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Homework #1

Contents

1 Table References

Employees	
EmpID	Name
100	A
150	B
200	C

Department	
DeptID	DeptName
100	HR
200	CS
300	IT
400	HR

2 Question #1

Perform the Cartesian Product: Employees × Department:

Employees × Department			
EmpID	Name	DeptID	DeptName
100	A	100	HR
100	A	200	CS
100	A	300	IT
100	A	400	HR
150	B	100	HR
150	B	200	CS
150	B	300	IT
150	B	400	HR
200	C	100	HR
200	C	200	CS
200	C	300	IT
200	C	400	HR

3 Question #2

Perform the theta join between Employees and Department where EmpID = DeptID:

Employees $\bowtie_{EmpID=DeptID}$ Department			
EmpID	Name	DeptID	DeptName
100	A	100	HR
200	C	200	CS

4 Question #3

Suppose R is a relation with attributes $A_1, A_2, ..., A_n$. As a function of 'n', tell how many super keys R has, if:

a) The only key is A_1:

$$f(n) = \begin{cases} 2^{n-1} & n \geq 1 \\ 0 & n < 1 \end{cases}, \text{ where } n \in \mathbb{Z}$$

b) The only keys are A_1 and A_2:

$$f(n) = \begin{cases} 2^{n-1} + 2^{n-2} & n > 1 \\ 1 & n = 1 \\ 0 & n < 1 \end{cases}, \text{ where } n \in \mathbb{Z}$$

c) The only keys are $\{A_1, A_2\}$ and $\{A_3, A_4\}$:

$$f(n) = \begin{cases} 2^{n-2} + 3 * 2^{n-4} & n \geq 4 \\ 2^{n-2} & 2 \leq n < 4 \\ 0 & n < 2 \end{cases}, \text{ where } n \in \mathbb{Z}$$

d) The only keys are $\{A_1, A_2\}$ and $\{A_1, A_3\}$:

$$f(n) = \begin{cases} 2^{n-2} + 2^{n-3} & n > 2 \\ 1 & n = 2 \\ 0 & n < 2 \end{cases}, \text{ where } n \in \mathbb{Z}$$

5 Question #4

Consider a relation with schema $R(A, B, C, D)$ and FD's $AB \to B, C \to D$ and $D \to A$.

a) What are all the nontrivial FD's that follow from the given FD's? You should restrict yourself to FD's with single attributes on the right side.

Nontrivial FD's: $C \to D, C \to A, D \to A$

b) What are all the keys of R?

Keys: $\{B, C\}$

c) What are all the super keys for R that are not keys?

Super Keys: $\{B, C, D\}, \{A, B, C\}, \{A, B, C, D\}$