



UNIVERSITI
TEKNOLOGI
PETRONAS

FINAL EXAMINATION MAY 2024 SEMESTER

COURSE : **TEB1103 - DATA AND INFORMATION
MANAGEMENT**

DATE : **1 AUGUST 2024 (THURSDAY)**

TIME : **9:00 AM - 12:00 NOON (3 HOURS)**

INSTRUCTIONS TO CANDIDATES

1. Answer **ALL** questions in the Answer Booklet.
2. Begin **EACH** answer on a new page in the Answer Booklet.
3. Indicate clearly answers that are cancelled, if any.
4. Where applicable, show clearly steps taken in arriving at the solutions and indicate **ALL** assumptions, if any.
5. **DO NOT** open this Question Booklet until instructed.

Note :

- i. There are **ELEVEN (11)** pages in this Question Booklet including the cover page and the Appendix.
- ii. **DOUBLE-SIDED** Question Booklet.

1. a. Explain **TWO (2)** limitations of file-based approach.
[4 marks]
- b. Discuss the **THREE (3)** levels of the ANSI SPARC architecture.
[6 marks]
- c. Explain **TWO (2)** activities involved in database design phase of Database Development Life Cycle (DDLC).
[4 marks]
- d. Discuss **THREE (3)** advantages of database views in ensuring security in database management.
[6 marks]

2. In a data science project management system, each project is identified by a unique project ID and involves one or more data scientists, each identified by a unique data scientist ID. Each project can utilize multiple data sources, and each data source can be associated with multiple projects. Projects have a composite attribute project duration that includes start date and end date. A data scientist has a multivalued attribute skill, which lists the various skills the scientist possesses. Clients are also part of the system, with each client having a unique client ID and the ability to commission multiple projects. Additionally, each project is broken down into multiple tasks. Each task has a unique task ID, a task name, and a specific task duration consisting of start date and end date and is assigned to one data scientist. This structure ensures comprehensive management of projects, tasks, data sources, clients, and personnel, facilitating efficient tracking and execution of data science initiatives.

- a. Design a conceptual Entity Relationship Diagram (ERD) to represent the above business rules.

[10 marks]

- b. Redraw the diagram answered in **part (a)** into logical ERD based on relational database model requirements.

[6 marks]

- c. Convert the completed logical diagram in **part (b)** into corresponding relational schemas.

[4 marks]

3. a. Consider the following relational database schema shown in **FIGURE Q3**:

```

BOOK (ISBN, b_title, b_author, b_publisher,
b_yearPublished, b_Genre)
MEMBER (m_ID, m_Name, m_Address, m_Phone, m_Email,
DateOfMembership)
LOAN (l_ID, ISBN, m_ID, l_Date, l_DueDate, l_ReturnDate)
LIBRARIAN (libID, lib_Name, lib_Email, lib_Phone,
lib_EmploymentDate)
RESERVATION (res_ID, ISBN, m_ID, res_Date, res_Status)

```

FIGURE Q3: Relation Schema

Prepare relational algebra queries for the following operations:

- i. Retrieve all books published by 'Tech Press'.
[2 marks]
- ii. Find the names and contact information of all members who joined before 2020.
[3 marks]
- iii. Find all reservations that are currently pending.
[3 marks]
- iv. Retrieve the names of members who have borrowed books along with the titles of those books.
[4 marks]
- v. Find all overdue loans and the names of the borrowing members.
[4 marks]

b. Identify error(s) for the following SQL queries:

i. `SELECT id, name, salary x 12 ANNUAL_SALARY
FROM employee
WHERE sal > 3000 AND start_date LIKE %84;`

[2 marks]

ii. `SELECT employee_id, employee_name
FROM employee
WHERE department_id IN (SELECT department_no FROM
department WHERE department_name = Sales);`

[2 marks]

4. **FIGURE Q4** shows relational database schema for machine maintenance record.

```
MACHINE_MAINTENANCE (machineID, componentID,  
maintenanceID, machineName, componentName, manufacturer,  
maintenanceDate, maintenanceDescription, technicianName,  
technicianContact, nextMaintenanceDate, machineLocation)
```

FIGURE Q4: Machine Maintenance Relation Database Schema

- a. Normalize the MACHINE_MAINTENANCE record database shown in **FIGURE Q4** into its 3rd Normal Form (3rd NF) and list down ALL its final relational schemas. Show all steps of the normalization process.

[12 marks]

- b. Write Structured Query Language (SQL) code to create a table structure for each of the relation schemas produced in **part (a)**. Each table must indicate primary key, and foreign key(s). Include as well the NOT NULL, UNIQUE and CHECK constraints in any of the table structure.

[8 marks]

5. The proposed Microcredential Management System and its associated tables are designed to facilitate the administration, issuance, and tracking of microcredentials within an educational or professional context. The User table stores information about individuals involved in the system, including learners, instructors, and administrators. Microcredential table captures details about specific credentials offered, including their names, descriptions, validity periods, and the organizations issuing them, as recorded in the Issuer table. Achievement table tracks users' attainment of microcredentials, documenting the date of achievement and any supporting evidence. Assessment table manages evaluations associated with each microcredential, outlining criteria for passing and deadlines. The system enables efficient management of credentials, assessment processes, and user achievements, enhancing transparency and accountability in recognizing specialized skills and competencies.

APPENDIX A presents samples record populated for each table in the system.

Write SQL code for the following queries:

- a. Write SQL code to list:
- i. all microcredential names together with the descriptions. [2 marks]
 - ii. the names and emails of users who have earned "Data Analysis Certificate". [3 marks]
 - iii. all microcredentials issued by "Cybersecurity Institute" along with the issuer's contact email. [3 marks]

b. Write SQL code to find:

i. all microcredentials and their issuers that have a validity period of more than 2 years

[4 marks]

ii. the issuer name and contact email for the microcredential achieved by a userID 1 on '2023-02-05'.

[4 marks]

iii. the names and descriptions of all assessments associated with the most recently issued microcredential.

[4 marks]

- END OF PAPER.-

APPENDIX A

Table: USER

| userID | username | password | firstName | lastName | email | role |
|--------|-------------|-----------|-----------|----------|------------------------|------------|
| 1 | user1 | pass123 | John | Doe | john.doe@example.com | learner |
| 2 | user2 | pass456 | Jane | Smith | jane.smith@example.com | learner |
| 3 | admin1 | adminpass | Admin | Admin | admin@example.com | admin |
| 4 | instructor1 | teach123 | Michael | Johnson | michael@example.com | instructor |
| 5 | user3 | userpass | Emily | Davis | emily@example.com | learner |

Table: MICROCREDENTIAL

| credentialID | credentialName | cre_description | issuerID | validityPeriod | issueDate |
|--------------|----------------------------|-------------------------------------|----------|----------------|------------|
| 1 | Data Analysis Certificate | Advanced data analysis techniques | 1 | 2 years | 15/1/2023 |
| 2 | Cybersecurity Fundamentals | Basic cybersecurity principles | 2 | 1 year | 28/2/2023 |
| 3 | Project Management | Effective project management skills | 1 | 3 years | 10/12/2022 |
| 4 | Python Programming | Proficiency in Python programming | 3 | 2 years | 20/3/2023 |
| 5 | Digital Marketing | Strategies for digital marketing | 4 | 1.5 years | 5/4/2023 |

Table: ACHIEVEMENT

| achievementID | userID | credentialID | achievedDate | evidence |
|---------------|--------|--------------|--------------|---|
| 1 | 1 | 1 | 5/2/2023 | https://example.com/portfolio |
| 2 | 2 | 2 | 10/3/2023 | Uploads/Assessment_results.pdf |
| 3 | 3 | 3 | 20/1/2023 | Photos/Project_Management_Project.pdf |
| 4 | 4 | 4 | 2/4/2023 | Screenshots/Python_Programming_project |
| 5 | 5 | 5 | 15/3/2023 | Examples/Digital_Marketing_Strategies |

Table: ASSESSMENT

| assessmentID | credentialID | title | ass_description | deadline | passCriteria |
|--------------|--------------|-------------------------|--|-----------|--------------|
| 1 | 1 | Data Analysis Project | Analyze datasets and present findings | 31/3/2023 | 80% correct |
| 2 | 2 | Cybersecurity Quiz | Assess knowledge of cybersecurity basics | 15/4/2023 | 70% correct |
| 3 | 3 | Project Management Exam | Test understanding of PM principles | 20/3/2023 | 75% correct |
| 4 | 4 | Python Coding Challenge | Solve programming problems in Python | 30/4/2023 | 90% correct |
| 5 | 5 | Digital Marketing Plan | Create a digital marketing strategy | 10/4/2023 | Pass/Fail |

Table: ISSUER

| issuerID | issuerName | is_description | contactEmail | website |
|----------|-------------------------|---|----------------------------|---------------------------|
| 1 | Tech Academy | Offers technical and professional courses | info@techacademy.com | www.techacademy.com |
| 2 | Cybersecurity Institute | Specializes in cybersecurity education | contact@cyberinst.com | www.cyberinst.com |
| 3 | Coding School | Focuses on programming and coding skills | hello@codingschool.org | www.codingschool.org |
| 4 | Marketing Hub | Provides training in digital marketing | support@marketinghub.com | www.marketinghub.com |
| 5 | Business Skills Inc | Offers business management courses | info@businessskillsinc.com | www.businessskillsinc.com |

