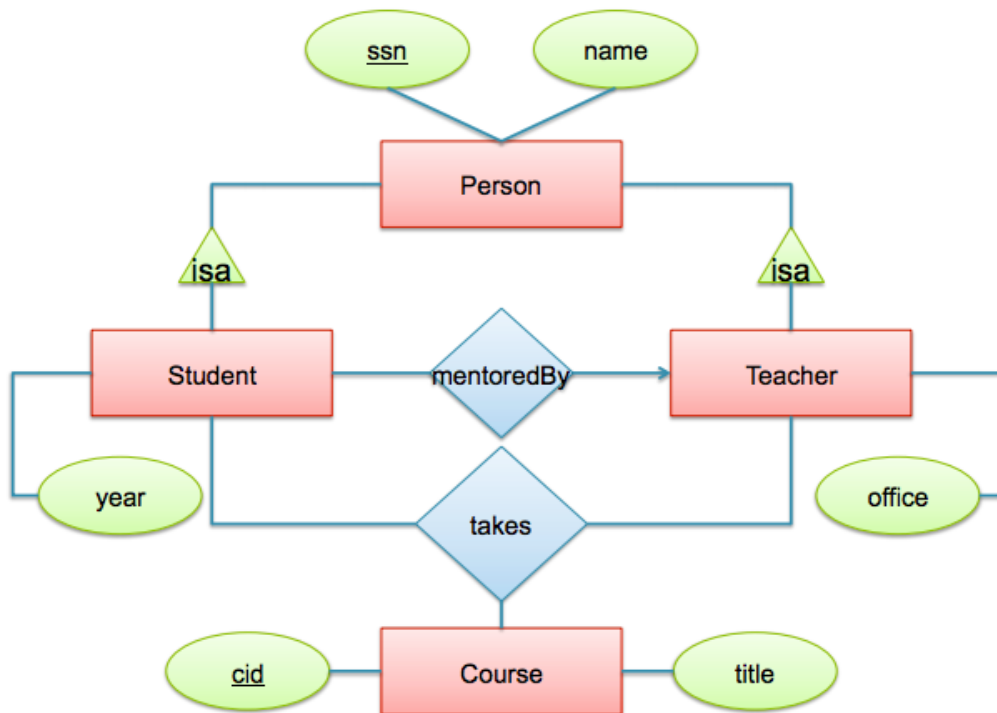


CSE 344 Section 7 – Worksheet – Solution

E/R Diagram and conceptual design



Write SQL queries that will reflect the E/R diagram given above.

```
create table Person(ssn int primary key, name
varchar(30));
```

```
create table Teacher(
ssn int primary key references Person,
office varchar(20));
```

```
create table Student(
ssn int primary key references Person,
mentoredby int references Teacher,
year int);
```

```
create table Course(cid int primary key, title
varchar(30));
```

```
create table Takes(
sid int references Student,
tid int references Teacher,
cid int references Course);
```

Finding keys and superkeys

Consider $R(A,B,C,D,E)$ with functional dependencies $AB \rightarrow E$ and $D \rightarrow C$, find all the keys and superkeys of R .

A superkey is a set of attributes X s.t. $X^+ = \text{all attributes}$.

From the FDs above, we can derive:

$$\{A; B; D\}^+ = \{A; B; C; D\}^+ = \{A; B; D; E\}^+ = \{A; B; C; D; E\}^+ = \{A; B; C; D; E\}$$

Hence,

$\{A; B; D\}$; $\{A; B; C; D\}$; $\{A; B; D; E\}$; and $\{A; B; C; D; E\}$ are all superkeys.

A key is a set of attributes which form a superkey and for which no subset is a superkey. In our example, $\{A; B; D\}$ is the only key.

BCNF Decomposition

i) From the previous relation, decompose the relation to BCNF.

Both functional dependencies violate BCNF.

Try $\{A; B\}^+ = \{A; B; E\}$. Decompose into $R_1(A,B,E)$ and $R_2(A,B,C,D)$.

For R_1 , $AB \rightarrow E$ is the only FD and $\{A; B\}$ is a key, so R_1 is in BCNF.

R_2 is not in BCNF, since $\{D\}$ is not a key and we have $D \rightarrow C$.

Try $\{D\}^+ = \{C; D\}$. Decompose into $R_3(C, D)$ and $R_4(A, B, D)$

End result: $R_1(A,B,E)$, $R_3(C, D)$, and $R_4(A, B, D)$

ii) Consider the following relational schema and set of functional dependencies.

$R(A,B,C,D,E,F,G)$ with functional dependencies:

$A \rightarrow D$

$D \rightarrow C$

$F \rightarrow EG$

$DC \rightarrow BF$

Decompose R into BCNF.

Watch-out! The first FD does NOT violate BCNF so we need to pick another one to decompose. We try the second one:

Try $\{D\}^+ = \{B; C; D; E; F; G\}$. Decompose into $R_1(B, C, D, E, F, G)$ and $R_2(A,D)$.

R_2 has two attributes, so it is necessarily in BCNF.

For R_1 , again not all FDs violate BCNF so we need to be careful.

Try $\{F\}^+ = \{E, F, G\}$. Decompose into $R_{11}(E, F, G)$ and $R_{12}(B, C, D, F)$.

Both R_{11} and R_{12} are in BCNF.