov, CGPA, TID)

Staff (SSN, PName, PNationality, Pgender, PBdate, Pstreet, Phone, PGov)

#Using ER notation

Doctor (SSN)

TA (SSN)

Department (DID, Dname)

Absence_Report (AID, SSN, Lecture, Section, count)

Course (CrsCode,CrsName,Credit)

Exams (Date,Time,CrsCode,CrsName)

Training(TID,SSN,PName,TName,TGrade)

Relations

Works_For(**DID,SSN**)

Enroll (**SSN,CrsCode**)

Instruct (**SSN,CrsCode**)

___

Normalize The Schema

(Entities)

Person (SSN$_{pk}$, PName, PNationality, Pgender, PBdate, Pstreet, Phone, PGov) **(1,2,3) NF achieved**

Authentication (SSN, Username, Password) **(1,2) NF achieved, 3 No, so will divide it**

User_SSn (SSN$_{fk}$, Username$_{pk}$) **(1,2,3) NF achieved**

Authentication (Username$_{pk}$,Password) **(1,2,3) NF achieved**

Student (SSN$_{fk}$, CGPA, AID$_{fk}$, TID$_{fk}$) **(1,2,3) NF achieved**

Doctor (SSN$_{fk}$) **(1,2,3) NF achieved**

TA (SSN$_{fk}$) **(1,2,3) NF achieved**

Department (DID$_{pk}$, Dname) **(1,2,3) NF achieved**

Absence_Report (AID$_{pk}$, SSN$_{fk}$, Lecture, Section, count) **(1,2,3) NF achieved**

Course (CrsCode$_{pk}$, CrsName, Credit) **(1,2,3) NF achieved**

Exams (Date, Time, CrsCode$_{fk}$, CrsName$_{fk}$) **(1,2,3) NF achieved**

Training (TID$_{fk}$, SSN, PName, TName, TGrade) **(1,2,3) NF achieved**

(Relations)

Works_For (DID$_{fk}$, SSN$_{fk}$) **(1,2,3) NF achieved**

Enroll (SSN$_{fk}$, CrsCode$_{fk}$) **(1,2,3) NF achieved**

Instruct (SSN$_{fk}$, CrsCode$_{fk}$) **(1,2,3) NF achieved**

SQL

```sql
CREATE TABLE IF NOT EXISTS Person (
  SSN INT PRIMARY KEY,
  PName VARCHAR(255),
  PNationality VARCHAR(255),
  Pgender VARCHAR(255),
  PBdate DATE,
  Pstreet VARCHAR(255),
  Phone VARCHAR(255),
  PGov VARCHAR(255)
);

CREATE TABLE IF NOT EXISTS User_SSn (
  SSN INT,
  Username VARCHAR(255),
  PRIMARY KEY (SSN, Username)
);

CREATE TABLE IF NOT EXISTS Doctor (
  SSN INT,
  PRIMARY KEY (SSN),
  FOREIGN KEY (SSN) REFERENCES Person(SSN)
);

CREATE TABLE IF NOT EXISTS Department (
  DID INT PRIMARY KEY,
  Dname VARCHAR(255)
);

CREATE TABLE IF NOT EXISTS Course (
  CrsCode INT PRIMARY KEY,
  CrsName VARCHAR(255),
  Credit INT
);

CREATE TABLE IF NOT EXISTS Works_For (
  DID INT,
  SSN INT,
  FOREIGN KEY (DID) REFERENCES Department(DID),
  FOREIGN KEY (SSN) REFERENCES Person(SSN)
);
```

Step 1 :

Creation of tables to

Establish the Database

```sql
CREATE TABLE IF NOT EXISTS Authentication (
  Username INT,
  Password VARCHAR(255),
  PRIMARY KEY (Username)
);

CREATE TABLE IF NOT EXISTS Student (
  SSN INT,
  CGPA FLOAT,
  AID INT,
  TID INT,
  PRIMARY KEY (SSN),
  FOREIGN KEY (AID) REFERENCES Absence_Report(AID),
  FOREIGN KEY (TID) REFERENCES Training(TID)
);

CREATE TABLE IF NOT EXISTS TA (
  SSN INT,
  PRIMARY KEY (SSN),
  FOREIGN KEY (SSN) REFERENCES Person(SSN)
);

CREATE TABLE IF NOT EXISTS Absence_Report (
  AID INT PRIMARY KEY,
  SSN INT,
  Lecture VARCHAR(255),
  Section VARCHAR(255),
  Counter INT,
  FOREIGN KEY (SSN) REFERENCES Person(SSN)
);

CREATE TABLE IF NOT EXISTS Exams (
  Date DATE,
  Time TIME,
  CrsCode INT,
  CrsName VARCHAR(255),
  PRIMARY KEY (Date, Time),
  FOREIGN KEY (CrsCode) REFERENCES Course(CrsCode),
  FOREIGN KEY (CrsName) REFERENCES Course(CrsName)
);

CREATE TABLE IF NOT EXISTS Training (
  TID INT,
  SSN INT,
  PName VARCHAR(255),
  TName VARCHAR(255),
  TGrade VARCHAR(255),
  PRIMARY KEY (TID),
  FOREIGN KEY (SSN) REFERENCES Person(SSN)
);
```

```sql
CREATE TABLE IF NOT EXISTS Enroll (
  SSN INT,
  CrsCode INT,
  FOREIGN KEY (SSN) REFERENCES Person(SSN),
  FOREIGN KEY (CrsCode) REFERENCES Course(CrsCode)
);

CREATE TABLE IF NOT EXISTS Instruct (
  SSN INT,
  CrsCode INT,
  FOREIGN KEY (SSN) REFERENCES Person(SSN),
  FOREIGN KEY (CrsCode) REFERENCES Course(CrsCode)
);
```

#STUDENT DETAILS

```sql
-- Inserting data into the Person table
INSERT INTO Person (SSN,PName,PNationality,Pgender,PBdate,Pstreet,Phone,Pgov)
VALUES (9876543210, "John Doe", "American", "Male", "1995-03-15", "123 Main St",
"555-123-4567", "New York");
-- Inserting data into the User_SSn table
INSERT INTO User_SSn(SSN,Username) VALUES (9876543210, "johndoe95");
-- Inserting data into the Authentication table
INSERT INTO Authentication (Username,Passwordofuser) VALUES ("johndoe95",
"password123");
-- Inserting data into the Training table
INSERT INTO Training (TID,SSN,PName,TName,TGrade) Values (2, 9876543210, "John
Doe", "IT Management", "B-");
-- Inserting data into the Absence_Report table
INSERT INTO Absence_Report (AID,SSN,Lecture,Section,Counter) VALUES (3,
9876543210, "Database Systems", "Section A", 1);
-- Inserting data into the Student table
INSERT INTO Student (SSN,CGPA,AID,TID) VALUES (9876543210, 3.25, 3, 2);
-- Inserting data into the Course table
INSERT INTO Course (CrsCode,CrsName,Credit) VALUES ("01-01-01001", "Web
Development", 4);
-- Inserting data into the Enroll table
INSERT INTO Enroll (SSN,CrsCode) VALUES (9876543210, "01-01-01001");
```

Teaching Staff

```sql
INSERT INTO PERSON VALUES
('20212120201834','Dr. Mahmoud','Egyptian','Male','12/12/2002','Muhammed
Nagib','01277345867','Alexandria'),
(70211370402987,"Aisha Ali","Emirati","Female","04/02/1997","Sheikh Zayed
Road","0501234567","Dubai");
INSERT INTO User_SSn(SSN,Username)
VALUES(70211370402987,20301761098),(20212120201834,20301761097);
INSERT INTO Authentication (Username,Passwordofuser) VALUES
(20301761098,"AishaAli123"),(20301761097,"drmahmoud");
```

```
INSERT INTO Absence_Report (AID,SSN,Lecture,Section,Counter) VALUES
(107,70211370402987,"","",0),(80,20212120201834,"","",0);
INSERT INTO Doctor (SSN) VALUES (70211370402987),(20212120201834);
INSERT INTO Instruct (SSN,CrsCode) VALUES (70211370402987,"03-05-00123"),(20212120201834,"02-
24-00109");
INSERT INTO Works_For(DID,SSN) VALUES(1,70211370402987),(1,20212120201834);
```

 # TA Staff

```
INSERT INTO person VALUES('30102015234567','Sarah
Ahmed','Egyptian','Female','03/04/1995','Ahmed Mohamed','01001234567','Cairo');
INSERT INTO person VALUES('29122020111223','Hassan Ali','Egyptian','Male','01/02/2000','Ali
Hassan','01112233445','Giza');
INSERT INTO person VALUES('03052008123456','Laila
Mahmoud','Egyptian','Female','05/06/1988','Mahmoud Ahmed','01543210987','Luxor');
INSERT INTO User_SSn(SSN,Username)
VALUES(30102015234567,20194567),(29122020111223,201901223),(3052008123456,20193456);
INSERT INTO Authentication (Username,Passwordofuser) VALUES
(20194567,"TA1"),(201901223,"TA2"),(20193456,"TA3");
INSERT INTO Absence_Report (AID,SSN,Lecture,Section,Counter) VALUES
(701,30102015234567,NULL,NULL,0),(702,29122020111223,NULL,NULL,0),(703,3052008123456,NULL,NUL
L,0);
INSERT INTO TA (SSN) VALUES (70211370402987),(20212120201834);
INSERT INTO Instruct (SSN,CrsCode) VALUES (30102015234567,"03-05-00123"),(29122020111223,"02-
24-00109"),(3052008123456,"03-05-00123")
INSERT INTO Works_For(DID,SSN) VALUES(1,30102015234567),(1,29122020111223),(3,3052008123456)
```

What about some specific questions with their answers?

1 How will you distinguish between (Student-Doctor-TA)?

1.1 Joins! We will use join to extract student then doctor then TA using People table, Code:

1.1.1 SELECT * FROM Student as s JOIN Person as p ON s.SSN = p.SSN "For Student"

SSN	CGPA	AID	TID	SSN	PName	PNationality	Pgender	PBdate	Pstreet	Phone	PGov
30212120201834	3.69	1	1	30212120201834	Mahmoud Essam	Egyptian	Male	12/12/2002	Muhammed Nagib	01277345866	Alexandria
9876543210	3.25	3	2	9876543210	John Doe	American	Male	1995-03-15	123 Main St	555-123-4567	New York
1234567890	3.9	5	4	1234567890	Jane Smith	Canadian	Female	1998-08-21	456 Oak St	555-555-5555	Toronto
4561237890	3.5	7	6	4561237890	Maria Rodriguez	Spanish	Female	2001-04-01	789 Maple St	555-123-7890	Madrid

1.1.2 SELECT * FROM Doctor as d JOIN Person as p ON d.SSN = p.SSN "For Doctors"

SSN	SSN	PName	PNationality	Pgender	PBdate	Pstreet	Phone	PGov
70211370402987	70211370402987	Aisha Ali	Emirati	Female	04/02/1997	Sheikh Zayed Road	0501234567	Dubai
20212120201834	20212120201834	Dr.Mahmoud	Egyptian	Male	12/12/2002	Muhammed Nagib	01277345867	Alexandria

1.1.3 SELECT * FROM TA as t JOIN Person as p ON t.SSN = p.SSN "For Teaching Assistant"

SSN	SSN	PName	PNationality	Pgender	PBdate	Pstreet	Phone	PGov
30102015234567	30102015234567	Sarah Ahmed	Egyptian	Female	03/04/1995	Ahmed Mohamed	01001234567	Cairo
29122020111223	29122020111223	Hassan Ali	Egyptian	Male	01/02/2000	Ali Hassan	01112233445	Giza
3052008123456	3052008123456	Laila Mahmoud	Egyptian	Female	05/06/1988	Mahmoud Ahmed	01543210987	Luxor

2 What about courses that student enrolling?

2.1 Another join for student! , so we will get student table and enroll it and retrieve the course:

SELECT s.SSN,e.CrsCode,c.CrsName;

FROM Student as s

JOIN Enroll as e ON s.SSN = e.SSN

JOIN Course as c ON e.CrsCode = c.CrsCode

SSN	CrsCode	CrsName
30212120201834	02-24-00109	Machine Learning
9876543210	01-01-01001	Web Development
1234567890	03-12-00201	Data Structures
4561237890	02-18-00101	Artificial Intelligence

3 how would I know the number of students enrolled in specific training?

Let's try some aggregation functions like Count!

SELECT count(*) as Number_of_students_in_iti FROM Training where Training.TName="ITI"

Number_of_students_in_iti
2

4 can I know the login system for every person?

4.1 Joins! We will use join to extract student then doctor then TA using People table, Code:

4.1.1 SELECT us.SSN,a.Username,a.Passwordofuser FROM User_SSn as us JOIN Authentication as a ON us.Username = a.Username JOIN Doctor as d ON us.SSN = d.SSN

SSN	Username	Passwordofuser
70211370402987	20301761098	AishaAli123
20212120201834	20301761097	drmahmoud

4.1.2 SELECT us.SSN,a.Username,a.Passwordofuser FROM User_SSn as us JOIN Authentication as a ON us.Username = a.Username JOIN Student as s ON us.SSN = S.SSN

SSN	Username	Passwordofuser
30212120201834	20221460231	Mahmoud7
9876543210	johndoe95	password123
1234567890	janesmith98	password456
4561237890	mariarodriguez01	pass1234

4.1.3 SELECT us.SSN,a.Username,a.Passwordofuser FROM User_SSn as us JOIN Authentication as a ON us.Username = a.Username JOIN TA as t ON us.SSN = T.SSN

SSN	Username	Passwordofuser
30102015234567	20194567	TA1
29122020111223	201901223	TA2
3052008123456	20193456	TA3

5 can I know number of doctors and TA working in data science department?

5.1 Let's perform it!

5.1.1 SELECT d.ssn,w.DID,p.pname FROM Doctor as d JOIN Works_For as w ON d.ssn = w.ssn JOIN Person as p ON d.ssn = p.ssn WHERE w.DID = 1

SSN	DID	PName
70211370402987	1	Aisha Ali
20212120201834	1	Dr.Mahmoud

5.1.2 SELECT t.ssn,w.DID,p.pname FROM TA as t JOIN Works_For as w ON t.ssn = w.ssn JOIN Person as p ON t.ssn = p.ssn where w.DID = 1

SSN	DID	PName
30102015234567	1	Sarah Ahmed
29122020111223	1	Hassan Ali

Last thing : retrieve all students where their CGPA greater than 3.5 with their names :

SELECT s.SSN,s.CGPA ,p.PName

from Student as s JOIN Person as p ON s.ssn = p.ssn

SSN	CGPA	PName
30212120201834	3.69	Mahmoud Essam
1234567890	3.9	Jane Smith