**LAB 2**

**DBI05**

**RELATIONAL DATABASE**

*Fullname: Phạm Tuấn Anh*

*Student ID: SE192861*

*ID Group*: SE1805

**Answer sheet:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Q1 (2 marks)** | **Q2 (2 marks)** | **Q3 (2 marks)** | **Q4 (4 marks)** |
| What is your answer  👉 | Fmin: {A → B, A → C, BD → E, E → G, CG → H, CG → I}  s | Candidate Key: {AD} | R is in 1NF only | R1(A,B,C), R21(B,D,E), R221(C,G,H,I), R222(A,B,D,G) |

Consider relation: R = (A, B, C, D, E, G, H, I)

with the set of functional dependencies: F={A→BC,BD→E,AH→C,E→G,CG→HI}

1. Find the minimal cover
2. Find all candidate keys.
3. Identify the best normal form that R satisfies
4. If the relation is not in 3NF, decompose it until it becomes 3NF (or BCNF).

At each step, identify a new relation, decompose and re-compute the keys and the normal forms they satisfy.

**SOLUTIONS:**

1. Find the minimal cover:

Step 1:  
F: {A → BC, BD → E, AH → C, E → G, CG → HI}

F’: {A → B, A → C, BD → E, AH → C, E → G, CG → H, CG → I}

Step 2:

BD → E: Neither B → E nor D → E holds → Keep BD → E

AH → C: A → C already exists → H is redundant → Remove AH → C

CG → H and CG → I: Neither C → H/I nor G → H/I holds → Keep both

Step 3:

A → B: Not redundant (A⁺ without it = {A,C})

A → C: Not redundant (A⁺ without it = {A,B})

BD → E: Not redundant (BD⁺ without it = {B,D})

E → G: Not redundant (E⁺ without it = {E})

CG → H: Not redundant (CG⁺ without it = {C,G,I})

CG → I: Not redundant (CG⁺ without it = {C,G,H})

Fmin: {A → B, A → C, BD → E, E → G, CG → H, CG → I}

**Q2:**

Step 1:

SRC: A, D

MIDDLE: B, C, E, G, H, I

Step 2:  
{AD}⁺:

Start: AD

A → B: ABD

A → C: ABCD

BD → E: ABCDE

E → G: ABCDEG

CG → H: ABCDEGH

CG → I: ABCDEGHI

Step 3:

{A}⁺ = ABC ≠ R

{D}⁺ = D ≠ R

Candidate Key: {AD}

**Q3:**

Partial dependencies on {AD}:

A → B (2NF)

A → C (2NF)

Conclusion: R is in 1NF only

**Q4:**

First (remove A → B, A → C):

R1(A,B,C) with A → B, A → C

R2(A,D,E,G,H,I) with BD → E, E → G, CG → H, CG → I

R1:

Key: A

BCNF

R2:

Key: AD

BD → E: BD is not a superkey → BCNF

Second (remove BD → E):

R21(B,D,E) with BD → E

R22(A,B,D,G,H,I) with E → G, CG → H, CG → I

R21:

Key: BD

BCNF

R22:

Key: AD

CG → H, CG → I: CG is not a superkey → BCNF

Third (remove CG → H, CG → I):

R221(C,G,H,I) with CG → H, CG → I

R222(A,B,D,G) (no FDs)

R1(A,B,C) with A → B, A → C (BCNF)

R21(B,D,E) with BD → E (BCNF)

R221(C,G,H,I) with CG → H, CG → I (BCNF)

R222(A,B,D,G) (no FDs, BCNF)