UNIT 2

Lecture 12

Integrity Constraints

Integrity Constraints

- Integrity constraints are used to ensure accuracy and consistency of data in a relational database.
- The major types of integrity constraints are:
  1. Domain Constraints
  2. Entity Integrity Constraints
  3. Referential Integrity Constraints
  4. Operational Constraints

Domain Constraints

- Domain Constraints specify that the value of each attribute must be an atomic value from the domain.
- All the values that appear in a column of a relation (table) must be taken from the same domain.
- A domain is a set of values that may be assigned to an attribute.
- A domain definition usually consists of the following components:
  1. Domain Name
  2. Meaning
  3. Data Type
  4. Size or Length
  5. Allowable values or allowable range (if applicable)
- For e.g., in the STUDENT table, the domain for the column rollno is a integer of length 3.

Domain Constraints specified on SQL

```
Create table student
(rollno number(3),
sname varchar2(20),
sem number(1),
branch varchar2(10),
marks number(3),
pno number(3)
);
```

STUDENT

Rollno	Sname	Sem	Branch	Marks	Pno
1	RAM	3	CSE	40	121
2	SHYAM	5	CSE	50	122
3	MOHAN	7	CSE	55	123
4	GOPAL	5	IT	65	121
5	RINKI	3	MECH	40	122
6	PINKI	3	ETC	90	123

Entity Integrity Constraints

- The entity integrity constraint states that no primary key value can be null.
- This is because the primary key value is used to identify individual tuples in a relation. Thus, a null primary key value within a base relation would be like saying that there was some entity that has no known identity and we might not be able to distinguish them.
- An entity that cannot be identified is a contradiction in terms, hence the name entity integrity.
- Entity integrity constraints are specified on individual relations.
- In some cases, a particular attribute cannot be assigned a data value. There are two situations where this is likely to occur :
  - There is no applicable data value.
  - Applicable data value is not known when the values are assigned.

Entity Integrity Constraints specified on SQL

```
Create table student
(rollno number(3),
sname varchar2(20),
sem number(1),
branch varchar2(10),
marks number(3),
pno number(3),
primary key (rollno)
);
```

STUDENT

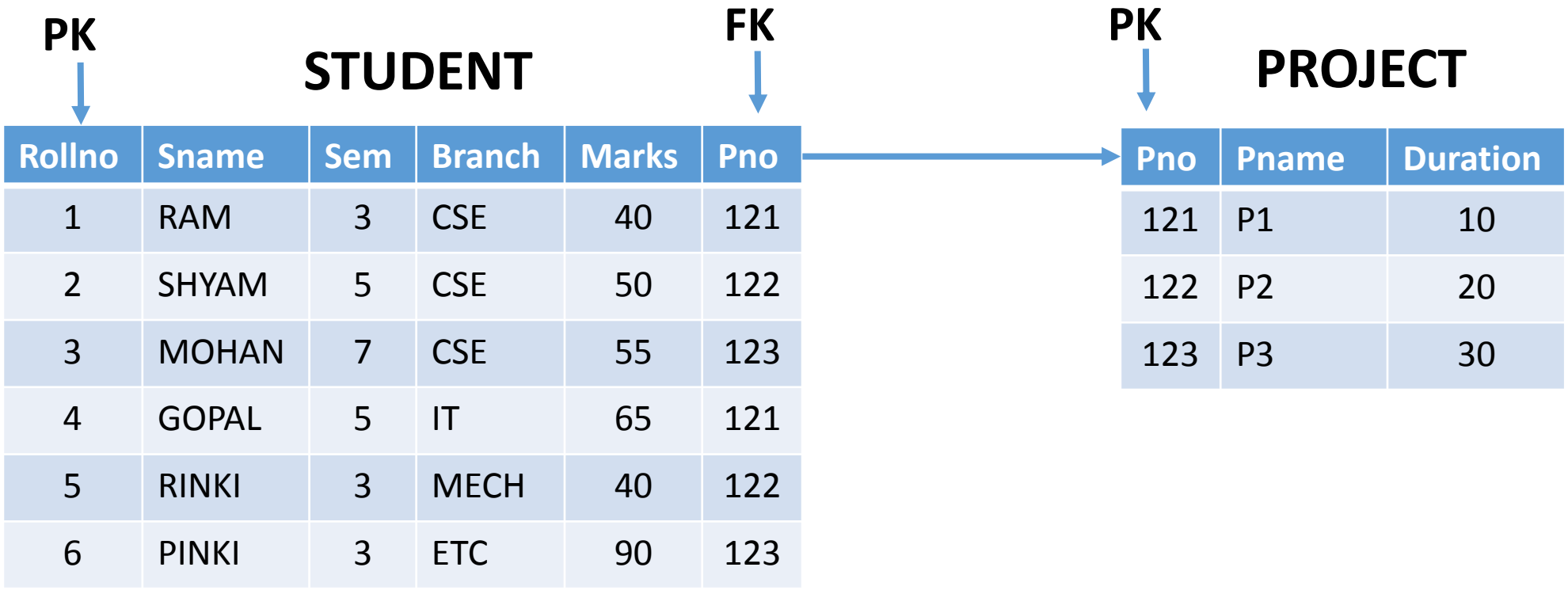
Rollno	Sname	Sem	Branch	Marks	Pno
1	RAM	3	CSE	40	121
2	SHYAM	5	CSE	50	122
3	MOHAN	7	CSE	55	123
4	GOPAL	5	IT	65	121
5	RINKI	3	MECH	40	122
6	PINKI	3	ETC	90	123

Referential Integrity Constraints

- A referential integrity constraint is specified between two relations and is used to maintain consistency among the rows of two tables (relations).
- This rule states that if there is a foreign key in one relation, either each foreign key value must match a primary key value in the other table or else the foreign key value must be null.
- Informally, the referential integrity constraint states that a tuple in one relation that refers to another relation must refer to an existing tuple in that relation.
- Association between tables is defined using foreign keys in the relational model.
- For e.g., the association between the STUDENT and PROJECT table is defined by including the PNO attribute as a foreign key in the STUDENT table. This means that before we insert a new row in the STUDENT table, the row for that PNO must already exist in the PROJECT table. If you check the rows in the STUDENT table, you will find that every PNO in that table appears in the PROJECT relation.

Referential Integrity Constraints

- We can diagrammatically display referential integrity constraints by drawing a directed arc from each foreign key to the relation it references. For clarity, the arrowhead may point to the primary key of the referenced relation.



Rollno	Sname	Sem	Branch	Marks	Pno
1	RAM	3	CSE	40	121
2	SHYAM	5	CSE	50	122
3	MOHAN	7	CSE	55	123
4	GOPAL	5	IT	65	121
5	RINKI	3	MECH	40	122
6	PINKI	3	ETC	90	123

Pno	Pname	Duration
121	P1	10
122	P2	20
123	P3	30

Referential Integrity Constraints

- If base relation (table) includes a foreign key FK matching the primary key PK of some other base relation, than every value of FK in the first table must either be equal to the value of PK in some tuple (row) of the second table or be wholly null (That is each attribute value participating in that FK value must be null.)
- In other words, a given foreign key value must have matching primary key value in some tuple of the referenced relation if that foreign key value is not null.
- Sometime, it is essential to allow foreign keys to accept nulls.
- Here it must be noted that the null is of the kind '**value does not exist**' rather than '**value unknown**'.

Referential Integrity Constraints specified on SQL

```
Create table project
(pno number(3),
pname varchar2(10),
duration number(2)
primary key (pno)
);
```

```
Create table student
(rollno number(3),
sname varchar2(20),
sem number(1),
branch varchar2(10),
marks number(3),
pno number(3)
primary key (rollno),
foreign key (pno) references project (pno)
);
```

Operational Constraints

- These constraints are forced in the database by the business rules or real world limitations.
- For e.g., if the retirement age of the employee in an organization is 60, then the age column of the employee table can have the constraint. **Age should be less than or equal to 60.**
- These kind of constraints, enforced by the business and the environment, are called operational constraints.

Operational Constraints specified on SQL

```
Create table student
(rollno number(3),
sname varchar2(20),
sem number(1),
branch varchar2(10),
marks number(3),
pno number(3),
check (sem between 1 and 8)
);
```

STUDENT

Rollno	Sname	Sem	Branch	Marks	Pno
1	RAM	3	CSE	40	121
2	SHYAM	5	CSE	50	122
3	MOHAN	7	CSE	55	123
4	GOPAL	5	IT	65	121
5	RINKI	3	MECH	40	122
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GATE Questions (Referential Integrity)

Let R(a, b, c) and S(d, e, f) be two relations in which d is the foreign key of S that refers to the primary key of R. Consider the following four operations R and S

1. Insert into R
2. Insert into S
3. Delete from R
4. Delete from S

Which of the following can cause violation of the referential integrity constraint above?

(A) None of (1), (2), (3) or (4) can cause its violation

(B) All of (1), (2), (3) and (4) can cause its violation

(C) Both (1) and (4) can cause its violation

(D) Both (2) and (3) can cause its violation

[GATE CS 1997]

GATE Questions (Referential Integrity)

Consider a database table T containing two columns X and Y each of type integer. After the creation of the table, one record (X= 1, Y=l) is inserted in the table. Let MX and MY denote the respective maximum values of X and Y among all records in the table at any point in time. Using MX and MY, new records are inserted in the table 128 times with X and Y values being MX+1, 2*MY+1 respectively. It may be noted that each time after the insertion, values of MX and MY change.

What will be the output of the following SQL query after the steps mentioned above are carried out?

SELECT Y FROM T WHERE X=7;

(A) 127 (B) 255 (C) 129 (D) 257 **[GATE 2011]**

University Questions

1. Explain integrity constraints specified on DBMS.
2. Explain the term :
    1. Entity Integrity Constraints
    2. Referential Integrity Constraints.

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https://www.youtube.com/channel/UCRWGtE76JlTp1iim6aOTRuw?sub_confirmation=1