Xi'an Jiaotong-Liverpool University

西交利物浦大学

PAPER CODE	EXAMINER	DEPARTMENT	TEL
CPT103	Jianjun Chen	Computing	0512 81889137

2023/24 FIRST SEMESTER FINAL EXAMINATION

Undergraduate – Year 2

Introduction to Database Systems

TIME ALLOWED: 2 Hours

INSTRUCTIONS TO CANDIDATES

1、 This is a closed book examination.

2、 Total marks available are 100. This will count for 85% in the final assessment.

3、 Answer all questions.

4、 Answer should be written in the answer booklet(s) provided.

5、 Only English solutions are accepted.

6、 The university approved calculator - Casio FS82ES/83ES can be used.

7、 All materials must be returned to the exam supervisor upon completion of the exam. Failure to do so will be deemed academic misconduct and will be dealt with accordingly.

Question A (20 marks)

Consider the following tables:

games

title (varchar)	release_date (date)
Deep Space Wanderer	2022-06-07
Pop Stars	2021-08-02
Potato Guy	2023-01-02
Starfighter II	2020-01-21

stock

title (varchar)	sname (varchar)	stock (int)
Starfighter II	R101 Store	21
Starfighter II	R212 Store	15
Pop Stars	R101 Store	5
Pop Stars	R212 Store	27
Deep Space Wanderer	R101 Store	null
Deep Space Wanderer	R212 Store	5
Potato Guy	R101 Store	10
Potato Guy	R212 Store	2

stores

sname (varchar)	address (varchar)
R101 Store	Hamster road 2-103
R212 Store	North bridge road 7-201

The games table stores the information of games. The stores table holds the information of game stores. The stock table stores the number of game cards of each game in each game store. The underlined columns are primary keys.

a) You are given the following SELECT queries. What are the results of application of these queries to the tables above? Provide the answer in a table format. In case that query is not valid, explain the reason. (3 marks each)

1. **SELECT** title **FROM** games **WHERE** release_date > '2022-10-01'
   OR title **LIKE** '*Stars_'; *Invalid. '*Stars_' is wrong. '%stars_' is right.*

2. **SELECT** g1.title **FROM** games g1, games g2
   WHERE g1.release_date > g2.release_date
   AND g2.title <> 'Deep Space Wanderer';

   g1.title
   Deep Space Wanderer
   Deep Space Wanderer
   Pop Stars
   Potato Guy
   Potato Guy

3. **SELECT** title, sname, stock **FROM** stock **WHERE** stock > 21 **OR**
   stock = 5;

   title   sname   stock
   Pop Stars   R101 store   5 ✓
   Deep Space Wanderer R212 store ✓
   Pop Stars   R212 store   27

4. **SELECT** sum(stock) **AS** all_stock **FROM** stock **GROUP BY** title
   HAVING all_stock < 20;

[handwritten annotation: all-stock / 5 / 12]

b) Write an SQL query to list all game titles that begins with 'deep' and ends with 'r' in the games table.

[handwritten: SELECT title FROM games where title like 'deep% r';]

(2 marks)

c) Write an SQL query to obtain the title of the most recently released game that is available in the store called 'R101 Store'.

(3 marks)

d) Write an SQL query to get the game titles that are not stocked in any stores (stock quantity being 0).

(3 marks)

[handwritten answer:]

C. SELECT Distinct g.title from games g inner join stock s on g.title = s.title where s.sname = 'R101 Store'

And s.stock > 0 And g.release_date = (SELECT Max(g1.release_date) from games g1 inner join Stock s1 on s1.title = g1.title where s1.sname = 'R101 Store' And s1.Stock > 0) ;

d. SELECT Distinct g.title from games left join stocks s on g.title = s.title Group by g.title Having Sum (s.stock) = 0 OR Sum(s.stock) IS Null ;

Question B (25 marks)

Answer the following questions related to database systems:

a) In database concurrency, what is a serial schedule? What is a non-serial schedule?

(4 marks)

b) Fill the table below about the expressions in 3-valued logic. True is considered as 1 and False is considered as 0 when arithmetic operations are involved:

a	b	a AND b	a OR (NOT b)	a + b	(a = 12) OR b
True	Unknown	Unknown	True	Unknown	Unknown
12	Unknown	Unknown	12	Unknown	True
0	Unknown	0	Unknown	Unknown	Unknown

(12 marks)

c) In the context of database management and recovery, please list 3 failures/issues that can affect databases along with the measures that can prevent these failures/issues.

(9 marks)

Question C (20 marks)

Below is a table storing the information about food ordering in a restaurant. It is assumed that customers do not share tables when eating food. A customer can make an order that contains multiple dishes.

A Table_id	B Order_time	C Customer_id	D Customer_name	E Dish_name	F Quantity
A03	2023-09-28 13:00:00	112233	Peterson	Mutton Masala	1
A03	2023-09-28 13:00:00	112233	Peterson	Pea Salad	1
B05	2023-09-11 12:00:00	778899	Pei	Vegetable Salad	1
B07	2023-09-12 16:00:00	778899	Pei	Mixed Fruit Salad	3
A03	2023-10-12 13:00:00	112233	Peterson	Fish and Chips	1
B02	2023-10-12 13:00:00	445566	Sam	Mutton Soup	1

Task 1: find a suitable primary key for this table. (4 marks) (Table-id , Order-time , Dish-name)

Task 2: Identify all functional dependencies of this table. (8 marks)

Task 3: Normalise this table into 3NF and underline the primary keys of each table (8 marks)

Task2: Customer-id → Customer-name   transitive dependence

Table-id, order-time, Dish-name → all other attributes.

Table-id, order_time → Customer-id, Customer-name   partial dependence.

Task3: (Table-id, order-time, Dish-name, Quantity)

(Table-id, order-time, customer-id)

(Customer-id , Customer-name)

Question D (35 marks)

You are asked to develop a database that is used by a chip design company. The requirements for the database are provided below:

1. The company wants to support multiple product lines, each product line has a unique product line name, a target customer group and several chip models.
    1. Valid values of target customer group are: "personal computers", "server", "workstation" and "gaming consoles".
2. Each chip model has a unique model name, a release date, an associated die size measured in nano metres.
3. Each chip produced has a model name, a unique serial number, a production date and a manufacturer. (Manufacturers are not chip design companies. They only manufacture chips based on the designs provided by other companies.)
    1. Chips of one model might be produced by multiple manufacturers.
    2. Several chips could be produced in the same date by the same manufacturer.
4. Manufacturers are reachable by their telephone numbers. Designs of chips will be sent to manufacturers through mails, as a result, the address information is also needed.

Task 1: Draw the entity relationship diagram. Make sure M:N and 1:1 relationships are properly dealt with. In your ERD, make sure primary keys are underlined. (25 marks)

Task 2: Write down the CREATE TABLE statements of these tables. (10 marks)

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END OF FINAL EXAM

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Entity-Relationship Diagram:

- **product_line** (entity)
  - linename (key attribute)
  - target_cus_group
- **chip_model** (entity)
  - model-name
  - release-date
  - die_size
- **manufacture** (entity)
  - address
  - phone-number
- **chip_produced** (entity)
  - serial_number
  - model-name
  - production-date

Relationships:
- product_line **has** chip_model
- chip_model **on** chip_produced
- manufacture **produce** chip_produced