

NANYANG TECHNOLOGICAL UNIVERSITY**SEMESTER 1 EXAMINATION 2023-2024****SC2207/CZ2007 – INTRODUCTION TO DATABASES**

Nov/Dec 2023

Time Allowed: 2 hours

INSTRUCTIONS

1. This paper contains 4 questions and comprises 4 pages.
 2. Answer **ALL** questions.
 3. This is a closed-book examination.
 4. All questions carry equal marks.
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1. Consider a database comprising six tables as shown. The six tables record information about travellers taking travel tours arranged by travel agencies. Some travellers bring their children together on tours. You may assume that each tour visits only one country. Keys are underlined.

TRAVELLER(tID, citizenShip, ageGroup)PARENT(parentTravellerID, childTravellerID)TRAVEL_AGENCY(aID, address, rating)TOUR_PACKAGE(pID, aID, price, countryVisiting, startDate, endDate)TOURS(uID, pID, tourGroupSize, startDate, endDate)TAKE_TOUR(tID, uID)

- (a) Construct an ER diagram corresponding to the six tables. You may make suitable assumptions in order to construct the ER diagram.

(9 marks)

- (b) Using relational algebra, find parents who brought along their child or children together to tour(s) last year (i.e. 2022).

(8 marks)

- (c) Moreover, for tours done by those families in Q1(b), find out which travel agencies arranged the most number of these tours. (Note: You can make use of the intermediate relations created when solving for Q1(b)).

(8 marks)

2. Consider the following table with schema R(A, B, C, D):

A	B	C	D
a1	b1	c1	d1
a2	b2	c2	d2
a3	b1	c1	d1
a4	b2	c2	d1
a1	b1	c1	d1
a2	b2	c2	d1
a1	b1	c1	d1

- (a) Verify whether $AB \rightarrow C$, $C \rightarrow B$, $A \rightarrow D$ hold with respect to the above table. Briefly explain your answers. (5 marks)
- (b) Suppose $AB \rightarrow C$, $C \rightarrow B$, $A \rightarrow D$ hold with respect to the above table. Is the table in 3NF? What are the consequences of R not in 3NF? Illustrate your answer with suitable examples. (10 marks)
- (c) If R is not in 3NF, apply a 3NF decomposition on R to obtain relations in 3NF. Are these relations necessarily smaller (in terms of schema) than the original R schema? Are there more ways to improve the table R? (10 marks)
3. Consider a database for co-curricular activity (CCA) / club record based on the following schema (primary keys are underlined).
- STUDENT(sID, name, gender, age)
CLUB(cID, name, yearFounded)
MEMBERSHIP(cID, sID, position, yearJoin)
ACTIVITY(date, cID, name)
- (a) Answer each query with an SQL statement:
- (i) List down all available clubs and sort by recently founded clubs to the older clubs. (2 marks)
 - (ii) List down the name, age, and gender of all ‘male’ students whose name start with ‘J’. (3 marks)

Note: Question Q3 continues on Page 3

- (iii) List down the name and gender of all youngest students.
(4 marks)
- (b) Write an SQL query that shows the student's name, club name, and their position in the club for student(s) who joined since year 2020.
(5 marks)
- (c) Write an SQL query that shows the name of students and total number of activities they could join. Do take note that for a student to join an activity, the student must be a member of the club which organized the activity.
(6 marks)
- (d) Write an SQL query that shows the name of students aged 21 and above who joined more than 4 clubs since 2020. Your SQL query **MUST NOT** use any Join clause.
(5 marks)
4. (a) Consider the database schema in Q3
- (i) Build an index named “StudentIndex” for relation STUDENT to best speed up the query filtered by gender and age.
(2 marks)
- (ii) Create an SQL trigger named “newStudent” for the following constraint:
- When a new student record is added to the STUDENT relation, the student will be added as a ‘member’ of Student Union Society automatically. In addition, female student will be added as the ‘member’ of Young Women Society as well.
- These additional record(s) will be added in the MEMBERSHIP relation. The cID for Student Union is ‘SU001’, while the Young Women Society is ‘YWS012’. The year joined should be the year when the student record is added into STUDENT relation.
(Hint: use YEAR (GETDATE ()))
(6 marks)
- (b) Identify and list down three differences between structured data and unstructured data.
(6 marks)

Note: Question Q4 continues on Page 4

- (c) Consider the following database schema (primary keys are underline)

HOTEL(Hname, UnitNo, StreetName, Zipcode, Country)
 ROOM(RoomNo, Type, Prices, Currency)

Every hotel has at least one room. The hotel address consists of unit no, street name, zipcode and country. Each room has a room number, type, and must have a price with the fixed currency which is in ‘SGD’.

Prepare a Document Type Declaration (DTD) for exporting the data as an XML view based on the database schema and additional business narrative provided above. The data should be grouped by hotel followed by room.

(6 marks)

- (d) Translate the following JSON data into XML format (remember to include the root element):

(5 marks)

<pre>{ "Person": [{ "Name": "Alan", "Age": 32, "Roles": [{ "Role": "Teaching Asst.", "School": "SCSE", "Course": "SC2207" }, { "Role": "PhD Student", "School": "MAE", "Supervisor": "Prof. David" }] }], "Person": [{ "Name": "Belinda", "Age": 28, "Roles": [{ "Role": "Student", "School": "SCSE" }], "Courses": [{ "Course": "SC2207", "Grade": "A+" }, { "Course": "SC2005", "Grade": "A" }] }] }</pre>	<pre>{ "Name": "Belinda", "Age": 28, "Roles": [{ "Role": "Student", "School": "SCSE" }], "Courses": [{ "Course": "SC2207", "Grade": "A+" }, { "Course": "SC2005", "Grade": "A" }] }</pre>
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END OF PAPER

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SC2207 INTRODUCTION TO DATABASES

Please read the following instructions carefully:

- 1. Please do not turn over the question paper until you are told to do so. Disciplinary action may be taken against you if you do so.**
2. You are not allowed to leave the examination hall unless accompanied by an invigilator. You may raise your hand if you need to communicate with the invigilator.
3. Please write your Matriculation Number on the front of the answer book.
4. Please indicate clearly in the answer book (at the appropriate place) if you are continuing the answer to a question elsewhere in the book.