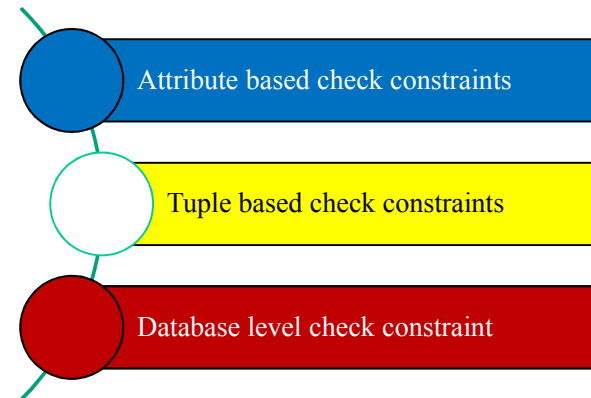


CHECK constraint

CHECK (<condition>)
↓
CHECK (condition that must hold)

conditions are like predicates that
are written after WHERE clause

CHECK constraint



Attribute based CHECK constraint

The speed of a laptop must be at least 2.0

```
CREATE TABLE Laptop(  
    .....,  
    speed NUMBER(3,2) CHECK(speed >= 2.0),  
    ....  
);
```

Attribute based CHECK constraint

The only types of printers are laser, ink-jet, and
bubble-jet

```
CREATE TABLE Printer(  
    .....,  
    type CHAR(20) CHECK(type IN ('laser', 'ink-jet', 'bubble-jet')),  
    ....  
);
```

A model of a product must also be the model of a PC, a laptop, or a printer

Maker	Model	Type
A	1001	pc
A	1002	pc
A	1003	pc
A	2004	laptop
A	2005	laptop
A	2006	laptop
B	1004	pc
B	1005	pc
B	1006	pc
B	2007	laptop
C	1007	pc
...
...
...

MODEL	SPEED	RAM	HD	PRICE
1001	2.66	1024	250	2114
1002	2.1	512	250	995
1003	1.42	512	80	478
1004	2.8	1024	250	649
1005	3.2	512	250	630
...

MODEL	SPEED	RAM	HD	SCREEN	PRICE
2001	2	2048	240	20.1	3673
2002	1.73	1024	80	17	949
2003	1.8	512	60	15.4	549
2004	2	512	60	13.3	1150
...

PC

Laptop

Product

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Attribute based CHECK constraint

A model of a product must also be the model of a PC, a laptop, or a printer

```
CREATE TABLE Product(
    ....,
    model CHAR(4) CHECK(model IN (SELECT model FROM PC
                                UNION SELECT model FROM Laptop
                                UNION SELECT model FROM Printer),
    ....
);
```

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Tuple based CHECK constraint

If the Head of the Department's gender is male then his name must not begin with 'Ms.'

$P \rightarrow Q \iff \neg P \vee Q$

```
CREATE TABLE Department(
    ....,
    ....,
    PRIMAR KEY..
    FOREIGN KEY,..
    CHECK (gender = 'F' or name NOT LIKE 'Ms.%')
);
```

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Tuple based CHECK constraint

A PC with a processor speed less than 2.0 must not sell for more than \$800

$P \rightarrow Q \iff \neg P \vee Q$

```
CREATE TABLE PC(
    ....,
    ....,
    PRIMAR KEY..
    FOREIGN KEY,..
    CHECK (speed > 2.0 or price <= 800)
);
```

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Tuple based CHECK constraint

A Laptop with a screen size less than 15 inches must have at least a 40 GB hard disk or sell for less than \$1000

$P \rightarrow Q \iff TP \vee Q$

```
CREATE TABLE PC(
.....,
    PRIMAR KEY..
    FOREIGN KEY,...
    CHECK (screen > 15 or hd > 40 or price < 1000)
);
```

If the relation Product mentions a model and its type then this model must appear in the relation appropriate to that type.

Maker	Model	Type
A	1001	pc
A	1002	pc
A	1003	pc
A	2004	laptop
A	2005	laptop
A	2006	laptop
B	1004	pc
B	1005	pc
B	1006	pc
B	2007	laptop
C	1007	pc
...
...
...

MODEL	SPEED	RAM	HD	PRICE
1001	2.66	1024	250	2114
1002	2.1	512	250	995
1003	1.42	512	80	478
1004	2.8	1024	250	649
1005	3.2	512	250	630
...

PC

MODEL	SPEED	RAM	HD	SCREEN	PRICE
2001	2	2048	240	20.1	3673
2002	1.73	1024	80	17	949
2003	1.8	512	60	15.4	549
2004	2	512	60	13.3	1150
....

Laptop

Product

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Tuple based CHECK constraint

If the relation Product mentions a model and its type then this model must appear in the relation appropriate to that type.

```
CREATE TABLE Product(
.....,
CHECK(
(type = 'pc' AND model IN (SELECT model FROM PC))
OR (type = 'laptop' AND model IN (SELECT model FROM Laptop))
OR (type = 'printer' AND model IN (SELECT model FROM Printer))
);
```

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Database level CHECK constraint

- Database level CHECK constraints called assertions
- Condition checks over multiple relations
- Assertions are executed upon any modifications to any relations mentioned in the assertion
- SQL standard supports assertions

```
CREATE ASSERTION <assertion-name>
```

```
CHECK (<condition>);
```

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CREATE ASSERTION <assertion-name>

CHECK (<condition>;

There are two approaches in writing conditions:

- (1) Positive approach
- (2) Negative approach

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RULE: Departmental head must be an employee of the university

name	head
CSE	2
EEE	4
ME	1

id	name	address	gender
1	A	X	M
2	B	Y	M
3	C	Z	F
4	D	W	M

Positive approach: Look at each departmental head and make sure that s/he is an employee of the university

Negative approach: Look for a departmental head who is not an employee and make sure that such head does not exist

EXISTS or NOT EXISTS which way to go?

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Negative approach: Look for a departmental head who is not an employee and make sure that such head does not exist

name	head
CSE	2
EEE	4
ME	1

id	name	address	gender
1	A	X	M
2	B	Y	M
3	C	Z	F
4	D	W	M

CREATE ASSERTION checkHeadConstraint
CHECK (NOT EXISTS (SELECT head
FROM Department
WHERE head NOT IN (SELECT id
FROM Employee)
);

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Assertion more examples

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No manufacturer of PCs may also make laptops

Maker	Model	Type
A	1001	pc
A	1002	pc
A	1003	pc
A	2004	laptop
A	2005	laptop
A	2006	laptop
B	1004	pc
B	1005	pc
B	1006	pc
B	2007	laptop
C	1007	pc
...
....

Product

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Assertion example

No manufacturer of PCs may also make laptops

'A manufacturer of a PC makes Laptop' such occurrences do NOT EXIST...

```
CREATE ASSERTION makeConstraint
CHECK (NOT EXISTS (SELECT maker
                    FROM Product
                    WHERE type = 'pc'
                    AND maker IN (SELECT maker
                                   FROM Product
                                   WHERE type = 'laptop')
);
```

If a laptop has a large main memory than a PC, then the laptop must also has a higher price than the PC

PC

MODEL	SPEED	RAM	HD	PRICE
1001	2.66	1024	250	2114
1002	2.1	512	250	995
1003	1.42	512	80	478
1004	2.8	1024	250	649
1005	3.2	512	250	630
...

Laptop

MODEL	SPEED	RAM	HD	SCREEN	PRICE
2001	2	2048	240	20.1	3673
2002	1.73	1024	80	17	949
2003	1.8	512	60	15.4	549
2004	2	512	60	13.3	1150
....

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Assertion example

If a laptop has a large main memory than a PC, then the laptop must also has a higher price than the PC

```
CREATE ASSERTION makeConstraint
CHECK (NOT EXISTS (
    SELECT model
    FROM Laptop, PC
    WHERE Laptop.ram > PC.ram
    AND Laptop.price < PC.price
)
);
```

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If the relation Product mentions a model and its type then this model must appear in the relation appropriate to that type.

Maker	Model	Type
A	1001	pc
A	1002	pc
A	1003	pc
A	2004	laptop
A	2005	laptop
A	2006	laptop
B	1004	pc
B	1005	pc
B	1006	pc
B	2007	laptop
C	1007	pc
...
...

Product

MODEL	SPEED	RAM	HD	PRICE
1001	2.66	1024	250	2114
1002	2.1	512	250	995
1003	1.42	512	80	478
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...

PC

MODEL	SPEED	RAM	HD	SCREEN	PRICE
2001	2	2048	240	20.1	3673
2002	1.73	1024	80	17	949
2003	1.8	512	60	15.4	549
2004	2	512	60	13.3	1150
...

Laptop

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Assertion example

If the relation Product mentions a model and its type then this model must appear in the relation appropriate to that type.

```
CREATE ASSERTION makeConstraint
CHECK (NOT EXISTS (
  SELECT model
  FROM Product
  WHERE (type = 'pc' AND
         model NOT IN (SELECT model FROM PC))
      OR (type = 'laptop' AND
         model NOT IN (SELECT model FROM Laptop))
      OR (type = 'printer' AND
         model NOT IN (SELECT model FROM Printer))
);
```

A manufacturer of a PC also make a laptop with at least as great a processor speed

Maker	Model	Type
A	1001	pc
A	1002	pc
A	1003	pc
A	2004	laptop
A	2005	laptop
A	2006	laptop
B	1004	pc
B	1005	pc
B	1006	pc
B	2007	laptop
C	1007	pc
...
...

Product

MODEL	SPEED	RAM	HD	PRICE
1001	2.66	1024	250	2114
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...

PC

MODEL	SPEED	RAM	HD	SCREEN	PRICE
2001	2	2048	240	20.1	3673
2002	1.73	1024	80	17	949
2003	1.8	512	60	15.4	549
2004	2	512	60	13.3	1150
...

Laptop

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Assertion example

A manufacturer of a PC also make a laptop with at least as great a processor speed

```
CREATE ASSERTION makeConstraint
CHECK (NOT EXISTS (
  SELECT maker
  FROM Product P1 NATURAL JOIN PC
  WHERE speed > ALL (SELECT speed
                    FROM Product P2 NATURAL JOIN Laptop
                    WHERE P2.maker = P1.maker)
);
```

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Different Constraint Types

Type	Where Declared	When activated	Guaranteed to hold?
Attribute CHECK	with attribute	on insertion or update on attribute	not if subquery
Tuple CHECK	relation schema	insertion or update to relation	not if subquery
Assertion	database schema	on change to any relation mentioned	Yes

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Giving Names to Constraints

Why give names? In order to be able to alter constraints.

Add the keyword **CONSTRAINT** and then a name:

(1) ssn CHAR(50) **CONSTRAINT** ssnIsKey PRIMARY KEY

(2) **CONSTRAINT** ninedigits CHECK (VALUE >= 100000000 AND VALUE <= 999999999)

(3) **CONSTRAINT** rightage CHECK (age >= 0 OR status = "dead")

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Altering Constraints

ALTER TABLE Product **DROP CONSTRAINT** positivePrice

ALTER TABLE Product **ADD CONSTRAINT**
positivePrice CHECK (price >= 0)

DROP ASSERTION assert1

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