

CS30202: Database Management Systems

Mid-semester Examination, Spring 2023

Time: 2 hrs. Total Marks: 60. Answer all three questions.

Please answer all parts of a question together.

1. A. We want to build an Indian movie database including information about: Films, Actors, Crew, Producers, and Theatres. A Film has four attributes: title, year, rating (U, A, UA, S), and category (e.g., action, comedy, romance, fantasy etc.). Actors, Crew, Producer, and Theatres, have a name and address. A Contract is signed between an Actor and a Producer against a fee for making a Film. A Film may be exhibited in multiple Theatres over various date intervals. An actor has signed at least one contract during her/his career. A crew may work for single/none/multiple Producer(s). No two Films, Actors, Producers, and Theatres, have the same name.

Draw the E-R diagram. Mark all participation and cardinality constraints for the relations. [10]

B. Convert the E-R diagram to a set of equivalent relational tables. [4]

C. Write the relational algebra expressions for the following queries: [6]

- Name of all Producers who has produced both "action" and "romance" films having "SRK" as an actor.
- Name of all Actors who have co-acted with Actor "SRK" in a film.
- Name of all Actors whose Film was exhibited in at least 1000 Theatres.

2. A. Consider two relations R and S having m and n tuples respectively. Express the following operations in terms of (a) primitive relational algebra operators, (b) SQL queries. What is the minimum and maximum number of tuples that the result of the operations might have? [4 x 3 = 12]

- $R \bowtie S$ is the collection of tuples t in R such that there is at least one tuple s in S that agrees with t in all attributes that R and S have in common.
- $R \triangleright S$ is the collection of tuples t in R that do not agree with any of the tuples in S in the attributes common to R and S .
- $R \div S$ is the restrictions of tuples in R to the attribute names unique to R , (i.e., present in R but not in S), for which it holds that all their combinations with tuples in S are present in R .

B. Write SQL statements involving the following three relation answering the following queries. Two or more movies released in two different years can have the same title. [2 x 4 = 8]

Movie(title, year, rating, category, producerId)

ActedIn(movieTitle, movieYear, actorName)

Producer(id, name, address)

- Name of all the producers of the movies titled "Devdas".
- Name of all producers of movies in which "SRK" acted.
- Number of "romance" movies in which "SRK" acted.
- Titles that has been used for two or more movies.

P.T.O

3. A. Define what is a functional dependency (FD).

[5]

B. Consider the relation schema $R(A, B, C, D)$ with set of FD's: $AB \rightarrow C, C \rightarrow D, D \rightarrow A$.

(i) List all the nontrivial FD's that follows from the given FD's. Restrict the list to FD's with single attributes on the right side. [5]

(ii) What are the candidate keys of R? [5]

C. Consider the schema $R = (A, B, C, D, E, F, G)$ and the set F of functional dependencies:

[5]

$AB \rightarrow CD$

$B \rightarrow D$

$DE \rightarrow B$

$DEG \rightarrow AB$

$AC \rightarrow DE$

R is not in BCNF for many reasons, one of which arises from the functional dependency $AB \rightarrow CD$. Explain why $AB \rightarrow CD$ shows that R is not in BCNF and then use the BCNF decomposition algorithm starting with $AB \rightarrow CD$ to generate a BCNF decomposition of R . Once that is done, determine whether your result is dependency preserving or not, and explain your reasoning.

----- BEST WISHES -----