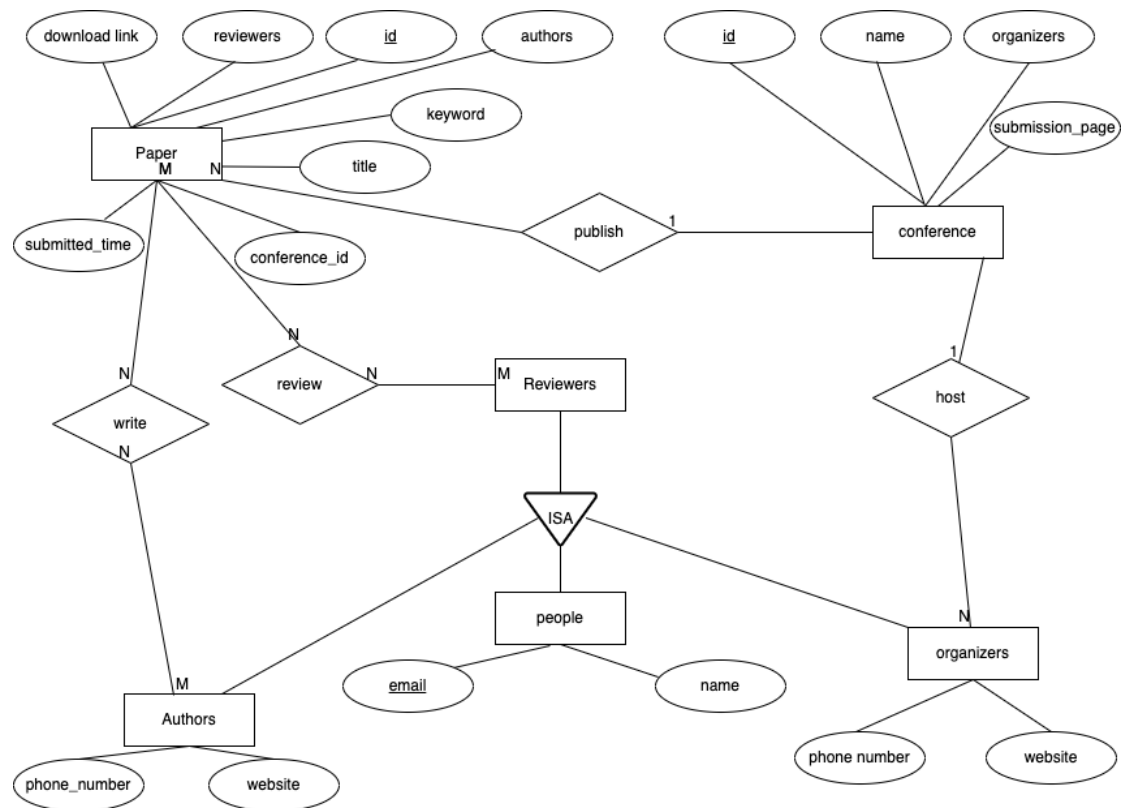


Homework 3

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problem1:



Problem2:

```
CREATE SCHEMA 'online_conference_review_system' ;
```

```
CREATE TABLE authors (
    email VARCHAR(20) NOT NULL,
    name VARCHAR(20) DEFAULT NULL,
    phone_number VARCHAR(20) DEFAULT NULL,
    website VARCHAR(20) DEFAULT NULL
    PRIMARY KEY(email)
)
```

```
CREATE TABLE organizers(
    email VARCHAR(20) NOT NULL,
    name VARCHAR(20) DEFAULT NULL,
    phone_number VARCHAR(20) DEFAULT NULL,
    website VARCHAR(20) DEFAULT NULL
    PRIMARY KEY(email)
)
```

```
CREATE TABLE Reviewers(
    email VARCHAR(20) NOT NULL,
```

```

name VARCHAR(20) DEFAULT NULL,
PRIMARY KEY(email)
)

```

```

CREATE TABLE conference(
id INT NOT NULL,
name VARCHAR(20),
organizers VARCHAR(50),
submission_page INT,
PRIMARY KEY(id),
Foreign key (id) references paper (conference_id),
Foreign key (organizers) references organizer (email)
)

```

```

CREATE TABLE Paper(
id INT NOT NULL,
title VARCHAR(50) DEFAULT NULL,
authors VARCHAR(50) DEFAULT NULL,
key_word VARCHAR(50) DEFAULT NULL,
submitted_time DATE,
conference_id VARCHAR(50) DEFAULT NULL,
reviewers VARCHAR(50) DEFAULT NULL,
download_link VARCHAR(50) DEALLOCATE NULL,
PRIMARY KEY(id),
Foreign key (authors) references authors (email),
Foreign key (reviewers) references Reviewers (email),
Foreign key (conference_id) references conference (id)
)

```

Problem3:

| FD | Satisfied by R | Hold on R | Trivial |
|---------------------|----------------|-----------|---------|
| $A \rightarrow B$ | No | No | No |
| $B \rightarrow A$ | No | No | No |
| $AC \rightarrow D$ | Yes | Unknown | No |
| $ABD \rightarrow B$ | Yes | Yes | Yes |
| $AC \rightarrow B$ | No | No | No |
| $AD \rightarrow B$ | No | No | No |
| $C \rightarrow ABC$ | No | No | No |
| $BC \rightarrow D$ | Yes | Unknown | No |
| $BD \rightarrow D$ | Yes | Yes | Yes |
| $BD \rightarrow A$ | No | No | No |

Problem4:

| FD | YES/NO | Proof if yes |
|-----------------------|--------|--|
| $ABC \rightarrow G$ | YES | $B \rightarrow DE, AC \rightarrow E, ABC \rightarrow DE, (1 \& 2) ABC \rightarrow D$ (Decomp of 3) $CD \rightarrow GF$ (Decomp), $ABC \rightarrow CD$ (Decomp) $ABC \rightarrow G$ (Trans) |
| $AC \rightarrow F$ | NO | |
| $BF \rightarrow G$ | YES | $BF \rightarrow DEF, F \rightarrow C, CD \rightarrow GF,$ $BF \rightarrow CDEFG, BF \rightarrow CDEF$ $BF \rightarrow G$ (Decomp) |
| $BCD \rightarrow F$ | YES | $BCD \rightarrow DECD, BCD \rightarrow DECDFG$ $BCD \rightarrow F$ |
| $ABC \rightarrow DEF$ | YES | $ABCF \rightarrow EBF, B \rightarrow DE, ABCF \rightarrow BEDF$ $ABCF \rightarrow DEF$ |

Problem5:

| Decomposition | Lossless(yes/no) | why |
|---------------------------|------------------|---|
| $R1(ABF)$ and $R2(CDE)$ | NO | $R1 \cap R2 = \emptyset$ |
| $R1(ABCEF)$ and $R2(CDE)$ | NO | $R1 \cap R2 = CE$ CE isn't a key in these two sets |
| $R1(ABDE)$ and $R2(ACDF)$ | NO | $R1 \cap R2 = AD$ AD isn't a key I $R1$ |
| $R1(ACDF)$ and $R2(BCDE)$ | YES | $R1 \cap R2 = CD$ CD is a key in $R1$ and $R2$ $CD \rightarrow CD, D \rightarrow A, C \rightarrow BF$ Thus $CD \rightarrow ACDF$ $C \rightarrow F$ so Lossless |
| $R1(ABEF)$ and $R2(BCDF)$ | NO | $R1 \cap R2 = BF$ BF isn't a key in these two sets |

Problem6:

| Relation, FD | Answer(a, b or c) | Solution |
|---|-------------------|--|
| $R1(A, B, C, D)$ $\{AB \rightarrow C, C \rightarrow D\}$ | c | $A \rightarrow ABC, C \rightarrow D, AB \rightarrow ABCD$ AB is a primary key, and C is not a key. $R1$ is neither 3NF nor BCNF. |
| $R2(A, B, C, D)$ $\{AC \rightarrow BD\}$ | a, b | $AC \rightarrow BD, AC \rightarrow ABCD,$ AC is the primary key. $R2$ is both in 3NF and BCNF. |
| $R3(A, B, C, D)$ | b | $AB \rightarrow CD, D \rightarrow A, AB \rightarrow ABCD$ |

| | | |
|---|---|--|
| $\{AB \rightarrow CD, D \rightarrow A\}$ | | AB is primary key. D isn't a key. A depends on D. R3 is 3NF. |
| R4(A, B, C, D, E) $\{AC \rightarrow D, D \rightarrow B\}$ | c | $AC \rightarrow D, D \rightarrow B$ both not primary key. R4 is neither 3NF nor BCNF. |
| R5(A, B, C, D, E) $\{A \rightarrow CE, D \rightarrow CE\}$ | c | $A \rightarrow CE, D \rightarrow CE, D \rightarrow CDE,$ $A \rightarrow CE$ A and D both are not primary key. R5 is neither 3NF nor BCNF. |

Problem7:

A:5 kBytes.

Running table T needs to take 1 block size in the disk, so it will take 5 kBytes.

Problem8:

A:300 Mbytes.

According to the equation: $n \times \text{size_of_tuple} = \text{block_size}$.

Dbms has to read the whole table, so there are 300 Mbytes for this query to be read.

Problem9:

A:61440 blocks, 300 Mbytes(314572800bytes).

Firstly, it will read 300 Mbytes= $300 \times 1024 \times 1024 \text{ bytes} = 314572800 \text{ bytes}$ from the disk.

$$n \text{ tuple} = \frac{300 \text{ MBytes}}{5 \text{ KBytes}} = \frac{300 \times 1024 \text{ KBytes}}{5 \text{ KBytes}} = 61440 \text{ blocks}$$

So, it will be read 61440 blocks from the disk.

problem10:

the clustered index will be included in the table T, so there need 8 Kbytes equals to 2 blocks.

Best case, there will have 2 blocks + n tuples = 2 + 61440 = 61442 blocks

If all the num != 500, so there will be no data need to be read, then the blocks are 2.

problem11:

order : $m=3$

50 : maximum number of parent node = $m-1=2$

minimum number of parent node = $\lceil m/2 \rceil - 1 = 1$

maximum number of children node = $m=3$

minimum number of children node = $\lceil m/2 \rceil = 2$

