Relational Database Design

(PYQ) Discuss the concept of functional dependencies and their role in database management & use.

ans ⇒ functional dependency is a concept ~~that~~ specifies the relationship between ~~the value of~~ two sets of attributes. it is denoted as $x \rightarrow y$, where the attribute set on the left side of the arrow is called Determinant and y is called the Dependent.

Ex ⇒

roll_No	name	dept_Name	building
1	ABC	IT	A4
2	DEF	CSE	A2

roll_NO → {name, dept_name, building}

here roll no can determine name, dept_Name and dept_building hence a valid functional dependency.

use/role → It helps in organizing data efficiently, minimizing redundancy; a process that reduce data redundancy by organizing tables.

uses → Database Design, Normalization, Data integrity, Query optimization

Q. what do you mean by multivalued dependency

ans ⇒ when one attribute in a database depends on another attribute and has many independent values, it is said to be multivalued dependency.

Person (P)	Mobile (M)	Food (F)
P1	M1	f1
P1	M2	f2
P1	M1	f2
P1	M2	f1
P2	M3	f2

(P →→ M)

(P →→ F)

P	M	F
P1	M1	f1
	M2	f2
P2	M3	f2

Q Explain join dependency: If we join each individual relation projection (π) and at end/last if we get original relation then it will called as join dependency.

$$\pi_{R_1}(R) \bowtie \pi_{R_2}(R) \bowtie \cdots\cdots\cdots \bowtie \pi_{R_n}(R) = R$$

PName	Skill	Job
Aman	DBA	J1
Mohan	Tester	J2
Rohan	programmer	J3
Sohan	Analyst	J1

R1 (Pname, Skill)

Pname	Skills
Aman	DBA
mohan	Tester
Rohan	programmer
sohan	Analyst

R2 (Pname, Job)

pname	Job
Aman	J1
mohan	J2
Rohan	J3
sohan	J1

Join $(R1 \bowtie R2)$

Pname	Skills	Job
Aman	DBA	J1
mohan	Tester	J2
Rohan	programmer	J3
sohan	Analyst	J1

R3 (Skills, Job)

Skills	Job
DBA	J1
Tester	J2
programmer	J3
Analyst	J1

Again join $((R1 \bowtie R2) \bowtie R3)$

pname	Skills	Job
Aman	DBA	J1
mohan	Tester	J2
Rohan	programmer	J3
sohan	Analyst	J1

We get original relation

$$(R1 \bowtie R2 \bowtie R3) = R$$

join dependency

PYQ Explain All forms of Normalization with relevant Example.

Normalization: It is a process of organizing data in the database.

① 1NF [First Normal form]: Table should not contain any multivalued Attribute.

Roll	Name	Course
1	Raufhan	C/C++
2	Aarumi	Java
3	Pawan	C/DBMS

→

Roll	Name	Course
1	Raufhan	C
1	Raufhan	C++
2	Aarumi	Java
3	Pawan	C
3	Pawan	DBMS

Primary key → (Roll & Course)

* 2NF: (i) Table must be in 1st Normal form

(ii) All the non-prime attributes should be fully functional dependent on candidate key.

or should Not partial functional dependency

Example:

R

A	B	C
a	1	x
b	2	y
a	3	z
c	3	z
d	3	z
e	3	z

→ R1

A	B
a	1
b	2
a	3
c	3
d	3
e	3

→ R2

B	C
1	x
2	y
3	z

Candidate key (A, B)

Prime Attribute → (A, B)

Non prime Attribute (C)

R(A, B, C)

3NF : (i) Table must be in second Normal form
(ii) There should not transitive dependency

Transitive dependency means → when a non prime attribute determine another non prime attribute

(A B C)

where
A is Prime Attribute

A → B fine(✓)

B → C Not fine(✗)

B → non prime attribute
C → non prime Attribute

prime Attribute
A

R

A	B	C
a	1	x
b	1	x
c	1	x
d	2	y
e	2	y
f	3	z
g	3	z

→

R1

A	B
a	1
b	1
c	1
d	2
e	2
f	3
g	3

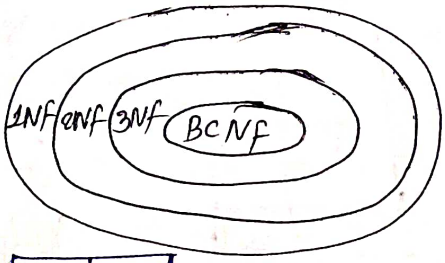
R2

B	C
1	x
2	y
3	z

BCNF : (i) The table should be in the 3rd normal form

Rule 2 : $x \rightarrow y$

x should be a superkey for every functional dependency



R(A B C)

AB
AC

R1(C, B)
R2(A, C)

A	C
a	x
b	y
e	z
c	w
d	w
e	w

C	B
x	1
y	2
z	2
w	3

R

A	B	C
a	1	x
b	2	y
c	2	z
c	3	w
d	3	w
e	3	w

Q. How BCNF is different from 3NF or difference b/w BcNf and 3NF

BCNF	3NF
(i) BCNF stands for Boycee-codd normal form.	3NF stands for
(ii) In BCNF for any relation A→B, A should be a super key	(ii) In 3NF for any relation A→B, A should be a prime Attribute.
(iii) It is comparatively more stronger than 3NF.	(iii) It is less stronger than BCNF.
(iv) In BCNF two main condition (a) table should be in 3NF (b) x→y x should be a super key	(iv) In 3NF two main condition (a) table must be in second NF. (b) There should not transitive dependency.
(v) The redundancy is comparatively low in BCNF.	(v) The redundancy is high in 3NF.
(vi) Difficult to achieve	(vi) Eqy to Achieve.
(vii) Lossless decomposition is hard to achieve in BCNF.	(vii) Lossless decomposition can be achieved by 3NF.

* 4NF (i) 4NF → table should be in BCNF.
(ii) no multivalued dependency x →→ y

ans ⇒ when one attribute in a database depends on another attribute and has many independent values, it is said to be multivalued dependency.

Person (P)	Mobile (M)	Food (F)
P1	M1	F1
P1	M2	F2
P1	M1	F2
P1	M2	F1
P2	M3	F2

(P →→ M)

(P →→ F)

P	M	F
P1	M1	F1
	M2	F2
P2	M3	F2

* 5NF : 5NF is also known as project-join Normal form.
  (i) It must be in 4NF
  (ii) Won't have lossless decomposition into smaller tables

Q Explain join dependency: If we join each individual relation projection (π) and at end/last if we get original relation then it will called as join dependency.

$$\pi_{R1}(R) \bowtie \pi_{R2}(R) \bowtie \text{--------} \bowtie \pi_{Rn}(R) = R$$

PName	Skill	Job
Aman	DBA	J1
Mohan	Tester	J2
Rohan	programmer	J3
Sohan	Analyst	J1

R1 (Pname, Skill)

Pname	Skills
Aman	DBA
mohan	Tester
Rohan	programmer
sohan	Analyst

R2 (Pname, Job)

Pname	Job
Aman	J1
Mohan	J2
Rohan	J3
Sohan	J1

Join $(R1 \bowtie R2)$

Pname	Skills	Job
Aman	DBA	J1
mohan	Tester	J2
Rohan	programmer	J3
sohan	Analyst	J1

R3 (Skills, Job)

Skills	Job
DBA	J1
Tester	J2
programmer	J3
Analyst	J1

Again join $((R1 \bowtie R2) \bowtie R3)$

pname	Skills	Job
Aman	DBA	J1
mohan	Tester	J2
Rohan	programmer	J3
sohan	Analyst	J1

We get original relation

$$(R1 \bowtie R2 \bowtie R3) = R$$

join dependency