Function Dependency: Relationship among the attributes.

$$FD: A \xrightarrow[Determines]{} B$$

So we can uniquely determine B

Ex.

Name	Roll	CGPA
A	R_1	7.6
B	R_2	5.5
C	R_3	9.2
A	R_4	9.1
B	R_5	8.7

What is the CGPA of A?   We can't determine as 2A exist

What's the CGPA of R_4 ⇒ 9.1

Say Roll associated with CGPA

which mean $Roll \xrightarrow[determine]{} CGPA$

FD $\{\begin{array}{l} R \longrightarrow C \\ R \longrightarrow N \end{array}$ // Name

Ex. find FD for this table?

A	B	C	D
a_1	b_1	c_1	d_1
a_1	b_2	c_1	d_2
a_2	b_2	c_2	d_2
a_1	b_2	c_2	d_3
a_3	b_3	c_2	d_4

$A \to B$ Means

for instance of 'A' we will have a unique value of 'B'

$a_1 \longrightarrow b_2$ ✗
$a_1 \longrightarrow b_1$ ✗

$b_1 \longleftarrow a_1$
$b_2 \longleftarrow a_1$ ✗

not sigle value
⇒ Not possible in FD

$A \to B$ ✗

assume, then attempt to discard it

$A \longrightarrow C$

$a_1 \longrightarrow c_1$ // a_1 corresponding to unique element ✓

$a_2 < \begin{matrix} c_3 \\ c_4 \end{matrix}$ ✗

$A \to C$ ✓

assume $C \to D$ ✗

$c_1 < \begin{matrix} d_1 \\ d_2 \end{matrix}$
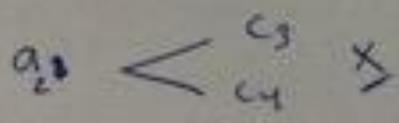
* FD : X $\longrightarrow$ Y تُحقَّق Holds $\boxed{\forall\ t_1,\ t_2}$ $\overset{\frown}{(14-11-2018)}$

if $t_1 [X] = t_2 [X]$

Then

$t_1 [Y] = t_2 [Y]$

Any Key Can reach any attribute.

Relation Instance   اللِّ محدَّدة

Rules ① if   X $\geq$ Y $\Rightarrow$ X $\longrightarrow$ Y

[Y subset from X]   X determines Y, regardless what is the data

Ex   Sname, age, age

Sname, age $\longrightarrow$ age

① called Reflexivity (Trivial)

②   X $\longrightarrow$ Y كُل اذا is true, Then

$\Downarrow$ كائنا ما هو
                      $\longleftarrow$ ◡◡◡◡◡◡◡
XZ $\longrightarrow$ YZ $\forall Z$ انجلى واحد
                                      من نوق لتحت

② called Augmentation

~~age~~ ~~#####~~

Major $\xrightarrow{\text{يحدد}}$ faculty

age, Major $\longrightarrow$ faculty, age

اثبات القاعدة

Rules $\equiv$ Soundess $\Rightarrow$ Correctly

$X \longrightarrow Y$ true

Means $\Rightarrow$ $t_1[x] = t_2[x]$

$\qquad\qquad\quad t_1[Y] = t_2[Y]$

$\qquad\qquad\quad$ true.

[We need to show $XZ \longrightarrow YZ$]
We need to show if $t_1[x_z] = t_2[xz]$ Then

$t_1[x] = t_2[x]$ $\longleftarrow$ ~~$t_1[xz] = t_2[xz]$~~
$\qquad$ & $\qquad\qquad\qquad$ ~~$t_1[xz] = t_2[xz]$~~
$t_1[z] = t_2[z]$ $\qquad\qquad$ $t_1[Yz] = t_2[Yz]$

③   Transitivity

$X \longrightarrow Y \qquad Y \longrightarrow Z \qquad X \longrightarrow Z$

[اثبتهم غير مباشر]
استخدمهم مباشرة

$\lceil$

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Ex $X \rightarrow Y$
     $X \rightarrow Z$

Using Rules Prove that $X \rightarrow YZ$

Ans $X \rightarrow XY$ Rule ②: Augmentation   · Aug X

      $XY \rightarrow YZ$ Rule ②: Aug Y

      $X \rightarrow YZ$

Note $X \rightarrow YZ$ called Union

Ex $X \rightarrow YZ$ ← start from here

Prove $X \rightarrow Y$ ← can't start from here

Ans $X \rightarrow YZ$

      $YZ \rightarrow Y$

      $X \rightarrow Y$

Ex   A B C D   attributer

      $A \rightarrow B$
      $BC \rightarrow E$
      $ED \rightarrow A$

      check if BCD Key

Ans   BCD ⟶ B   تحديد الحل   20%   Key تطبيق التعريف

          ⟶ C   20%

          ⟶ D   20%

       BCD $\xrightarrow{?}$ E

       BCA $\xrightarrow{?}$ A

       from ②   BC ⟶ E

                 _____ Aug D

                 BCD ⟶ DE   20%

       from ③   ED ⟶ A

                 _____ Tran

                 BCD ⟶ A

       BCD ⟶ BC
       BC ⟶ E   Trans   20%
       BCD ⟶ E

       Is CDE Key ?

          CDE ⟶ CDE ↘ Reflexivity

       A ?
       B ?

       CDE ⟶ DE   ref1
       DE ⟶ A   from 3
       CDE ⟶ A _④ Trans.

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$$CDE \longrightarrow A$$
$$A \longrightarrow B$$
$$CDE \longrightarrow B \quad \text{Trans} \checkmark$$

Ex   Is ACD Key

$$ACD \longrightarrow ACD$$

$$\begin{array}{c} B \\ E \end{array} ?$$

$$ACD \longrightarrow A$$
$$A \longrightarrow B$$
$$ACD \longrightarrow B \quad \checkmark$$

$$ACD \longrightarrow B$$
$$ACD \longrightarrow Bc \quad \text{Aug on Both side}$$
$$BC \longrightarrow E$$

Keys   ACD   Is CD Key ?
        BCD   No, Prove... ?
        CDE
    Super Key ?
    No
    ⇒ Key

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* First Normal form (1 NF):   17-11-2018

Domain of at attributes must includes only atomic values

and value of any attribute must be a single Value.

department

did   name   Location
 1   Comp   Ramallah Nablus
 2   Encs   (Ramallah , ~~Hebron~~ Hebron) INF   مخالفة
 3

Project - emp

eid   ename   Pid / Hours
 1   -   17 20
                   18 20   يصير
 2   -   15 18
                   19 22
 3   -

           single صار tuples هي كل att كل

Solution using object et Blob   لحلها

7

* Full FD

الـ X ~ key
او = key

$X \rightarrow Y$, if $\forall A$ $X - \{A\} \rightarrow Y$ doesn't hold

مثال
$AB \rightarrow C$ True
& $A \rightarrow C$ True
Not FD

emp-Prj

SSN	Pnumber	Hours	ename	Pname	Plocation
Key

$SSN \rightarrow ename$ $SSN, Pnum \rightarrow Pname$

$SSN \rightarrow Hours$ $Pnum \rightarrow Pname$ ⇑

also, $SSN, Pnumber \rightarrow ename$ ⎫ **Not F FD**

[$SSN, Pnumber \rightarrow Hours$] ⎬ Full FD, لأن يعتمد على كلا المفتاحين

Second Normal Form : (2NF)

every nonprime attribute must be fully Functionally dependent on the key

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* بعض حالات جديد وتنشيل الخاصيتين

SSN	Pnum	Hours	Pnum	Pname	Ploc	SSN	ename

في الطريقة السابقة Trace ←

if X is one att ⇒ FD

بأن تعريف X , اذا نشل منها استي ويتجرب
الطريقة ⇐ FD
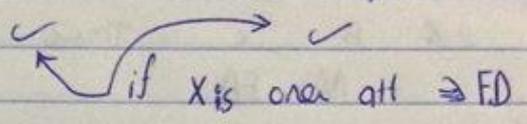
Third Normal Form (3NF)

∀ FDs X —→ A

① A ∈ X

or ② X is a super-key   or Key يتصقر بزنر واحد يكفي

or ③ A is part of Key

Ex   emp-dept

SSN	ename	bdate	address	dnumber	dname	mgr-ssn

أي سطر له key single Value, كل value depend on key ⟸ 2NF ✓

اذا بدأت احمل INF

↘ SSN ⟶ ename	✗ dnumber ⟶ dname
↘ SSN ⟶ bdate	✗ dnumber ⟶ mgr_SSN
↘ SSN ⟶ addess	
↘ SSN ⟶ dnumber	
↘ SSN ⟶ dname	
→ SSN ⟶ mgr_SSN	

🌐 ✓ أي شرط تحقت، يكن

افصل الحالتين

employee SSN   ename   bdate   addess   dnumber   3NF

dept

dnum   dname   mgr_SSN   2NF

رجوا ابدلوا، شي كل Merge لازم

Solve   Ex 2, 5, 6   chapter 19

Quiz Sat ⟹ Normalization   19-11-2018

* INF : every value must be : simple / atomic / single / Not Nested.

* Full FD :   x ⟶ Y   is a FD iff

for any A , x - {A} ⟶ Y doesn't holds.

* 2NF : Every non-prime attribute must be fully functionally

dependent on the key

* 3NF :   ∀ FD : x ⟶ A one of the following must hold :

① A∈x, i.e x ⟶ A is trivial.

or ② x superKey or Key

or ③ A part of a Key الحـظ هذا الشرط

BCNF :   ∀ FD : x ⟶ A one of the following must

hold : ① A∈x

or ② A super Key

example   A, B, C, D, E, F, G, H, I, J

AB ⟶ C ___ 1
A ⟶ DE ___ 2
B ⟶ F ___ 3
F ⟶ GH ___ 4
D ⟶ IJ ___ 5

find Key ?

Ans   Key must give ⟶ A B C D E F G H I J

From depercices find what we can't find ⟹ A, B

* Remember :① Reflex : Y≤X ⟹ X ⟶ Y   so AB Part
                                                    of any Key

            ② Aug :   X ⟶ Y
                       ⟹ XZ ⟶ YZ

            ③ Trans :   X ⟶ Y
                           Y ⟶ Z
                       ⟹   X ⟶ Z

AB ⟶ A   reflex   A ⟶ DE ___ 2
AB ⟶ B   reflex   DE ⟶ D ___ reflex
⟹ AB ⟶ C   from 1   ⟹ A ⟶ D ___ 6   Trans

A ⟶ E ___ 7   AB ⟶ B ___ reflex
    ⇓   B ⟶ F ___ 3
A ⟶ DE ___ 2   ⟹ AB ⟶ F ⟹ Trans
DE ⟶ E   reflex
⟹ A ⟶ E Trans

AB → A ___ reflex   AB → f

A → D ___ 6   F → GH

⇒ AB → D   Trans   AB → GH

Part of Any Key ← dep في الثانوية: ملاحظة

A,B must be a part of any Key

does 2NF ?   Is there any attribute doesn't depend
                         on the Key

Key   AB → DE
         also A → DE   Not Full Dependency 1✓ FD
                                               2-5 × N FD

⇒ Not in Second NF

Ex Transfer to 2NF   Decomposition
                        Table.   Table.   Table.
Step 1 final الخطوات [A D E]   [BF]   [ABCGHIJ]

A B C   من مختلفين لنأخذ

this Solution is Not unique

[A B c] D E F G H I J
نبدأ أول النحت من طرف من (AB → c)
         A → DE ⎤ نأخذ partial
         B → F   ⎦
         F → GH نأخذ part Dep
         D → IJ

From Previous example.

Convert to 2NF ?

C... J must be Fully Defen.

AB → D   شق   AB → F
A → D   ✗   B → F ✗

So Not 2NF. convert to 2NF   A B C D E
                                  F G H I J

AB → C ✓
A → DE ✗   So ⇒   A   D E   B F
B → F

F → GH   استفادوا من الأمثلة
D → IJ   بتطلعوا بحلوا مشاكل

INF   ① Primary Key exist

      ② No multivalue ~~m~~   Location

                                  | A , B | X

      ③   ما في عمود مشتق

2NF

1 if 1 PK ⇒ 2NF   مباشرة

2 if 2 PK.

     ⇒ if   Partial dependencies occur   Not 2NF

          ⇒ Part of key ⟶ att

            att. قدر على كل اكثر من att.

3NF   Non-Key ⟶ Non-Key   ممنوع

        Non-Key ⟶ Key   عادي

BCNF

             فقط Key أي لأ