

### G51DBS 2009-2010 coursework 5 answer

Consider a relation Listing with attributes Cinema, Film, Day, Time, Certificate:

Listing				
Cinema	Film	Day	Time	Certificate
Savoy	Green Zone	Wed	18 : 00	15
Savoy	Green Zone	Wed	20 : 00	15
Cineworld	Green Zone	Wed	20 : 00	15
Cineworld	Avatar	Wed	20 : 00	12A
Savoy	Avatar	Thu	18 : 00	12A
...	...	...	...	...

Each film is assigned a certificate by the British Board of Film Classification; certificate 15 means that nobody younger than 15 can see this film in a cinema. The same cinema can show a film on multiple times during a day, and may show different films at the same time (on different screens). For the purpose of this exercise, let us assume that there are no two different films with the same title.

- List all non-trivial functional dependencies in the Listing relation.

*Answer:*  $X \cup \{\text{Film}\} \rightarrow \text{Certificate}$  where  $X \subseteq \{\text{Cinema}, \text{Film}, \text{Day}, \text{Time}\}$

- List all candidate keys in the Listing relation and explain why they are unique and minimal.

*Answer:*  $\{\text{Cinema}, \text{Film}, \text{Day}, \text{Time}\}$ . It is unique because Certificate is determined by Film, and minimal because any proper subset of it is not unique (we cannot drop Cinema from the key, because the same film on the same day and time may be in two different cinemas, we cannot drop film because there could be several films showing in the same cinema on the same day at the same time, we could not drop day because showings of the same film in the same cinema can be repeated on different days, same for time).

- State whether the Listing relation is in 2NF and explain why.

*Answer:* it is not in 2NF because there is a partial dependency of a non-key attribute Certificate on a proper subset of the key (Film).

4. Give an example of update anomalies in the Listing relation.

*Answer:* If the certificate for a film were to be changed (say Green Zone was downgraded to 12A or upgraded to 18), each tuple which contains this film would have to be updated, for every cinema, day, and showing time.

5. If Listing is not in BCNF, decompose it to BCNF, and explain why the resulting relations are in BCNF.

*Answer:* it is not in BCNF because there is a dependency where the determinant is not a (super) key, namely  $\{\text{Film}\} \rightarrow \text{Certificate}$ . To decompose, we split Listing into Showing(Cinema,Film,Day,Time) and Certificates(Film, Certificate). They are both in BCNF because Showing does not have any non-trivial functional dependencies and Certificates only has dependency on the key Film.