15.19 Database System HW5 (BONUS). E94074037 王可萱

(a) Ssn. Snum 是 candidate keys ∴ 有 2 functional dependencies

FD1: Snum → { Sname, Ssn, Sc_addr, Sc_phone, Sp_addr, Sp_phone, Bdate, Sex, Class, Major_code, Minor_code, Prog }

FD2: Ssn → { Sname, Snum, Sc_addr, Sc_phone, Sp_addr, Sp_phone, Bdate, Sex, Class, Major_code, Minor_code, Prog }

(b) Dname, Dcode 是 candidate keys ∴ 有 2 functional dependencies

FD3: Dname → { Dcode, Doffice, Dphone, Dcollege }

FD4: Dcode → { Dname, Doffice, Dphone, Dcollege }

(c) 只有 Cnum 一個 primary key ∴ 為 single functional dependency

FD5: Cnum → { Cname, Cdesc, Credit, Level, Cdept }

(d) SECTION 是 weak entity type ⇒ relation with a partial key consisted of attributes "Semester, Year, Sec_num" and a foreign key Sec_course which represents identifying relationship type between COURSE and SECTION entities.
Partial key & foreign key together form → primary key

FD6: { Semester, Year, Sec_num, Sec_course } ⟶ Iname

(e) Relation GRADE represents a relationship type between STUDENT & SECTION entities.
This relation is of cardinality M:N and it is represented as a relation.
Primary key: form by Ssn 和 { Semester, Year, Sec_course, Sec_num }

FD7: { Ssn, Semester, Year, Sec_num, Sec_course } → Grade

All relations are in "BCNF". 所有 nonprime attribute 皆滿足 full FD (2NF)
且所有的 FD 的左邊都是 candidate key (3NF. BCNF)

relational schema diagram:

STUDENT (choose Ssn as primary key)

Sname	Snum	Ssn	Sc_addr	Sp_addr	Sc_phone	Sp_phone	Bdate	Sex	Class	Major_code	Minor_code	Prog

DEPARTMENT (choose Dcode as primary key)

Dname	Dcode	Doffice	Dphone	Dcollege

COURSE

Cname	Cdesc	Cnum	Credit	Level	Cdept

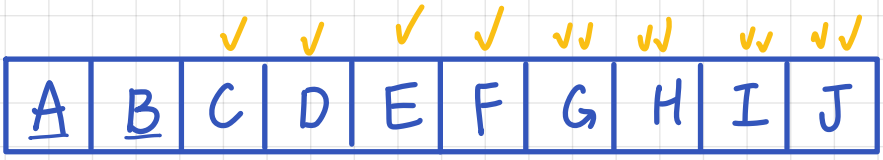
SECTION

Iname	Semester	Year	Sec_course	Sec_num

GRADE

Ssn	Semester	Year	Sec_course	Sec_num	Grade

15.24



① key of R

FD1

FD2 x

FD3 x

FD4 x

FD5 x

{A, B} is a super key of R.

∵ every other attributes is fully, partially or transitively functionally dependent on {A, B}

且 {A.B} 為 minimum super key.

② 目前滿足 1 NF

Nonprime attribute : C. D. E. F. G. H. I. J

FD2, FD3. FD4. FD5 : partial dependency on primary key ∴ 拆成

R_1: A B C

R_2: A D E I J

R_3: B F G H

FD1

FD2
FD5

FD3
FD4

③ 目前滿足 2NF

R_1 no transitive dependencies ∴ 是 3NF

R_2 的 {I, J} are transitive dependent on the primary key A

R_3 的 {G, H} are transitive dependent on the primary key B

> 不滿足 3NF ∴ 拆

R_1: A B C

FD1

R_2A: A D E

FD2

R_2B: D I J

FD5

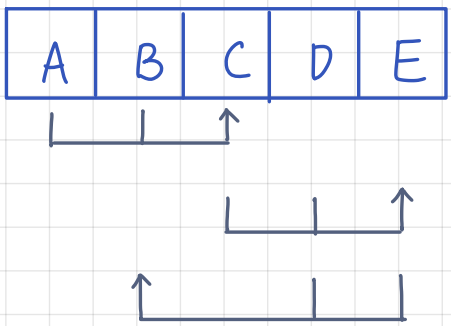
R_3A: B F

FD3

R_3B: E G H

FD4

15.27



① A.B is not a candidate key.

∵ candidate key 必須可 functionally determine values of all attributes of a relation

但 A.B 無法 determine "D".

② A.B.D is a candidate key

A.B 先 → C

C.D 又再 → E

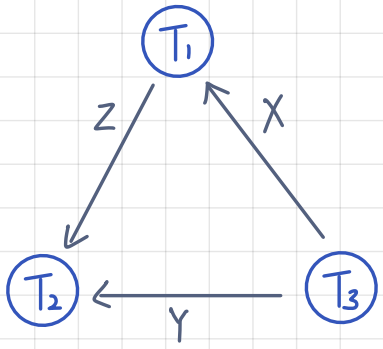
∴ all attributes' values can be determined.

21.23

r: read w: write

S_1

T_1	T_2	T_3
$r_1(X)$	$r_2(Z)$	
$r_1(Z)$		$r_3(X)$
		$r_3(Y)$
$w_1(X)$		$w_3(Y)$
	$r_2(Y)$	
	$w_2(Z)$	
	$w_2(Y)$	



No Cycle !!

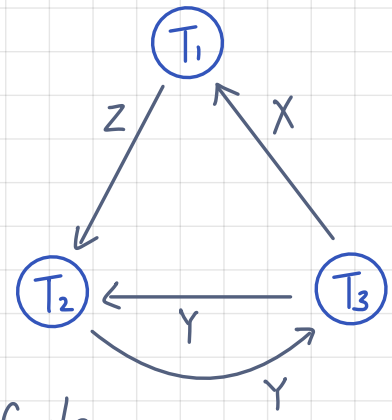
$r_3(X) \rightarrow w_1(X)$
$r_3(Y) \rightarrow w_2(Y)$
$r_1(Z) \rightarrow w_2(Z)$
$w_3(Y) \rightarrow w_2(Y)$

Equivalent serial schedule :

T_1	T_2	T_3
$r_1(X)$		
$r_1(Z)$	$r_2(Z)$	
		$r_3(X)$
$w_1(X)$		$r_3(Y)$
		$w_3(Y)$
	$r_2(Y)$	
	$w_2(Z)$	
	$w_2(Y)$	

S_2

T_1	T_2	T_3
$r_1(X)$	$r_2(Z)$	
		$r_3(X)$
$r_1(Z)$	$r_2(Y)$	
		$r_3(Y)$
$w_1(X)$		
	$w_2(Z)$	
	$w_2(Y)$	$w_3(Y)$



有 Cycle
∴ can not be serializable ※

無 Equivalent serial schedule

$r_1(Z) \rightarrow w_2(Z)$
$r_3(X) \rightarrow w_1(X)$
$r_2(Y) \rightarrow w_3(Y)$
$r_3(Y) \rightarrow w_2(Y)$
$w_3(Y) \rightarrow w_2(Y)$