Database System Midterm Exam 2020.5

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本次考试是本人独立完成，保证没有在考试时间范围内就相关内容与任何人进行交流。

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Part I:

AABAB ABBAC AAAAD

Part II

Question 1.

1. $\sigma_{price \geq 100 \wedge price \leq 200}(toy)$
2. $\sigma_{price > 10}(part)$
3. $\Pi_{tid, tname, toy.price}(\sigma_{pname='engine'}(toy \bowtie part \bowtie toypart))$
4. $toy \leftarrow \left(\Pi_{tid, tname, 40}(\sigma_{tname='hello-kitty'}(toy)) \cup \sigma_{tname \neq 'hello-kitty'}(toy) \right)$
5. $\Pi_{pname}\left(\sigma_{tname='hello-kitty'}(toy \bowtie part \bowtie toypart) \right)$

Question 2.

```
1  SELECT price FROM toy WHERE tname='hello-kitty';
2  CREATE VIEW alltoys AS (SELECT tid, tname FROM toy);
3  SELECT * FROM toy WHERE tname LIKE '%tiger%';
4  INSERT INTO toy (tid, tname, price) VALUES ('t006', 'jump-tiger', 150);
5  SELECT tid, SUM(amount) FROM toypart GROUP BY tid;
```

Part III

The ER-diagram is drawn as follows:
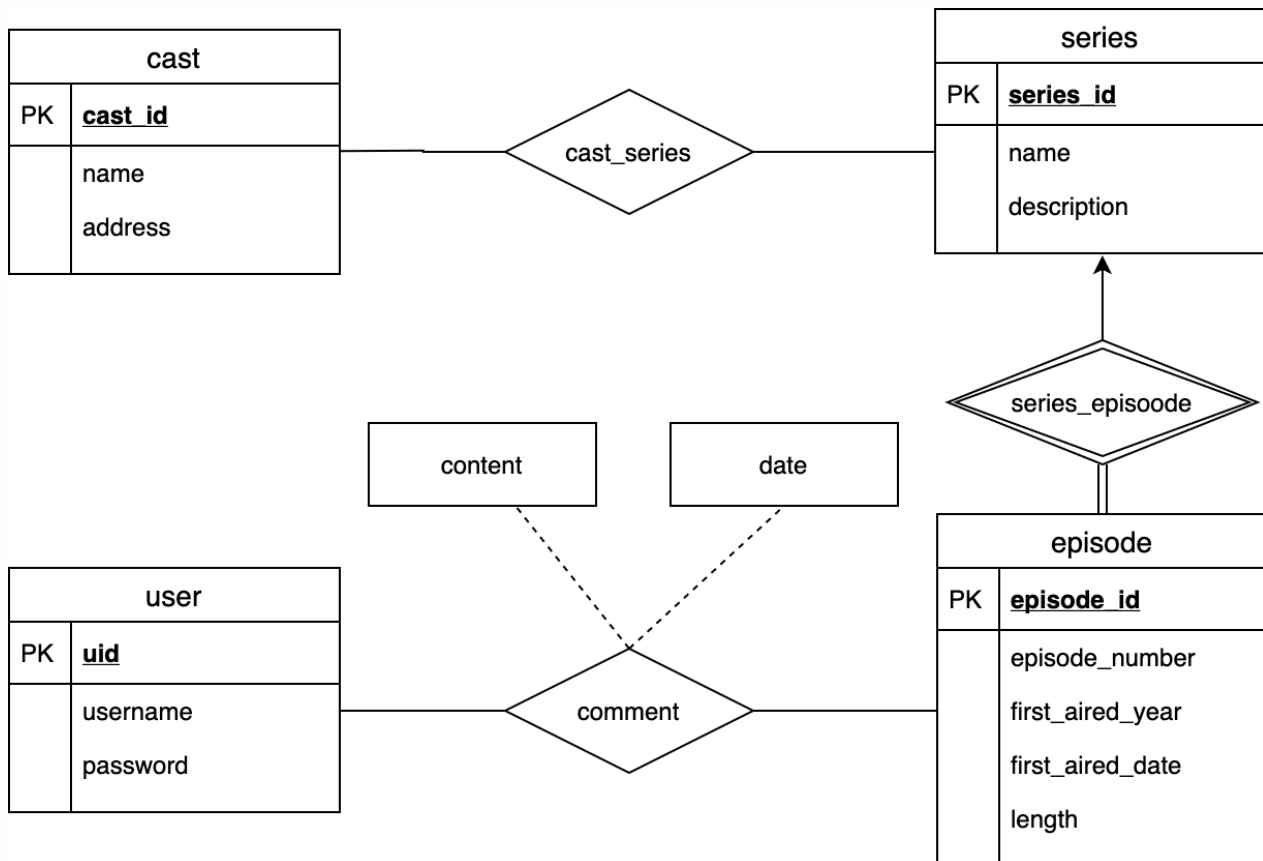
From the ER-diagram, we can design the relational scheme is as follows:

cast(cast_id, name, address)

cast_series(cast_id, series_id)

series(series_id, name, description)

episode(episode_id, eposide_number, first_aired_year, first_aired_date, length, series_id)

user(uid, username, password)

comment(uid, episode_id, content, date)

Ps. The primary key is denoted underline, and the foreign keys are denoted highlighted.

Part IV

Question 1.

By computing attribute closure for all attributes, we get:

$$
\begin{align}
A^+ &= AB \tag{1}\\
B^+ &= B\\
C^+ &= CD\\
D^+ &= D
\end{align}
$$

So the candidate key is AC.

Question 2.

$$\text{Since we have } A \to D, AE^+ = AE \cup D \tag{2}$$
$$\because E \to C, \Rightarrow AE^+ = AED \cup C$$
$$\because CD \to I, \Rightarrow AE^+ = ACED \cup I$$
$$\therefore AE^+ = ACDEI$$

Question 3.

- R is not BCNF. Because by computing $C^+ = CTDI$ doesn't include all attributes in relation R, so C is not a super key, since R is not BCNF.

- The decomposed relation is as follows:

    - R_1 = {C, T, D, I}
    - R_2 = {B, R, P}
    - R_3 = {C, E, S, Y, B, R, O}