

CS540 Winter 2019

Assignment 1

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1. Relational Model and SQL

(a)

$$\pi_{dname}(\sigma_{age < 40}(emp) \bowtie_{works.eid=emp.eid} works \bowtie_{dept.did=works.did} dept)$$

Q1(n): -Dept(d, n, b, m), Works(x, d, p), Emp(x, y, z, s), z < 40

(b)

SELECT DISTINCT dname

FROM dept

WHERE dept.did IN (SELECT works.did

FROM works

WHERE works.eid IN (SELECT emp.eid

FROM emp

WHERE emp.age < 40))

(c)

SELECT DISTINCT ename

FROM emp, dept

WHERE emp.salary > dept.budget

(d)

SELECT dname, COUNT(emp.eid)

FROM emp, dept, works

WHERE emp.eid = works.eid AND

works.did = dept.did

GROUP BY dept.did

HAVING (SUM(emp.salary)/COUNT(emp.eid)) < 64000

2. Schema Normalization

(a) The Key of R is ACD, BCD, CDE:

For ACD: A → B

AC → BC → E

ACD → BCD → ED

For BCD: BC → E

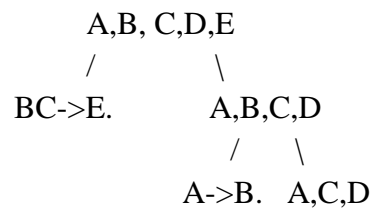
BCD → ED → A

For CDE: ED → A → B

CED → CA → BC

(b) It is not BCNF, The condition of BCNF is For each non-trivial FD $X \rightarrow Y$, X is a super-key of R.

$R = (A, B, C, D, E)$



$R_1 = (B, C, E)$ is BCNF

$R_2 = (A, B, C, D)$ is not BCNF, because the A can get B

$R_3 = (A, B)$ is BCNF

$R_4 = (A, C, D)$ is BCNF

(c) It is 3NF. because A,B,E all element in the key