

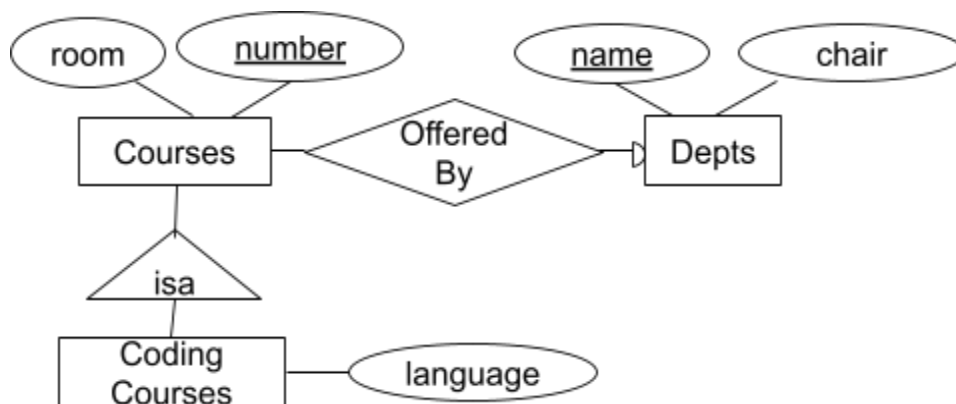
FD and BCNF Problem Solutions

Q1. Convert the E/R diagram below to relations in BCNF form. Assume no values are NULL, and the arrow between OfferedBy and Depts is a round one. Include all keys and foreign keys. Use the following notation and explicitly state foreign key relationships.

For instance:

$R(\underline{a}, b)$

$S(\underline{c}, d)$ -- c is a foreign key to R



Solution:

$\text{Courses}(\underline{\text{number}}, \text{room}, \text{name})$ -- name is foreign key to Depts

$\text{CodingCourses}(\text{language}, \underline{\text{number}})$ -- number is foreign key to Courses

$\text{Depts}(\underline{\text{name}}, \text{chair})$

Q2. Given $R(A, B, C, D, E, F)$, and functional dependencies: $B \rightarrow A$; $E \rightarrow B$; $D \rightarrow C$; $A \rightarrow C$

Decompose R into BCNF. In each step, explain which functional dependency you used to decompose and explain why further decomposition is needed. Your answer should consist of a list of table names and attributes. Make sure you indicate the keys for each relation.

Solution:

$B \rightarrow A, A \rightarrow C$

$R_1(\underline{B}, A, C)$

$A \rightarrow C$

$R_{11}(\underline{A}, C), R_{12}(\underline{A}, B)$

$R_2(\underline{B}, D, E, F)$

$E \rightarrow B$

$R_{21}(\underline{E}, B), R_{22}(\underline{E}, D, F)$

Final Decompositions: **$R_{11}(\underline{A}, \underline{B}), R_{12}(\underline{A}, C), R_{21}(\underline{E}, B), R_{22}(\underline{E}, D, F)$**

Q3. (17WI Final Q4) Given $R(A, B, C, D, E)$, and functional dependencies: $A \rightarrow C$, $BD \rightarrow A$, $D \rightarrow E$

Decompose R into BCNF. In each step, explain which functional dependency you used to decompose and explain why further decomposition is needed. Your answer should consist of a list of table names and attributes. Make sure you indicate the keys for each relation.

Solution:

One possible decomposition:

1. Use $A \rightarrow C$:

Decompose R into $R_1(A, C)$ and $T(A, B, D, E)$

T violates $BD \rightarrow A$ and $D \rightarrow E$, so we need to further decompose T

2. Use $D \rightarrow E$:

Decompose T into $R_2(B, D, A)$ and $R_3(D, E)$

Final relations: $R_1(\underline{A}, C)$, $R_2(\underline{B}, \underline{D}, A)$, and $R_3(\underline{D}, E)$