Database Exam

Lyon Theatre Shows and Actors

Name _____ Student ID _____ Date _____

Duration: 60 minutes | Total: 20 points | Answer all questions on separate paper.

Exercise 1 Database modelling

8 points

A theatre organisation manages productions and actors in Lyon. Each company has a unique CompanyID and a name. Each production has a unique ProductionID, a title and a genre, and belongs to exactly one company. A company may manage any number of productions, including none.

Each production may have any number of performances, including none. A performance belongs to exactly one production and is identified by its PerformanceNo within that production; the same PerformanceNo may occur in different productions. Store its start and end timestamps. Each performance takes place at exactly one theatre. A theatre has a unique TheatreID, a name and a Lyon district number, and may host any number of performances.

Each actor has a unique ActorID, a name and a home district number. An actor may be cast in any number of performances, and a performance may have any number of actors, including none while it is being planned. Record the agreed fee in euros for each casting. An actor has at most one casting record for the same performance; the fee may differ between actors and between performances. Individual characters are outside the scope of this database.

A. Draw an ER diagram with attributes, identifiers, relationship cardinalities and participation constraints. Explain your modelling decisions. (4 points)

B. Reduce the ER diagram to a relational schema. Show all primary and foreign keys and state any constraints not captured by those keys. SQL DDL is not required. (3 points)

C. For each resulting relation, state its candidate key(s), relevant functional dependencies and highest normal form among 1NF, 2NF, 3NF and BCNF. Justify your answer. (1 point)

Use the following three requests to test your design. For each, name the relations and join attributes needed, describe the selection or exclusion in words, and identify any missing information. Revise the design if necessary. Do not write SQL or relational algebra here.

For a given production and performance number, which actors are cast, and what fee is agreed with each?

Which performances take place at theatres in Lyon district 7 during January 2027? Give the production title, performance number and theatre name.

Which actors have never been cast in any performance?

D.

Exercise 2 Relational algebra and SQL

5 (2.5+2.5) points | all queries count the same, yes even the harder one!

Use the independent schema below. For every query, write both a relational-algebra expression and an SQL query (0.5 points each). Return distinct rows. No ordering is required. You do not need to compute the results. Classical set-based relational algebra is sufficient.

All attributes are non-null. IDs are integers, monetary values are numeric, and dates have type DATE. January 2027 means 2027-01-01 inclusive to 2027-02-01 exclusive. Sample data are illustrative; your queries must work for every valid instance.

Show(ShowID, Title, District, ShowDate)

PK: ShowID

Actor(ActorID, ActorName, HomeDistrict)

PK: ActorID

Casting(ShowID, ActorID, FeeEUR)

PK: ShowID, ActorID; FK: ShowID → Show.ShowID; ActorID → Actor.ActorID

Show

ShowID	Title	District	ShowDate
1	Night Voices	7	2027-01-10
2	The Bridge	2	2027-01-24
3	Winter Stage	7	2027-02-05
4	Last Curtain	7	2027-01-31

Actor

ActorID	ActorName	HomeDistrict
10	Camille	7
20	Jules	2
30	Leila	3
40	Sacha	7

Casting

ShowID	ActorID	FeeEUR
1	10	180
1	20	220
2	20	250
3	30	160
4	10	200

E. Give all show titles.

F. Give the IDs and names of actors whose home district is 7.

G. Give the IDs and names of actors cast in at least one show in district 7 during January 2027.

H. Give the IDs and titles of shows with at least one cast actor whose home district equals the show district.

I. Give the IDs and names of actors with no casting in any show during January 2027. Include actors who have never been cast.

Exercise 3 Theory

7 (2+2+3) points | Two open questions and three multiple-choice questions

Open questions

J. CastActor(ActorID) and AvailableActor(ActorID) use the same integer domain. State the conditions for union compatibility. Explain the results of CastActor ∪ AvailableActor and CastActor − AvailableActor. Why is CastActor ∪ Actor(ActorID, ActorName) not directly valid? (2 points)

K. What is a database transaction? Explain the difference between COMMIT and ROLLBACK. A theatre manager updates the wrong actor's fee but has not committed the transaction. Which operation should the manager use, and why? (2 points)

Multiple choice

Choose exactly one answer per question. Each correct answer earns 1 point; an incorrect, blank or multiple answer earns 0 points.

L. Which condition defines Boyce–Codd normal form (BCNF)?

M. Every attribute contains an atomic value.

N. Every foreign key is unique.

O. No non-key attribute depends on part of a candidate key.

P. For every non-trivial functional dependency $X \rightarrow Y$, X is a superkey.

Answer: _____

Q. Which SQL clause filters groups according to an aggregate condition, such as COUNT(*) > 3?

R. HAVING

S. WHERE

T. DISTINCT

U. ORDER BY

Answer: _____

V. One transaction reads an actor's new fee before the transaction changing that fee commits. Which ACID property is compromised by this dirty read?

W. Atomicity

X. Durability

Y. Isolation

Z. Consistency

Answer: _____